

# ***Human Factors Program and Main Control Room Development***

*June 21, 2012*

(Redacted Version)

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- HFE Technical Reports
  - Program Management Plan
  - Operating Experience Program
  - Human Reliability Assessment Interface
  - Functional Requirements Analysis and Function Allocation
  - Task Analysis and Design Assessment
- Critical Safety Functions
- Accident mitigation strategy
- Initial Manual Safety Panel inventory and concept
- MCR Concept and user interface development
- Path forward
- MCR Electrical and Heat Loads
- MCR heat-up curves for SBO



# HFE Program Initial Review

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- First Impression:
  - Scope
  - Approach
  - Level of Detail
  - Consistency
- Plan for submittal of new and revised Technical Reports
- Concept of Operation, Alarms, Navigation, and Control

# HFE Program Management Plan (PMP)

Program Management Plan																																	
	1.1	1.2	1.3	2	3.1	3.2	3.2.1	3.2.3	3.2.4	3.2.5	3.2.6	3.2.7	3.2.8	3.2.9	3.2.10	3.3	3.3.1	3.3.2	3.3.3	3.3.4	3.4	3.4.3	3.5	3.8	4	4.1	4.1.1	5.1	5.2	5.3	5.4	6	8
2.1			x	x																													
2.2		x					x																										
2.3					x	x																											
2.4						x																											
2.4.1 (1)		x						x	x																								
2.4.1 (2)								x				x																					
2.4.1 (3)			x																														
2.4.1 (4)			x							x	x																						
2.4.1 (5)									x														x										
2.4.1 (6)									x						x								x										
2.4.2 (1)		x	x													x	x																
2.4.2 (2)		x	x													x																	
2.4.2 (3)																		x	x	x													
2.4.2 (4)																			x	x													
2.4.3 (1)																	x				x												
2.4.3 (2)																						x											
2.4.3 (3)				x																	x	x											
2.4.3 (4)																															x		
2.4.3 (5)																																x	
2.4.3 (6)	x																																
2.4.4 (1)																						x			x	x							
2.4.4 (2)																											x	x					
2.4.4 (3)																											x	x				x	
2.4.4 (4)																											x	x					
2.4.5 (1)						x	x	x	x	x	x	x	x	x																			
2.4.5 (2)																																x	
2.4.5 (3)																						x						x	x	x			
2.4.5 (4)																							x										
2.4.5 (5)																							x	x									

NUREG-0711

## Review Criteria Cross-Reference



# Operating Experience Review

## Operating Experience Program

NUREG-0711

	1.3	1.4	1.5	1.6	2	3.1.1	3.2.1.1	3.2.1.2	3.2.1.3	3.2.1.4	3.2.2.3	3.2.3	3.2.3.1	3.2.3.3	3.3.1	4	6
3.1	X	X	X														
3.2		X			X												
3.3				X												X	
3.4.1 (1)							X										
3.4.1 (2)								X									
3.4.1 (3)									X								
3.4.1 (4)											X		X				
3.4.1 (5)										X							
3.4.2 (1)												X		X			
3.4.2 (2)						X										X	
3.4.2 (3)						X									X		
3.5																	X

## Review Criteria Cross-Reference



# Human Reliability Analysis

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## Human Reliability Analysis

	1.2	2	3.1	3.2	3.3	3.4	3.5	3.6	3.8	3.9	4	6
7.1	x	x	x	x								
7.2	x											
7.3											x	
7.4 (1)				x	x	x				x		
7.4 (2)				x	x		x	x	x			
7.4 (3)					x			x	x	x		
7.4 (4)				x					x			
7.5												x

## Review Criteria Cross-Reference



# Functional Requirements Analysis

Functional Requirements Analysis and Function Allocation

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	1.2	2	3	3.1	3.1.2.4	3.1.2.5	3.1.3	3.2	3.4	4	6
4.1		x									
4.2	x										
4.3			x							x	
4.4 (1)			x	x							
4.4 (2)								x			
4.4 (3)			x	x							
4.4 (4)				x	x	x					
4.4 (5)									x		
4.4 (6)								x			
4.4 (7)								x			
4.4 (8)								x			
4.4 (9)								x			
4.4 (10)							x	x		x	
4.4 (11)									x		
4.5											x

Review Criteria Cross-Reference



# Staffing and Qualification

NUREG-0711

Task Analysis										PMP
	1.2	2	3.1	3.3	3.3.4	3.4	3.5	4	6	3.2.4
6.1	x	x								
6.2	x									
6.3								x		
6.4 (1)					x	x				
6.4 (2)					x		x			x
6.4 (3)			x	x		x	x			
6.4 (4)				x	x		x	x		
6.5									x	

Review criteria addressed in Task Analysis and other plans



# Task Analysis / Design Assessment

Task Analysis

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	1.2	2	3.1	3.2	3.2.19	3.3	3.3.4	3.3.8	3.4	3.5	3.6	3.7	4	6
5.1		x												
5.2	x													
5.3													x	
5.4 (1)	x													
5.4 (2)				x		x								
5.4 (3)			x			x				x				
5.4 (4)						x	x		x	x				
5.4 (5)								x		x				
5.4 (6)					x						x		x	
5.4 (7)												x		
5.5														x

Review Criteria Cross-Reference

# Critical Safety Functions (CSF)

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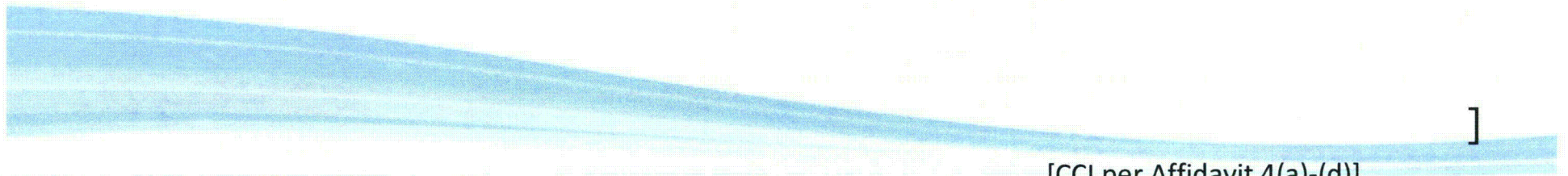




# Accident Mitigation Strategy Supports Critical Safety Functions

## Diversity, Simplicity, and Reliability

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# Preliminary Main Safety Panel (MSP) Layout

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# Full-scale Manual Safety Panel Mock-up

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[CCI per Affidavit 4(a)-(d)]

# MSP Indications Arranged based on Critical Safety Functions

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[CCI per Affidavit 4(a)-(d)]

# User Interface Development

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[CCI per Affidavit 4(a)-(d)]



# User Interface Development

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[CCI per Affidavit 4(a)-(d)]

# User Interface Development Tool Selection Methodology

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[CCI per Affidavit 4(a)-(d)]



# Simulator and User Interface Integration

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- Pilot OER, FRA/FA, and Task Analysis
- Develop Manual Safety Panel and Remote Shutdown Panel initial inventory of indications, alarms, and controls
- Develop Concept of Operations
  - Staffing levels
  - Accident mitigation strategies
  - Plant maneuvering and surveillance performance
- Develop user interface concepts
  - Alarm presentation
  - Navigation
  - Style guide
- Construct full-scope MCR mock-up and integrate with Engineering Simulator



# Preliminary MCR Electrical and Heat Loads

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# MCR Temperature During Station Black-Out

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# CONCLUSION