

Attachment 3: August 30, 2011 Presentation Slides (Redacted Version)

# generation ***mPower***

## *B&W mPower™ Software Process/Procedure Update and Human Factors Engineering Program Plan Overview*

*August 2011*

© 2011 BABCOCK & WILCOX NUCLEAR ENERGY, INC. ALL RIGHTS RESERVED.

This document is the property of Babcock & Wilcox Nuclear Energy Group, Inc. (B&W NE) and Northrop Grumman Corporation (NGC).



## August 30<sup>th</sup> Meeting Topics/Schedule

- Introduction
- Overview of Software Procedure  
Update
- Conclusion
- Lunch
- Introduction
- HFE Program Plan Overview
- Conclusion



# B&W mPower Software Process/ Procedure Update

## Regulatory Requirements/Software Procedures Review

- Based on feedback from the staff, Northrop Grumman is conducting a review of baseline set of software procedures

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

“Heading Check” for adequacy of baseline process



# Northrop Grumman Heritage of Process Improvement

[

]

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



# Essential Elements of NGC SW Development Process

[

]

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



# Northrop Grumman SW Integration Procedure

[

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

Note: each of the 5 pages of the above document  
contains NGC CCI information





## Next Steps

- Complete traceability matrix of regulatory requirements to baseline procedures.
- Assess any gaps with respect to Regulations
- Provide traceability matrix and associated baseline set of procedures to the staff.
- Schedule meeting with staff to discuss and review our existing processes and procedures.



# Attachment 1

Example Northrop Grumman [ ] [CCI per  
Affidavit 4(a)-(d)] Procedure, [  
]. [CCI per Affidavit 4(a)-(d)]

**Attachment to Slide Package**

**This procedure contains CCI per Affidavit 4(a)-(d). [**

]

**This procedure contains CCI per Affidavit 4(a)-(d). [**

]

**This procedure contains CCI per Affidavit 4(a)-(d). [**

]

**This procedure contains CCI per Affidavit 4(a)-(d). [**

]

**This procedure contains CCI per Affidavit 4(a)-(d). [**

**]**





# Conclusion



# Human Factors Engineering Program Plan Overview



## Meeting Objectives

- Expand NRC understanding of our HFE design team composition, responsibilities, authority, and placement within the organization
- Explain how the project is developing and implementing an effective HFE process
- Discuss planned submittals
- Outline design process and how it is compliant with NUREG 0711 review criteria
- Describe initial concepts, design, and assessment process which incorporate innovative technologies and concepts (ref. ACRS letter)
- Share early concepts related to proposed staffing



# mPower Engineering Organization

[



# HFE Program Scope of Responsibility

- Develop and Implement an iterative HFE process
- Submit HFE program implementation plans to the NRC, resolve and incorporate RAIs for submitted Topical Reports
- Develop “Concept of Operations” and “Human System Interface Concept” (DCS requirements)
- Integrate HFE with other design activities
- Ensure that subcontractor engineering processes include HFE program requirements
- Identify and Inform the design for areas that have the potential to improve human performance



# HFE Design Team Plant Design Accomplishments

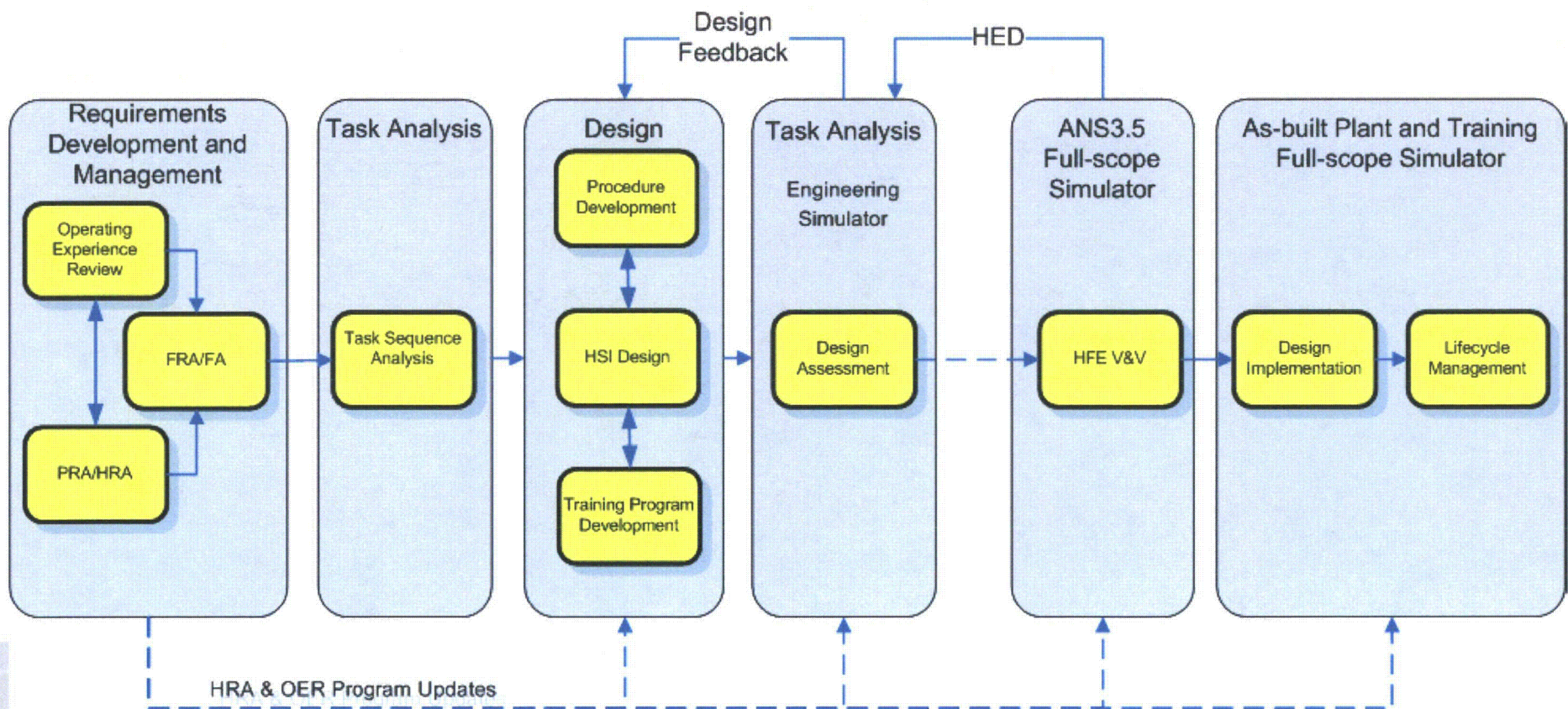
[

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



# Proposed Submittals Discussion

# mPower HFE Program Overview







## Design Philosophy

- Optimize the number of components and systems required to operate (not fail) to perform a given plant function.
- Capture and integrate user needs in design.
- Use a top-down requirements-based design process.
- Leverage design team experience to improve HRA critical shaping factors beginning in concept phase.
- Maintain an iterative design process.
- Consider entire design lifecycle including: development, validation, implementation, testing, operation, maintenance, and obsolescence.



[

]



# Credited Safety Systems

[

]

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



# Systems Included in the Initial Scope of HFE Program

[



# Systems Designed Using HFE Best Practices

[



# [ ] DCS and HSI Architecture

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



# Functional Control Room Layout

[

]

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



# B&W mPower Main Control Room Concept

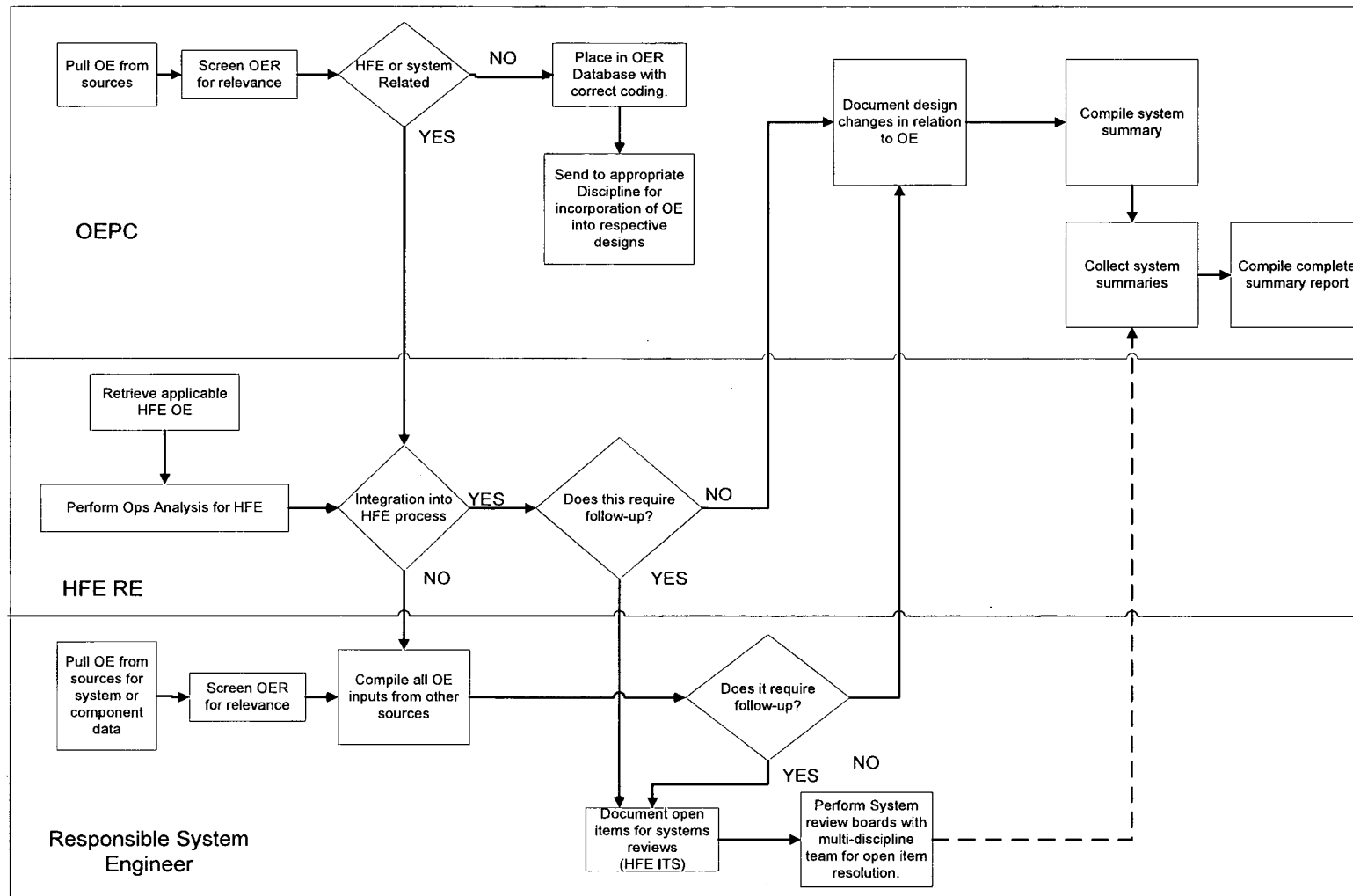
[

]

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



# Operating Experience Review Process

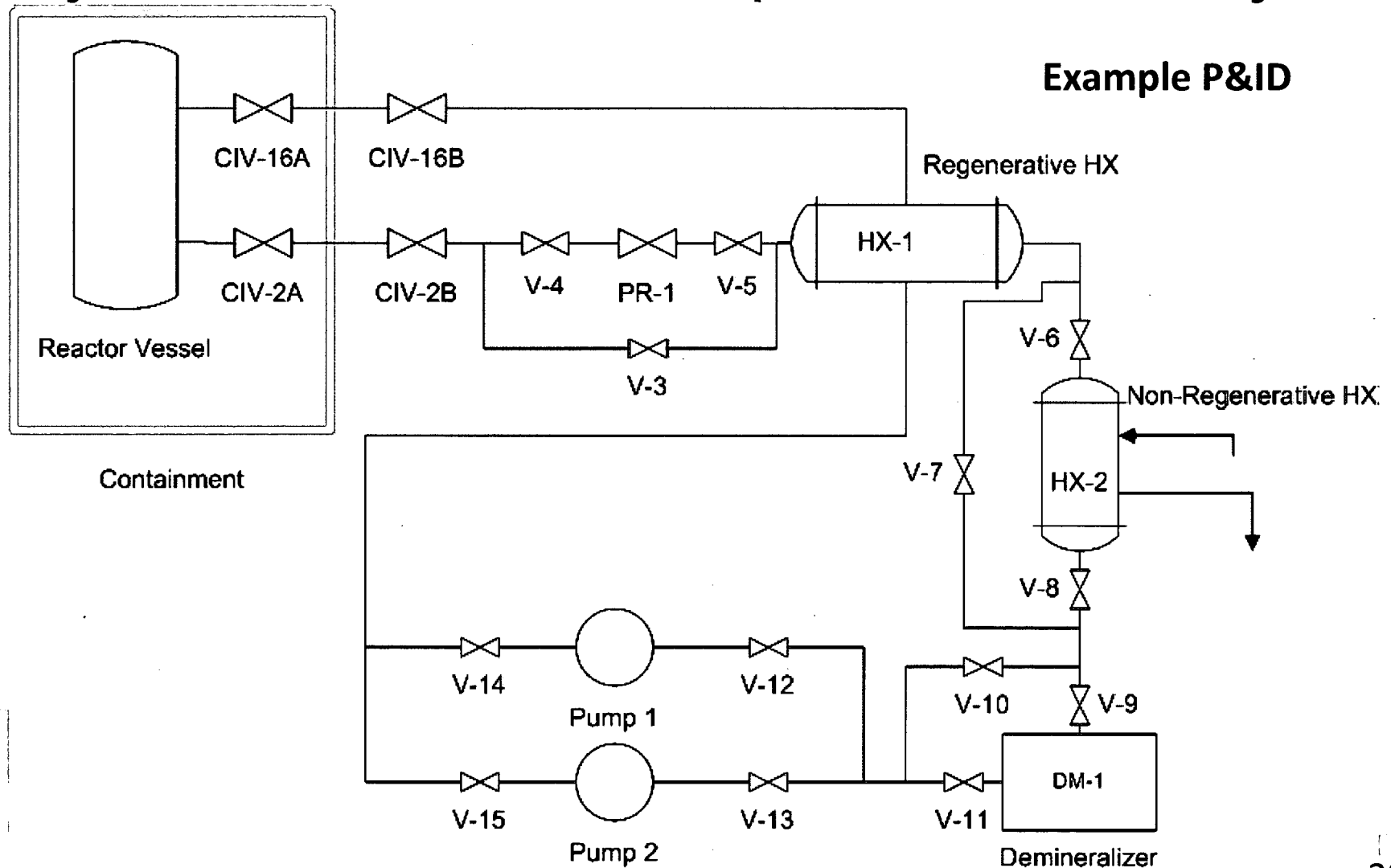




# Human Reliability Assessment (HRA)

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

# System Functional Requirements Analysis





# Example SFRA Function Tree

generation  
**mPower**  
Example SFRA

[

]

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



# System Function Verses Plant Mode Table

[

]

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



## Configuration Change Table

[

]



# Functional Configuration Change Table

[

]

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





# Component Configuration Change Table

[

]

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

[

]

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

generation  
***mPower***

[

]



[

]

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



# Additional Task Analysis Fields

[

]

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



# Areas of Design Assessment Focus

[

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



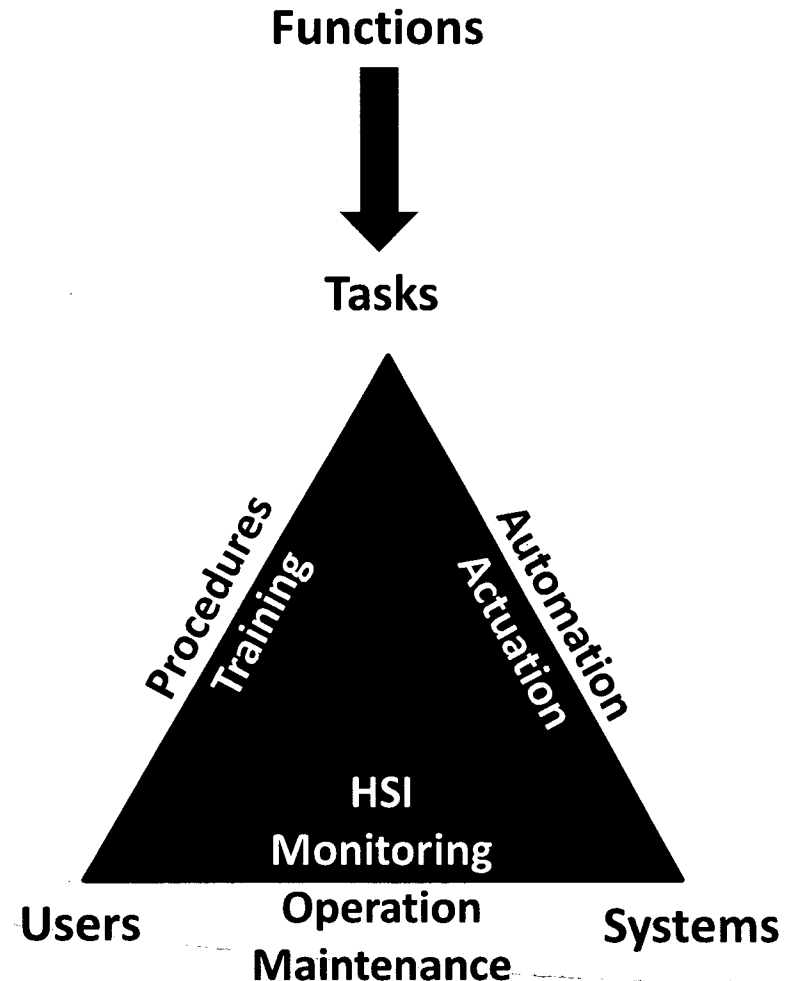
# Design Assessment

[

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

# Concept of Operation

- Functions are defined
- Tasks are developed to support functional requirements
- Functions/Tasks are allocated to man and/or machine to optimize reliability
- Knowledge and abilities, training objectives, and user guidance is provided for tasks allocated to man
- Prerequisites, interlocks, sequence, and success criteria are provided to control systems
- Guidance provided to user is compatible with requirements provided to control systems



Top-down and Based on Required Functions



# Initial HFE Design Considerations

[

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



generation  
**mPower**

[

1

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

generation  
**mPower**

[

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



[

]

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

generation  
***mPower***

[

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

]

generation  
***mPower***

[

]

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



# Home/Plant Overview Concept

[

]

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

generation  
***mPower***

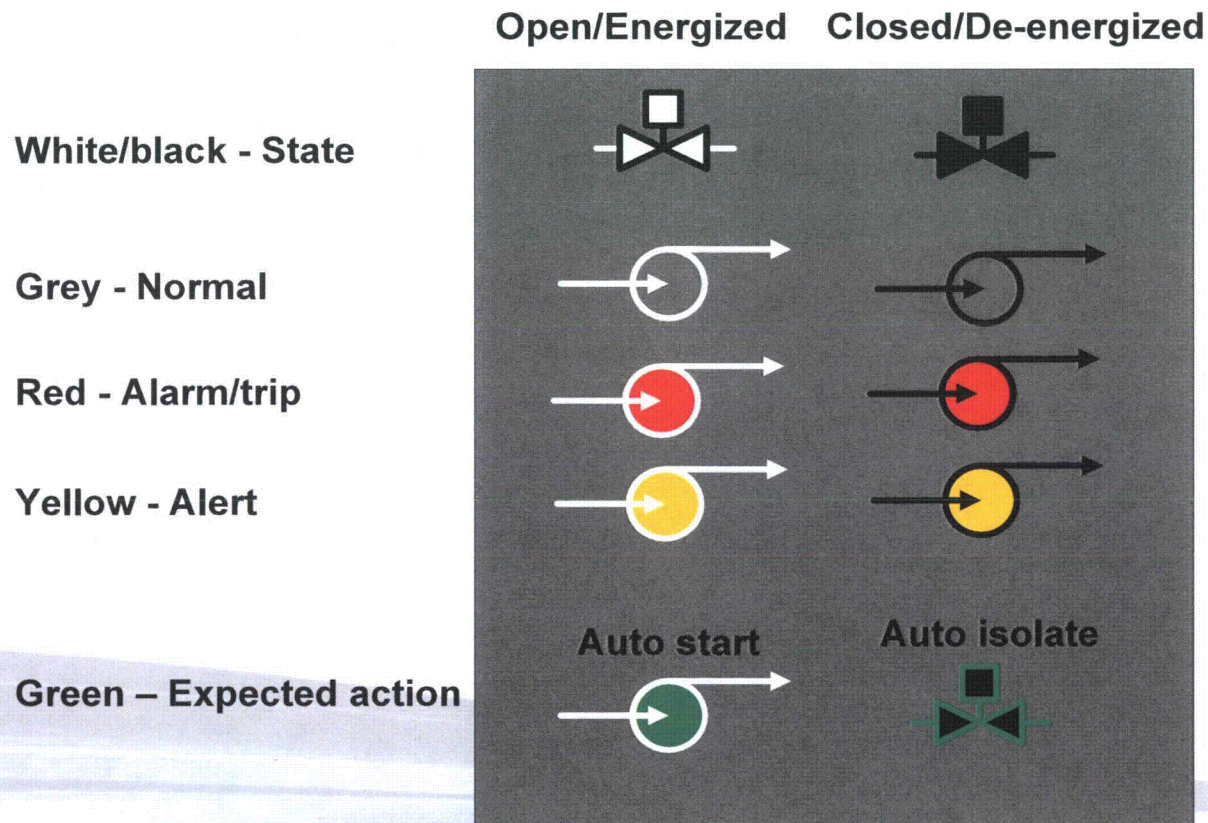
[

]

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

## Use of Color

- Monochromatic for normal operation
- Color used to indicate off-normal or changing condition





generation  
***mPower***

[

]

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



# Procedures Embedded in DCS

Improve Situational Awareness and Human Reliability

Bounding Principles:

- Minimize the opportunity for error
- Maintain user's awareness of plant mode, configuration, and operational goals
- Detect and mitigate errors before adverse consequence
- Maintain awareness of safety function status

generation  
***mPower***  
**DCS Illustrative Example**

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

generation  
***mPower***

[

generation  
**mPower**

[

generation  
**mPower**  
Post Accident Monitoring

[



# Discussion

- Submittal Timeline
- Future Meetings:
  - Dates
  - Location
  - Topics
- Questions and Parking Lot Items



# Conclusion