

# *Improving Procedural Operations*



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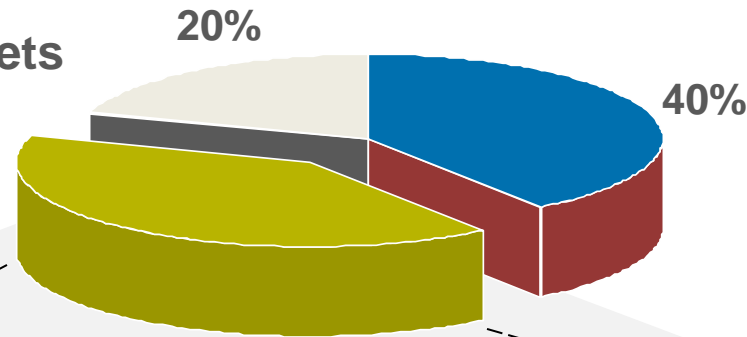
# *What is an Abnormal Situation?*

- An industrial process is being disturbed and the automated control system can not cope.
- Consequently, the operations team must intervene to supplement the control system.



***An Abnormal Situation Impacts Safety, Environment, Profitability***

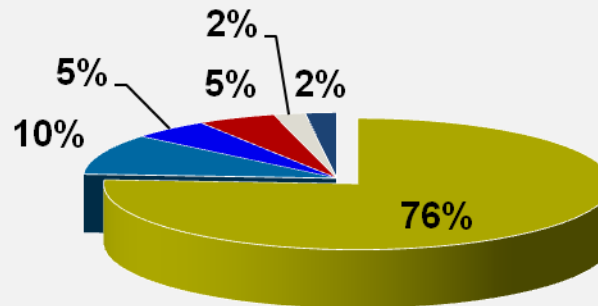
## Causes of Process Upsets



- Human error
- Equipment failure
- Other

Source: ASM Consortium

## Causes of Equipment Failure



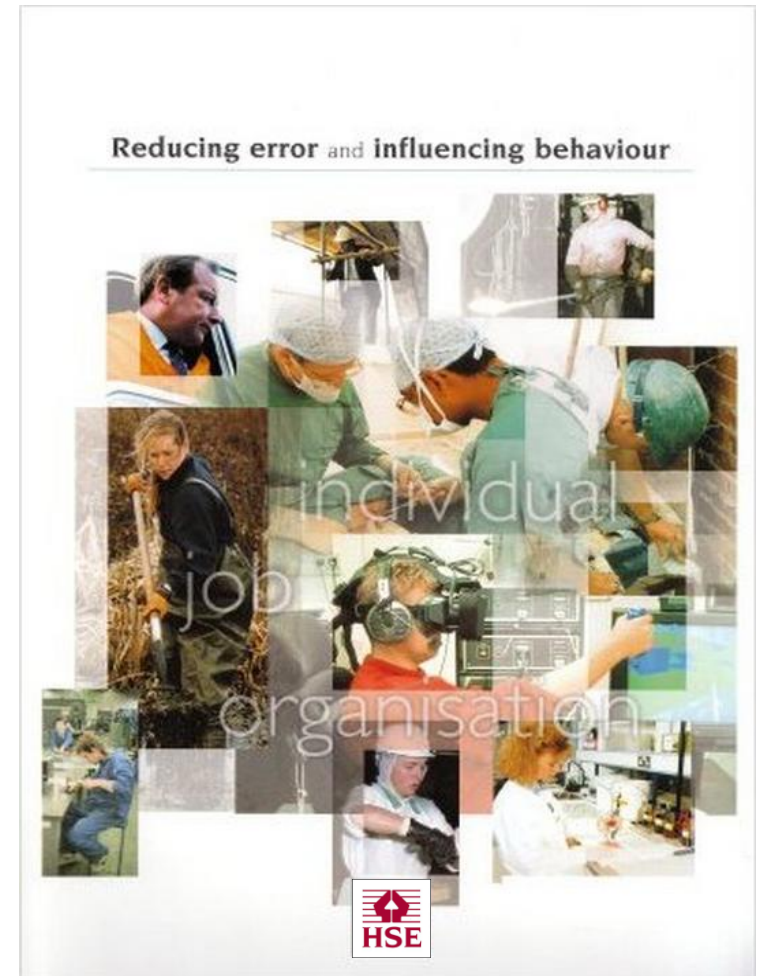
- Operating out of range
- Improper design
- Improper maintenance
- No defect found
- Improper installation
- Improper material

Presented by N Kosaric at  
2005 Defect Elimination Conference

70% or More Due to Human Performance Issues

UK HSE publication states:

“It is estimated that up to **80%** of accidents may be attributed, at least in part, to the actions or omissions of people.”





# *Aspects that Impact Operator Performance*



## **Organizational**

- Management practices that influence the organizational culture, work processes, staff roles and responsibilities, and valued behaviors



## **Knowledge**

- Development and maintenance of a competent work force through training and the creation of a continuous learning environment



## **Communications**

- Communication and situational dialog among plant personnel and use information technology that improves coordination in all situations.



## **Procedures**

- Ensure procedures are clear, intelligible compliant with policy, accessible and up to date



## **Environment**

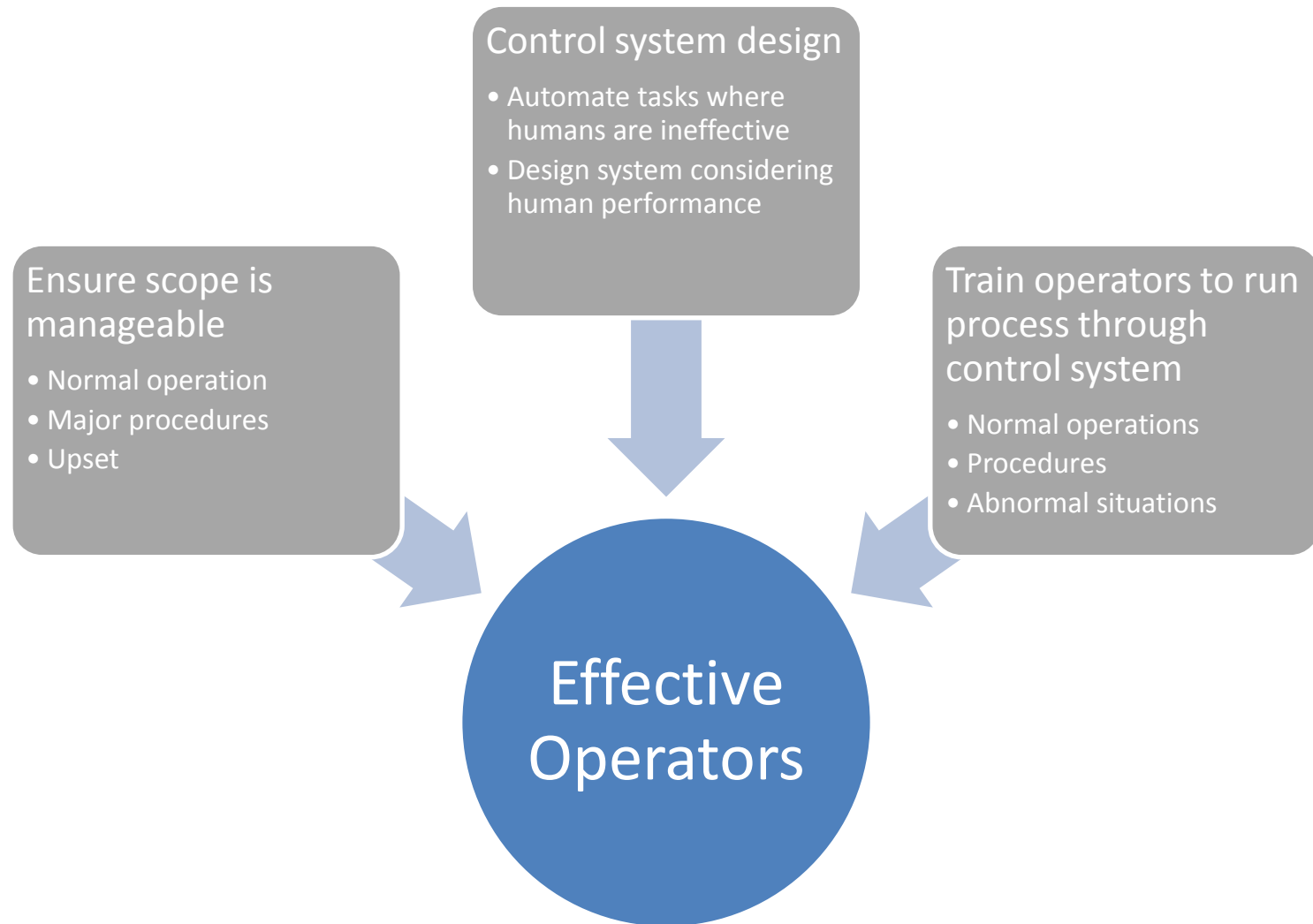
- Work place design factors that impact performance of personnel (vigilance, distraction)



## **Monitoring and Control**

- Effective design, deployment, and maintenance of hardware and software platforms that support process monitoring, control and support for effective operations.

# *Maximize Operator Effectiveness*





Digital Systems Excel	Approach
Very fast response required	Automate
Repetitive	
Complex, high risk tasks or calculations	
Response when operator overloaded	
Infrequent tasks	Automate or provide guidance tool
Storage and retrieval of large amounts of information (eg operating envelope)	Information system
Humans Excel	Approach
Pattern recognition	Effective presentation of information <ul style="list-style-type: none"> <li>• Effective design process</li> <li>• Well designed operator interface               <ul style="list-style-type: none"> <li>• consider human capabilities</li> <li>• highlight important information</li> <li>• minimize cognitive load</li> <li>• ensure situation awareness</li> <li>• enable pattern recognition</li> <li>• fast navigation</li> </ul> </li> </ul>
Decision making with limited, imprecise or conflicting information	
Determining what is relevant in undefined situations	

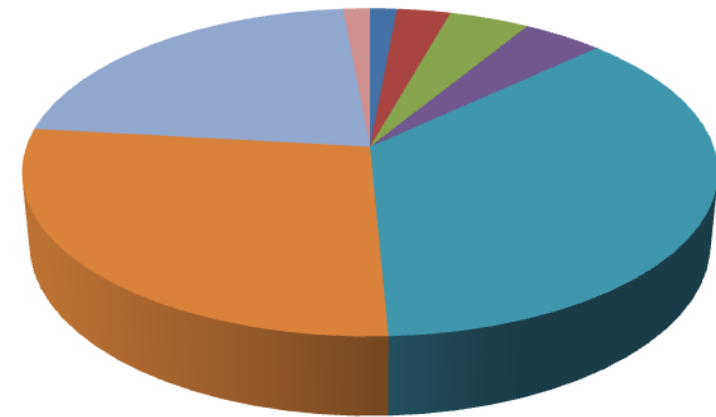


“Inadequate management of procedures have not only contributed to disasters such as Bhopal, Piper Alpha and Clapham Junction,.....The main causes are too much reliance placed on procedures to control risk, a failure to follow safe working procedures or the use of inadequate procedures”



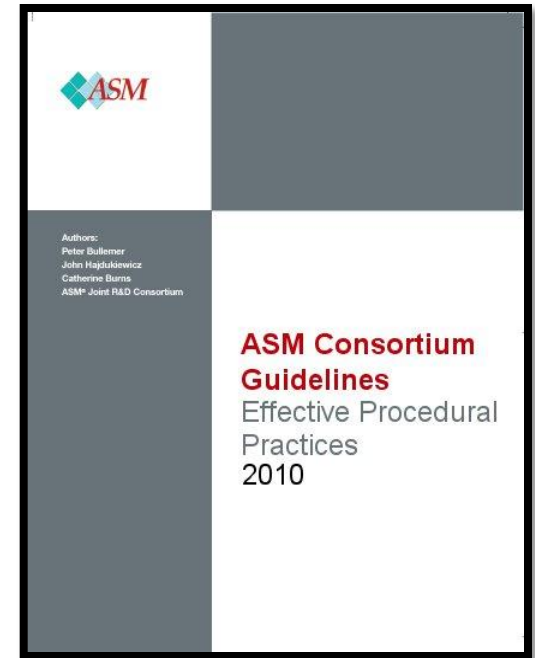
- One ASMC member company noted
  - “A disproportionate % of process safety incidents occurred during transient operations....a typical refinery or petrochemical plant spend less than 10% of its time in transient operations – yet 50% of process safety incidents occur during these operations”
- An ASMC study identified causes as
  - 6%: Procedure followed incorrectly
  - 40%: Procedure wrong
  - 51%: Procedure not followed

Cause

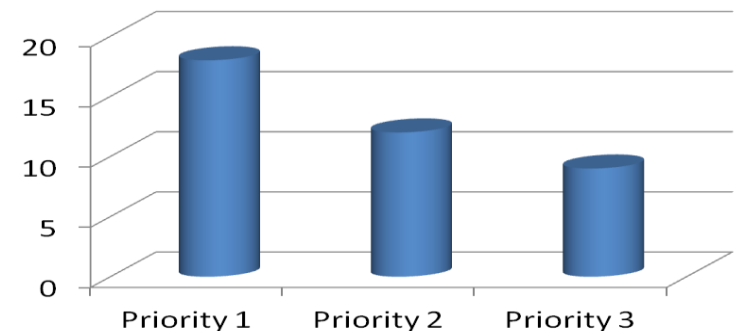


- Format confusing
- Details need improvement
- Check-off misused
- Facts wrong
- Situation not covered
- Procedure not used
- No procedure
- Procedure not available or inconvenient for use
- Procedure difficult to use

- To help members reduce problems in procedures a guideline has been developed and made available for purchase
- In addition a wide range of additional research has been completed and made available to members
- The document contains 39 guidelines broken down into 5 areas:
  - Development
  - Content and format
  - Deployment
  - Maintenance
  - Training

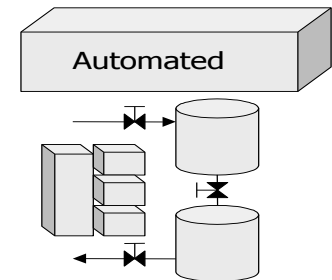
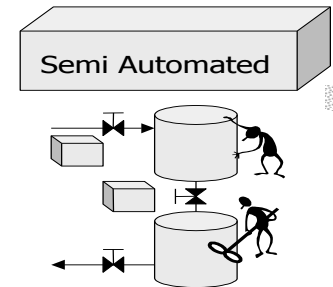
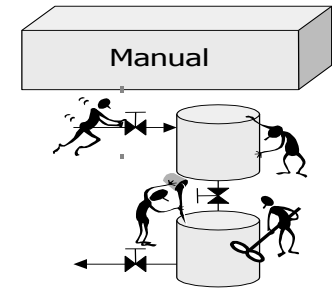


**Guideline Priorities**

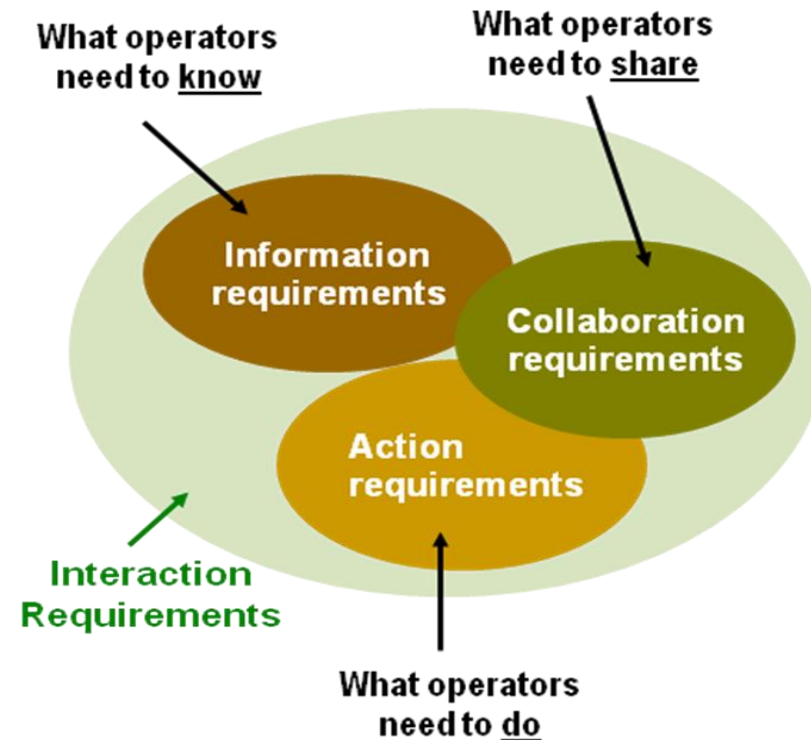


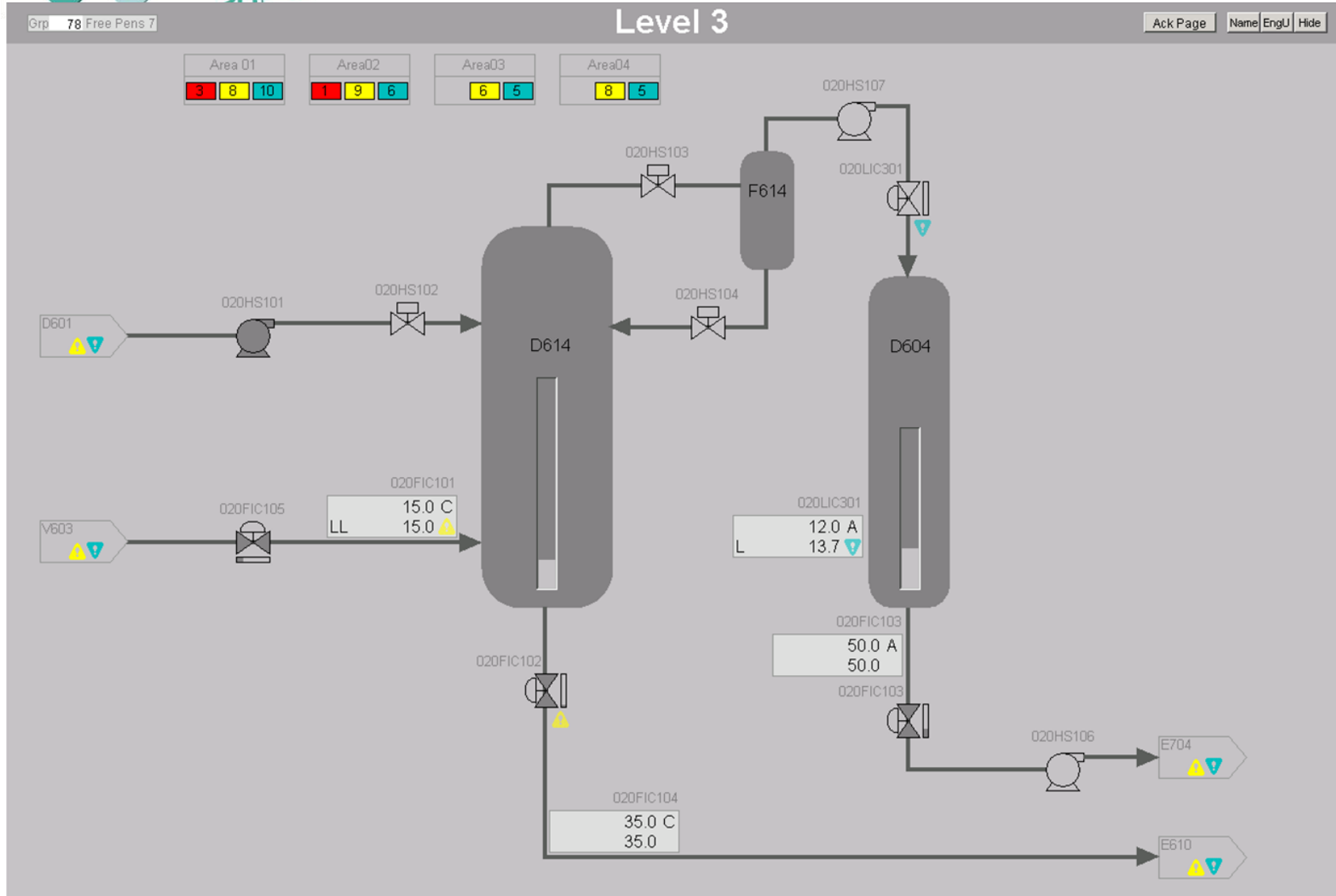
# Procedure Automation has Varying Degrees

- In batch processing procedures have been automated for many years, but this is still rare on continuous plants
  - ASMC has identified this as a significant opportunity to improve safety and production
- Procedural automation can fall into 3 categories
  - Manual Procedures
  - Semi-Automated Procedures
  - Automated Procedures
- Important to use prioritization tool to determine which approach to use where
  - Balance cost against risk of incorrect procedure execution and resulting safety impact or production loss

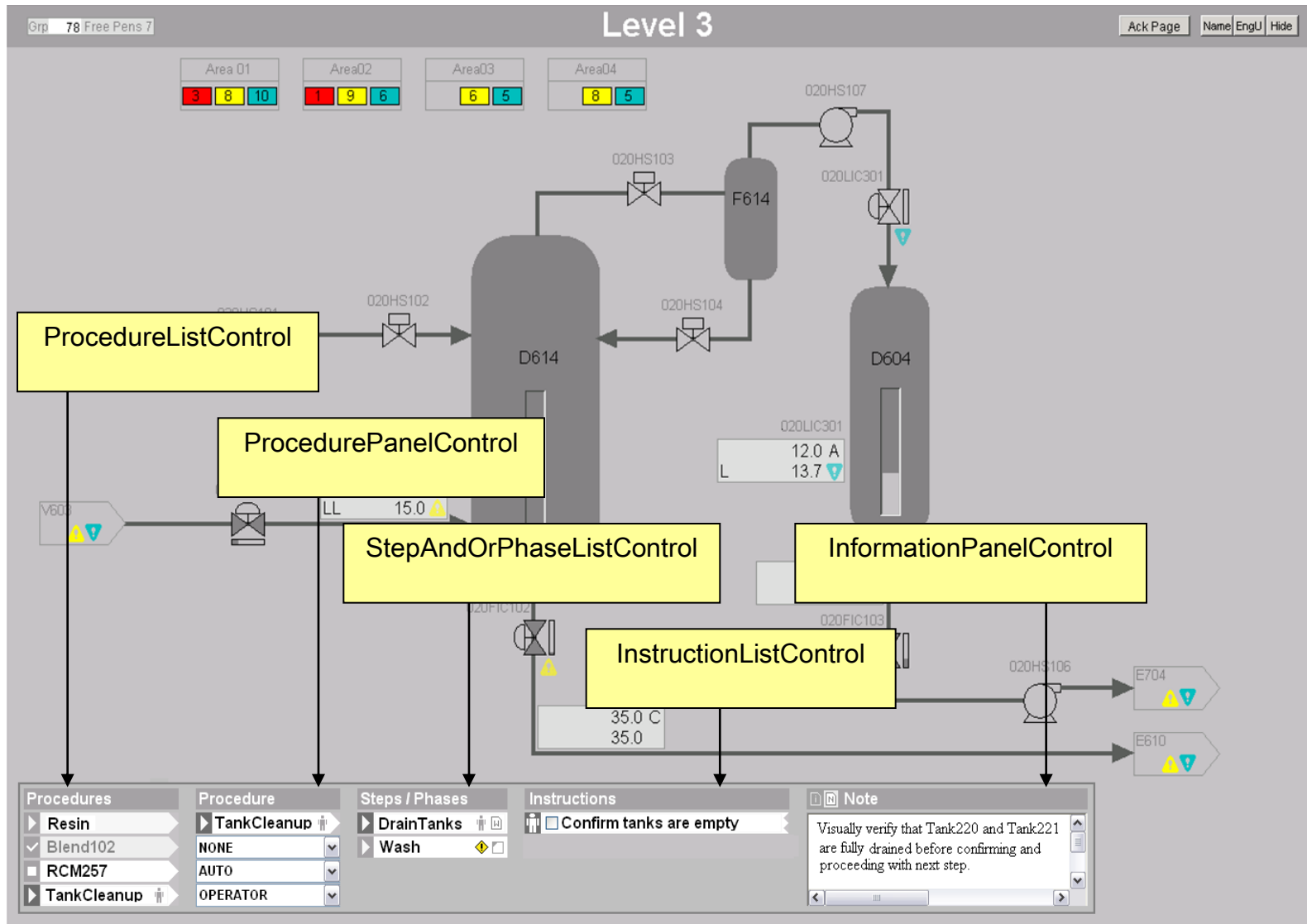


- As a minimum, when developing the operator interface, the interaction requirements analysis (IRA) should
  - evaluate all procedures
  - determine the information needed by the console operator to ensure safe and effective procedure execution
- Develop procedure or task-based displays that enable effective procedure execution
- Use pre-task checklists to ensure effective communication
- For procedures that impact all process areas under the scope of the operator (eg start up), all aspects of the display will support the procedure
- For other situations the procedural display integrates with the hierarchical displays

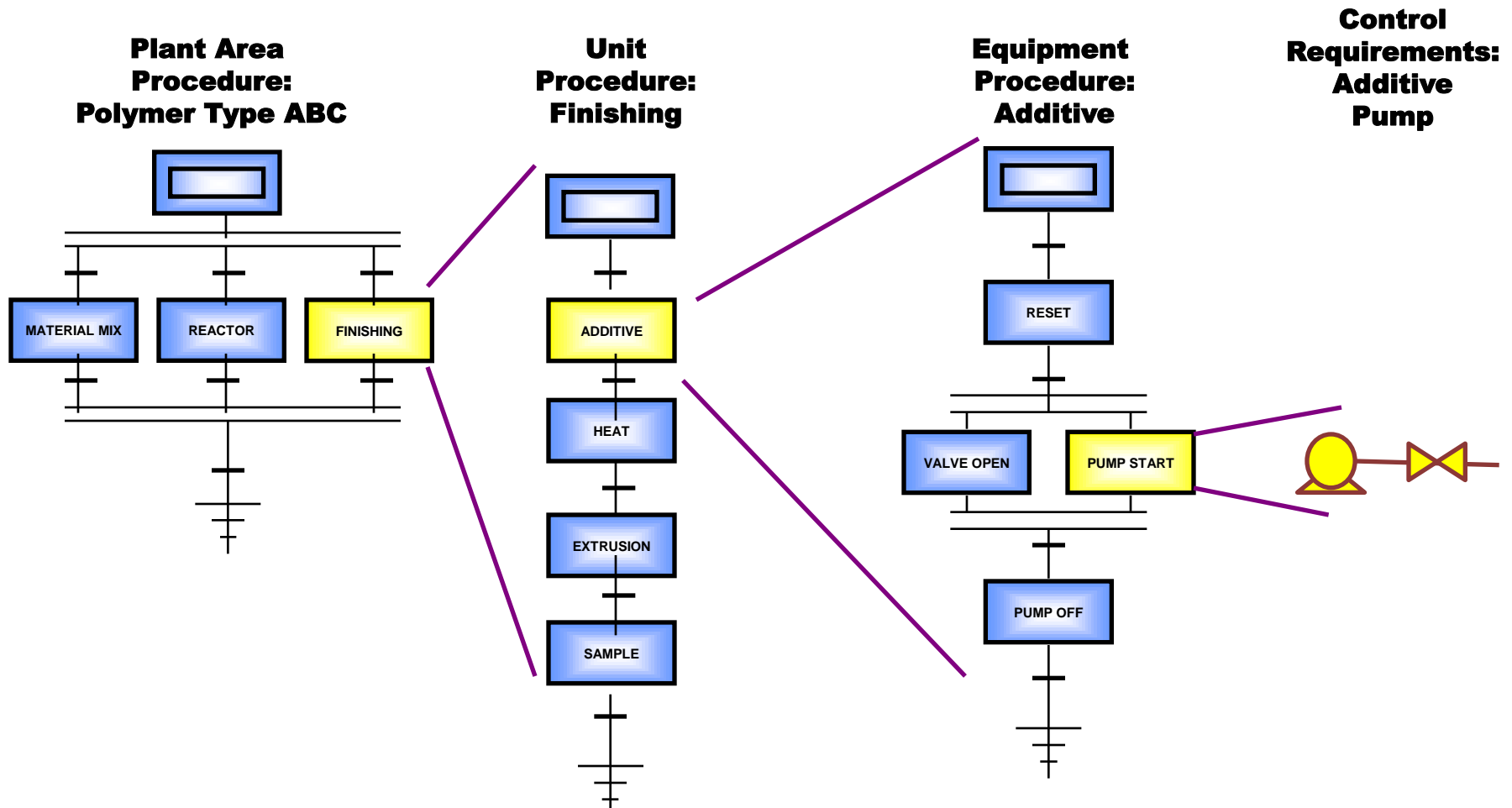




# Process Display with Procedure Controls



# Procedure Automation 3 Layered Procedure Hierarchy





- Widespread efforts to reduce frequency and impact of abnormal events at Honeywell's Geismar facility
  - High performance operator user interfaces
  - Simulator-based operator training
  - Early event detection
  - Automated procedures
- Automated procedures applied to catalyst regeneration
  - Minimize feedrate reduction
  - Reduce operator workload
  - Ensure consistent regeneration
- Project success with expected payback time
  - Detailed results not in public domain



- Reducing abnormal situations is key to improving safety and increasing production
- Operations team error is a key contributor to this
- Need to
  - Ensure operator scope is manageable, particularly during upsets
  - Automate tasks that humans are ineffective at
  - Maximize human performance through careful design of work environments and human machine interfaces
  - Effective operations team training
- Many process safety incidents occur during transient operations and so procedures for these need attention
  - Proper design and maintenance of procedures
  - Access to procedures
  - Appropriate automation and operator interface
  - Effective training in procedures

