

The Abnormal Situation Management Consortium: *Past and Future of Abnormal Situation Management*



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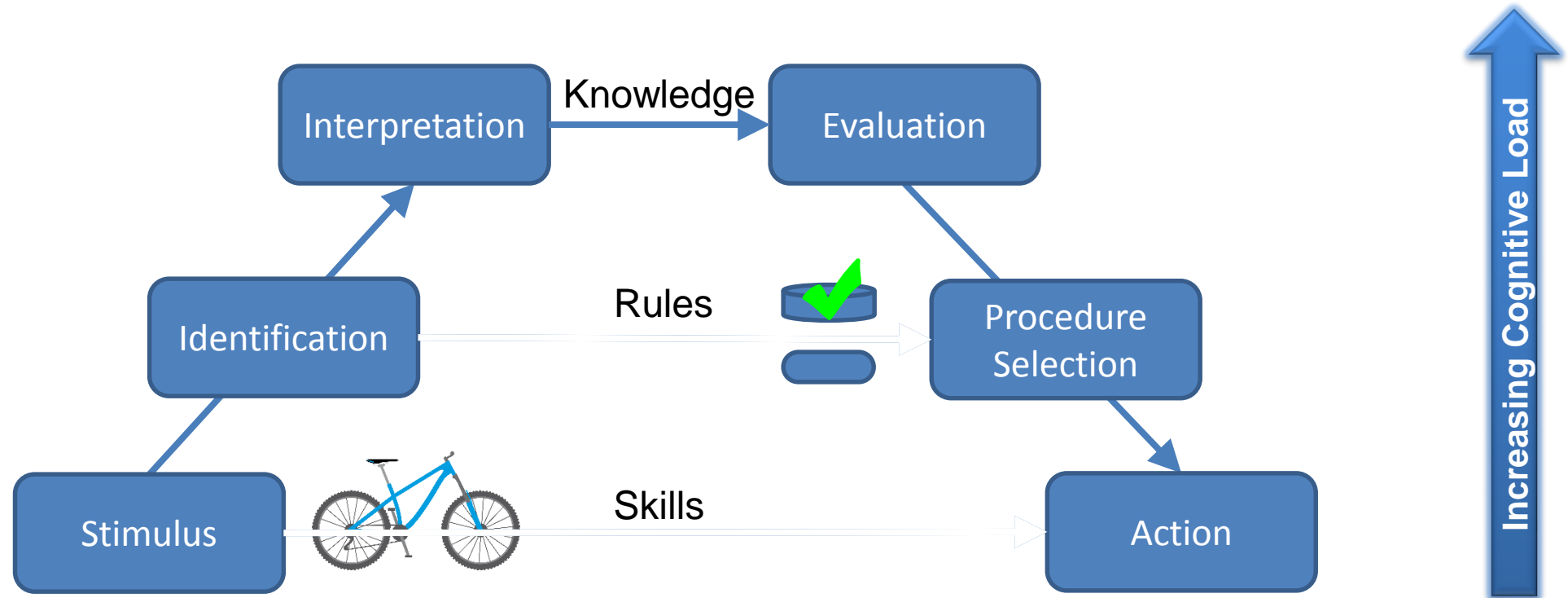
<http://www.asmconsortium.net>

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We make decisions in a Hierarchy

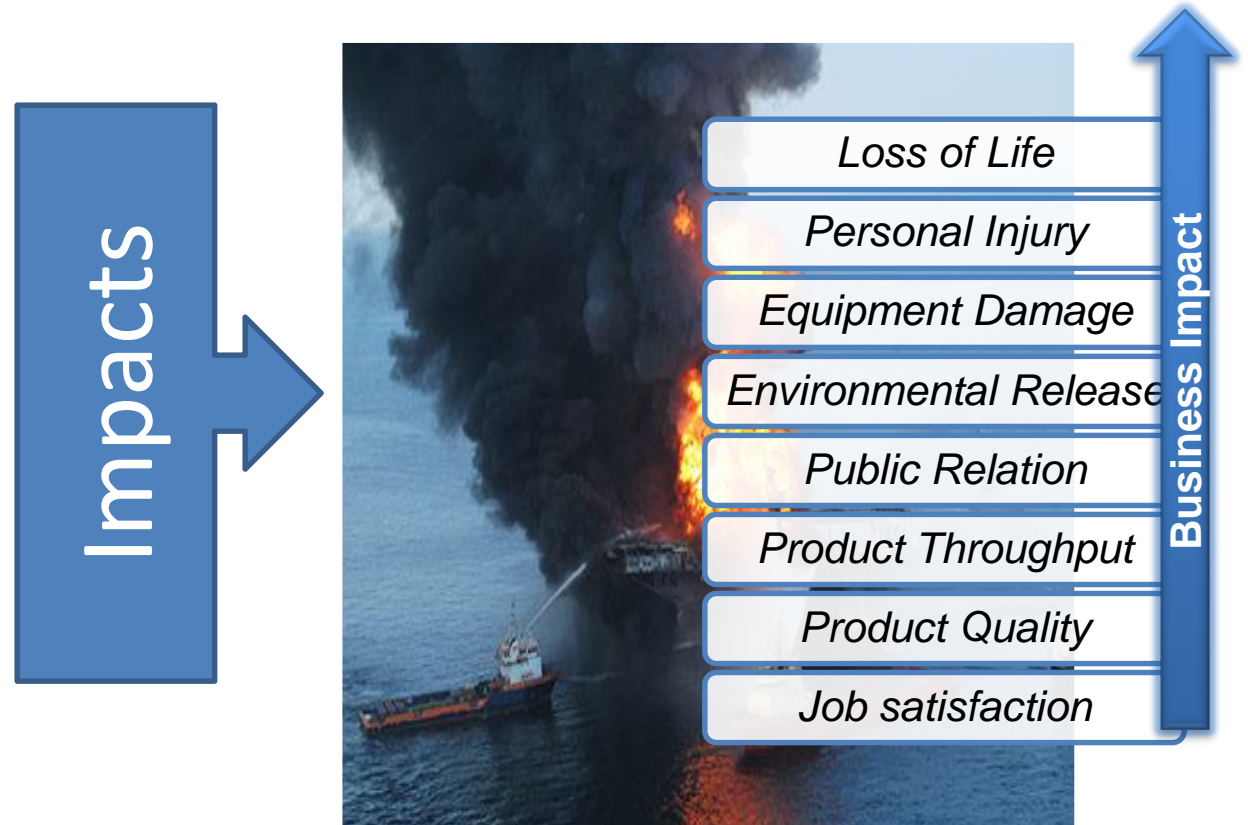


Rasmussen's SRK model

DEFINITION:

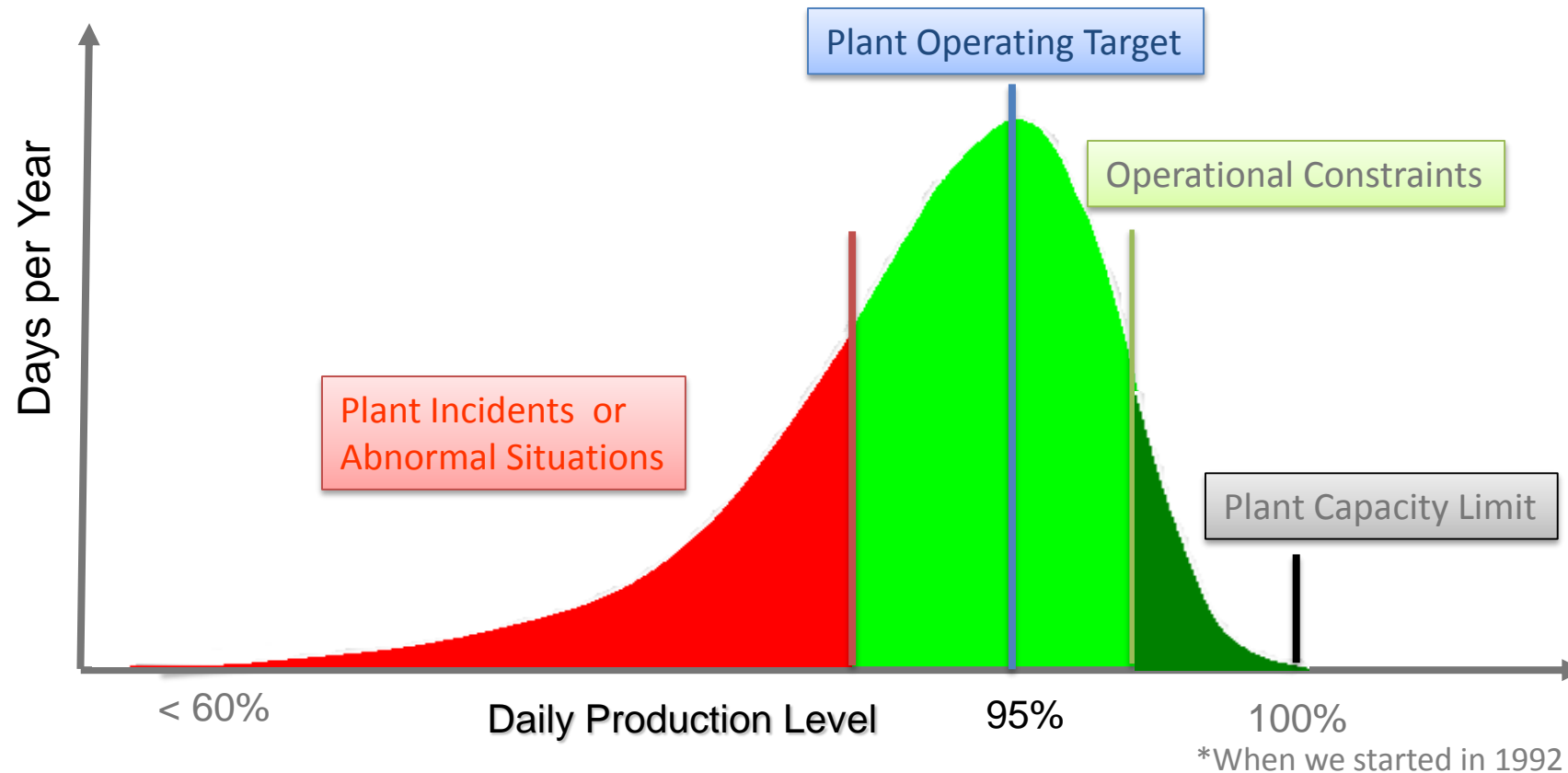
An industrial process is being **disturbed** and the automated control system cannot cope.

Consequently, the operations team **must intervene** to supplement the control system.



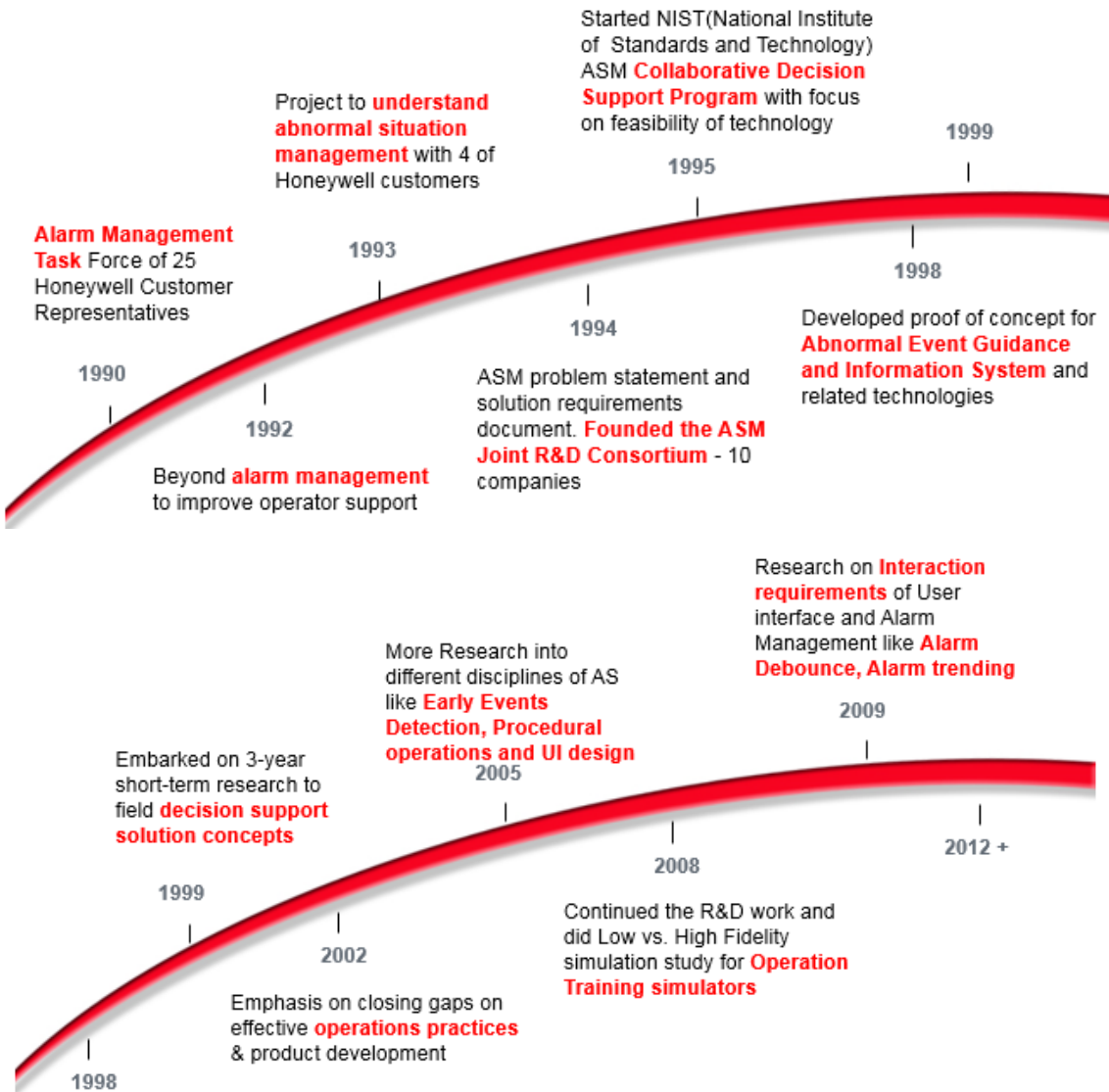
An Abnormal Situation Impacts Profitability – at the least

Cost of Abnormal Situations



- Unexpected Events Cost 3-8% of Capacity
- >\$10B annually lost in production*

Though Accidents are Rare, Impact is Significant

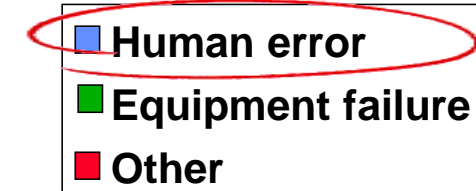
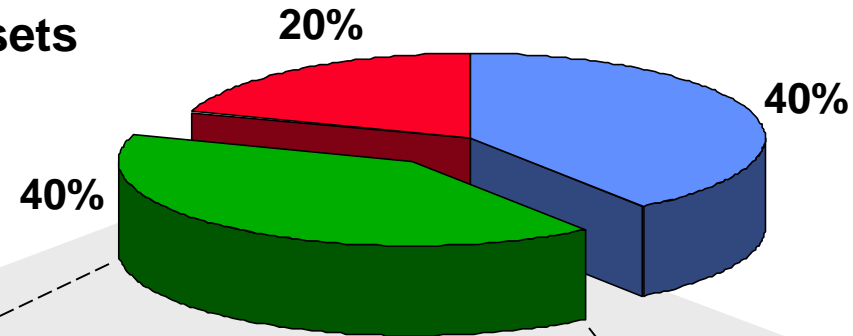


- Honeywell assembled a task force of 25 customers in 1989 to address Alarm Management
- Phillips' Petrochemical Explosion 10/23/1989 added urgency
- Discussion with US NIST led to formation of the Abnormal Situation Management Joint Research Consortium (ASM)
- US NIST Advanced Technology Development Program matched \$8.5M member funds with \$8.1M for a three year Research Program 1994-1996
- Since 1997 all funding has been from members. A total of approximately \$40M.
- 85% Research. 15% on Communicating Results

Sources of Abnormal Events

Causes of Process Upsets

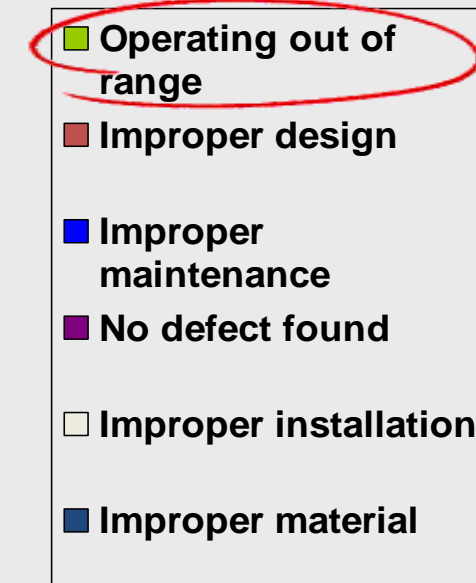
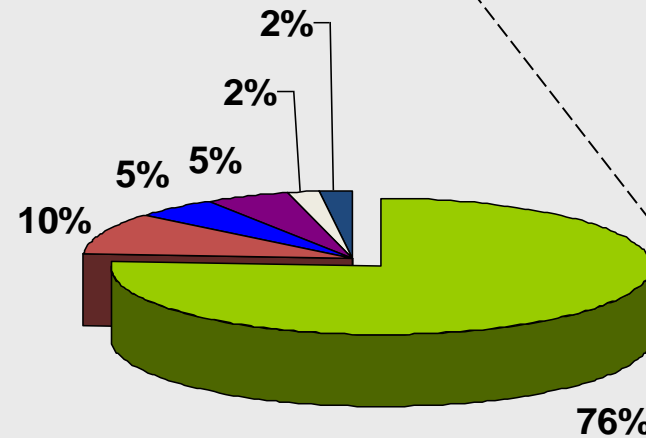
Source: ASM Consortium



40%

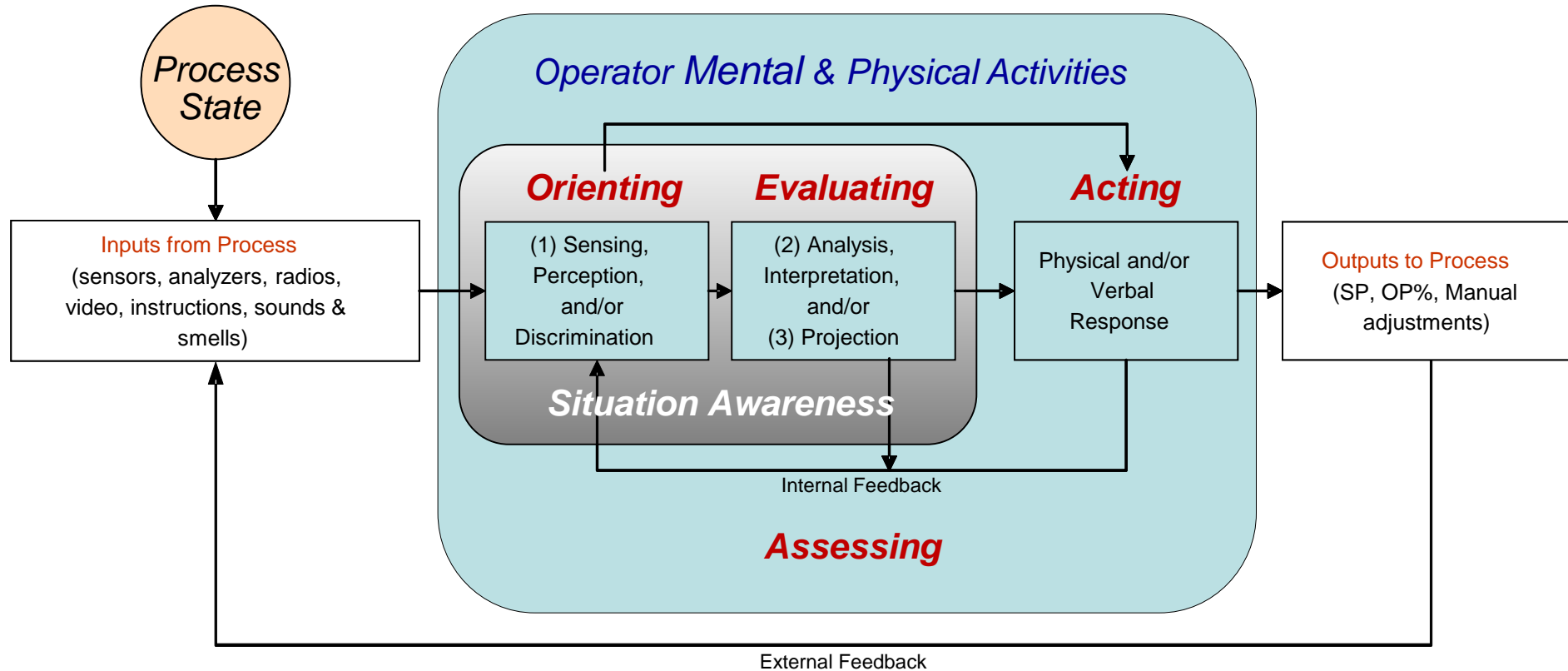
Causes of Equipment Failure

Presented by N Kosaric at
2005 Defect Elimination Conference



30%

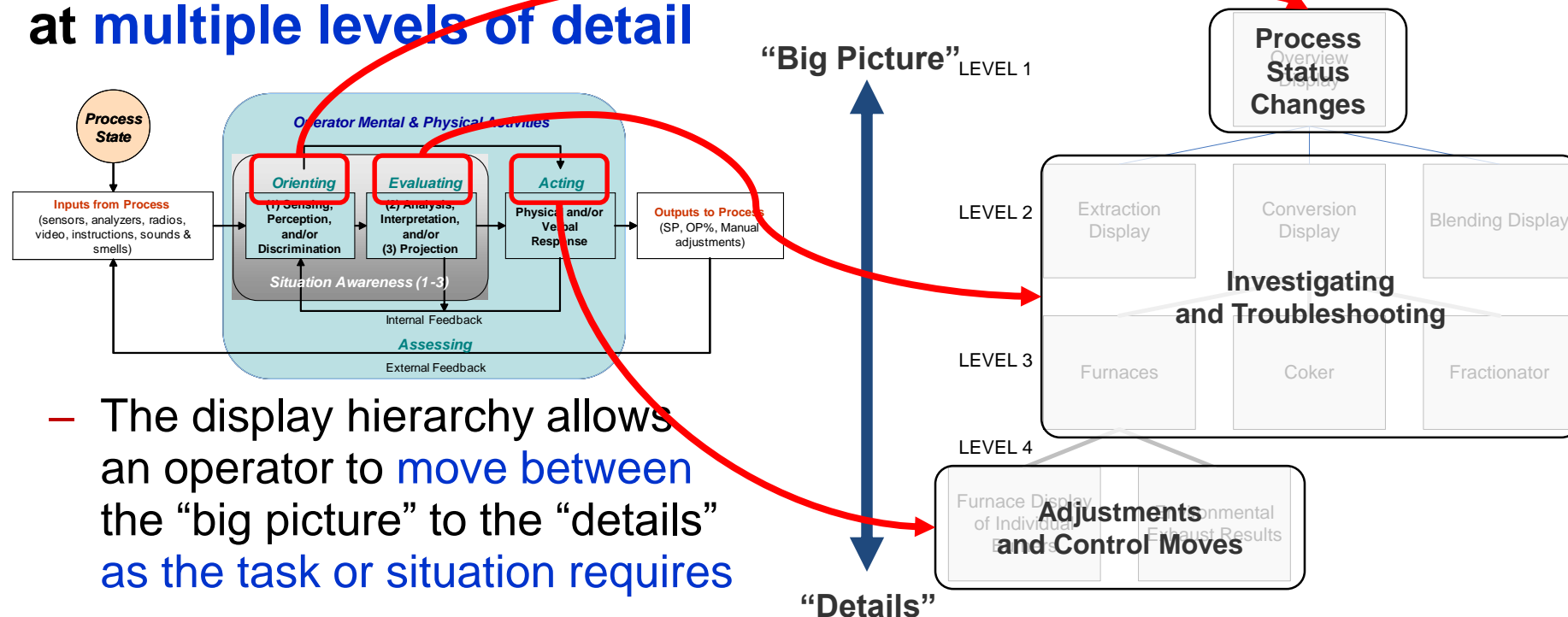
70%+ due to Human Performance Issues



- This model operationalizes the activity types in the **operator's supervisory control responsibilities** for managing abnormal situations

Adaptation of Supervisory Control Activity models of Jens Rasmussen and David Woods - CMA.

- Effective supervisory control involves processing information at **multiple levels of detail**



- The display hierarchy allows an operator to **move between** the "big picture" to the "details" as the task or situation requires

The Display Hierarchy is a Critical Solution for ASM

Applying Human Factors and doing simple things can improve operator performance dramatically:

Cases 1 & 2

1. Ensure Operators aren't overloaded

- Rationalize your alarms
- Make problems obvious
- Reduce load using automation where appropriate

Cases 3 & 4

2. Develop Console Displays based on Human Factors

- Make complex things simple by making it “visual”
- Turn data into information with proper context

3. Keep procedures up to date, easy to search, easy to use

- Address abnormal situations
- Automate difficult, complex, or lengthy procedures

4. Improve communications

- Start Up / Shutdown / Shift Change

Case 5

5. Improve Operator Competency

- Train operators: Be prepared

6. Provide a conducive Control Room Environment

- Ergonomic environment promoting operator performance

Case Study 1 : Alarm Overload

- Effective ASM Alarm Management Practices
 - Tools like Alarm Configuration Manager™
 - Deal with bad-actors
 - Set priorities
 - “First out”

Reduced alarms from 28,800/day to 288/day

- ROI
 - Reduced shutdowns (trips)
 - Effort payed back completely due to one less trip per year



- Shell Shearwater Platform – North Sea
 - 11,600,000 m³/d of gas
 - 18,400 m³/d (110,000 BPD) of condensate

Goal is 6 or less alarms per hour & No Floods *

- Effective ASM Alarm Management Practices

- 4000 tags rationalized
- 35% configured alarm reduction
- 45% average reduction in alarms for two units



- ROI
 - Improved Operator performance .
 - Better decision making
- Irving Oil refinery in Saint John, New Brunswick
 - 280,000 BPD refinery

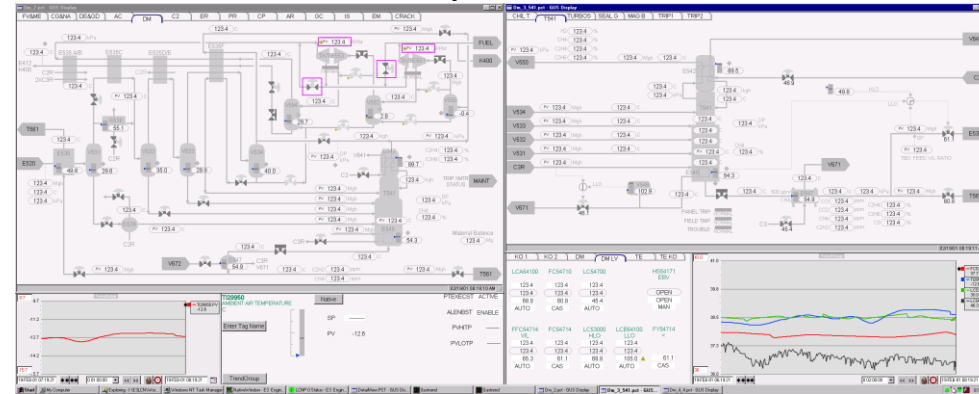
- Effective Operator Display Design
 - 38% better event detection before alarm
 - 41% improvement in time to solve problem
 - 26% better successful completion of scenarios
- ROI
 - Savings of \$800,000 per year
- NOVA Chemicals Corporation – Joffre, Alberta
 - 6 billion lbs of ethylene annually
 - 2 billion lbs of polyethylene annually



Key Interface Elements

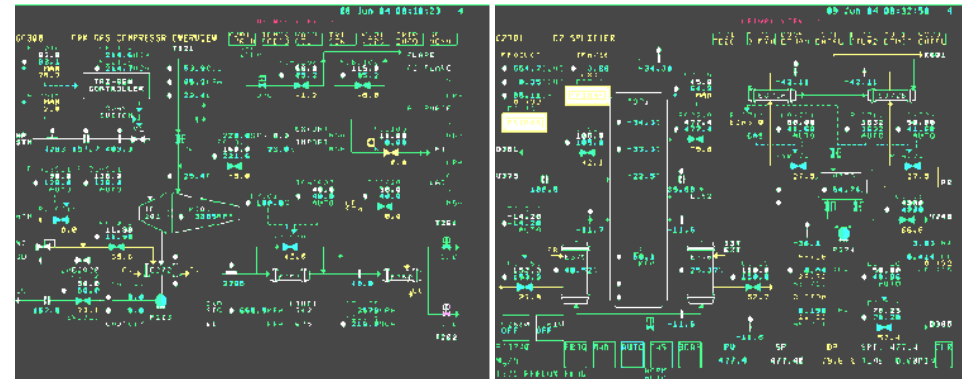
- Multi-level, simultaneous views of increasing detail
 - Level 1 – Console Overview
 - Level 2 – Unit Summary
 - Level 3 – Equipment detail
 - Level 4 – Group & Point detail
- Linked navigation between views with single key stroke
- Integrated Trending
- Integrated alarm management into graphics and navigation tabs

ASM Style Framework



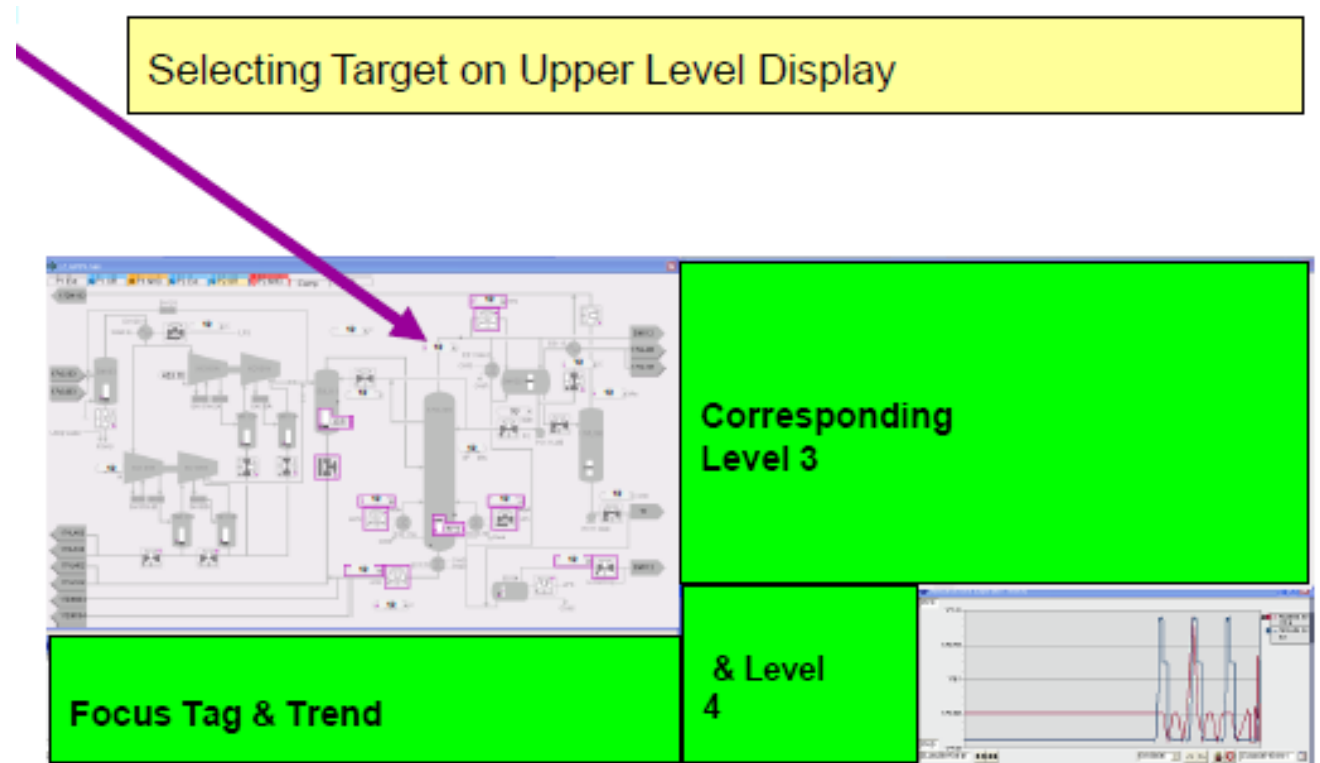
VS.

Traditional Drill-down Framework



Display Coordination

- Linked Displays
 - ✓ Selecting a target on an upper level display
 - ✓ Automatically opens more corresponding detailed displays
- Selected tag is put in Focus
 - ✓ Opens new Faceplate
 - ✓ Detail Trend



- Effective Design Display guidelines
 - Minimized Information displayed on HMI
 - Alarm Minimization review
- ROI
 - 95-98% uptime in first three months.



BP Clair Off-Shore Platform

- BP Clair Off Shore Platform
 - 60,000 barrels/day

- Effective Operator Training
 - Trained with at least 5 process trips during start up.
 - Training in simulated upsets
- ROI
 - Reduced trips during start up
 - Increased Operator confidence



Woodside Energy improved safety and shortened operator training with Honeywell's UniSim.

- Woodside Angel Oil platform
 - Remote Controlled operation.
 - Stands in ~80 m of water

- Use AI to make Early Event Detection less costly to develop.
- Use NLP to mine HAZOP information → **Safe Operating Limits tables** to provide Operators with guidance on situations they rarely see.
- Use NLP to mine equipment manuals, provide real time assistance at start-up & shutdown to improve equipment reliability.
- AR / VR training models (Available today. Costs are coming down)
 - for example fired heaters / furnaces / boilers
- Improving Emergency Response



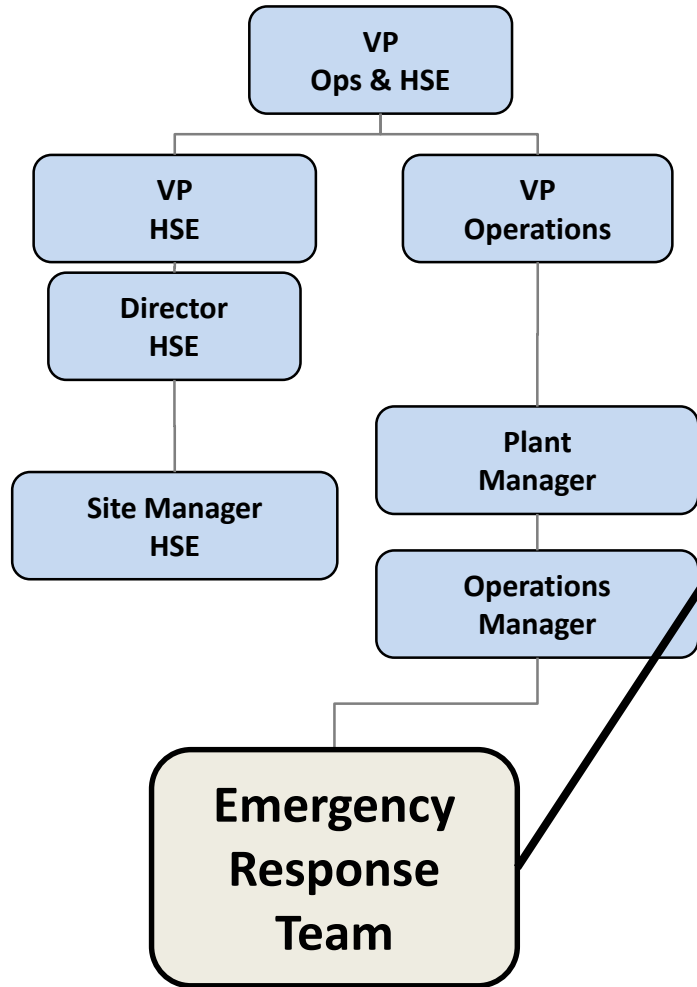
Typical Emergency Response Organization

Corporate Leadership

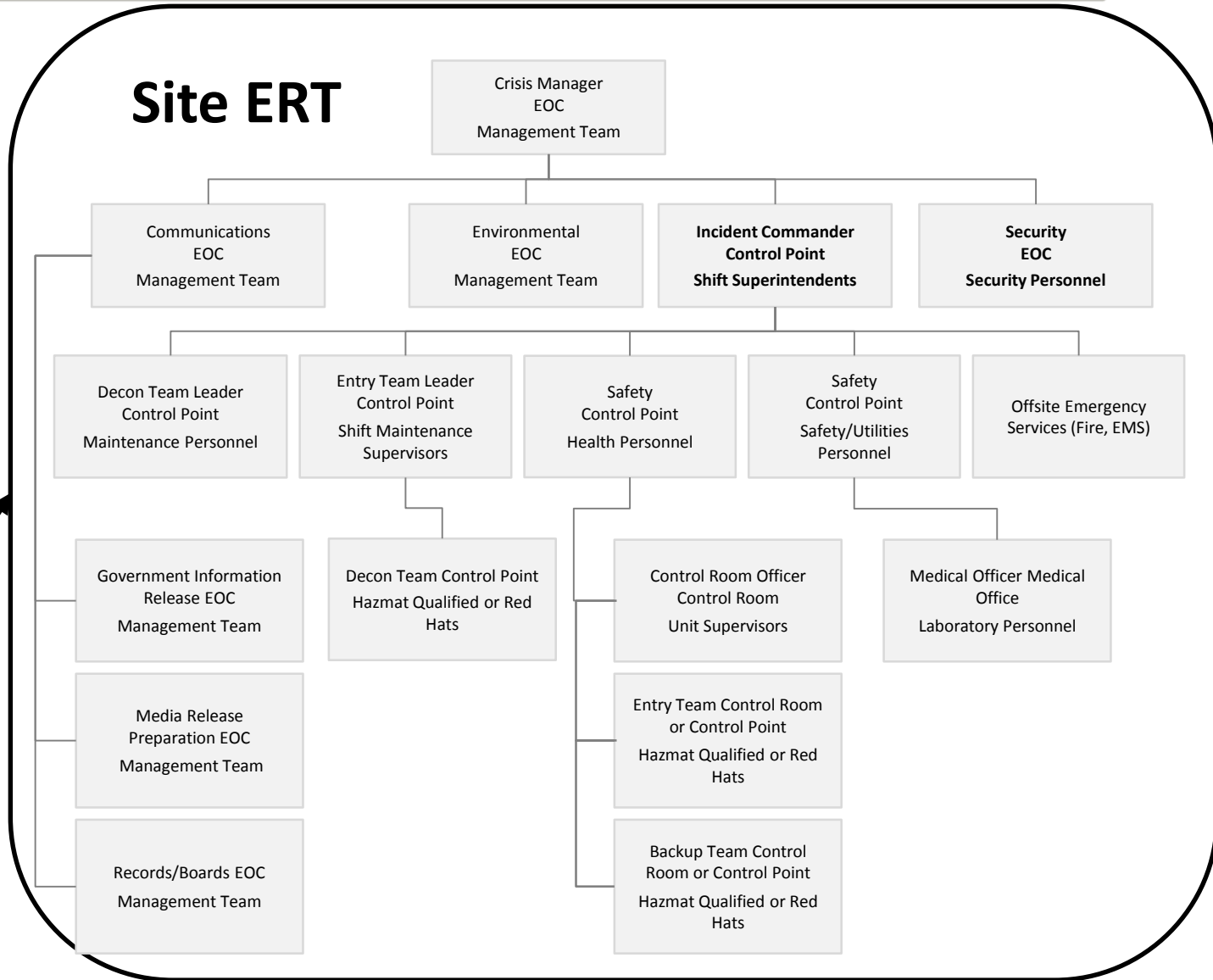
Corp HSE

Site Mgmt

Site Team



Site ERT





Typical Emergency Response...

Corporate Leadership



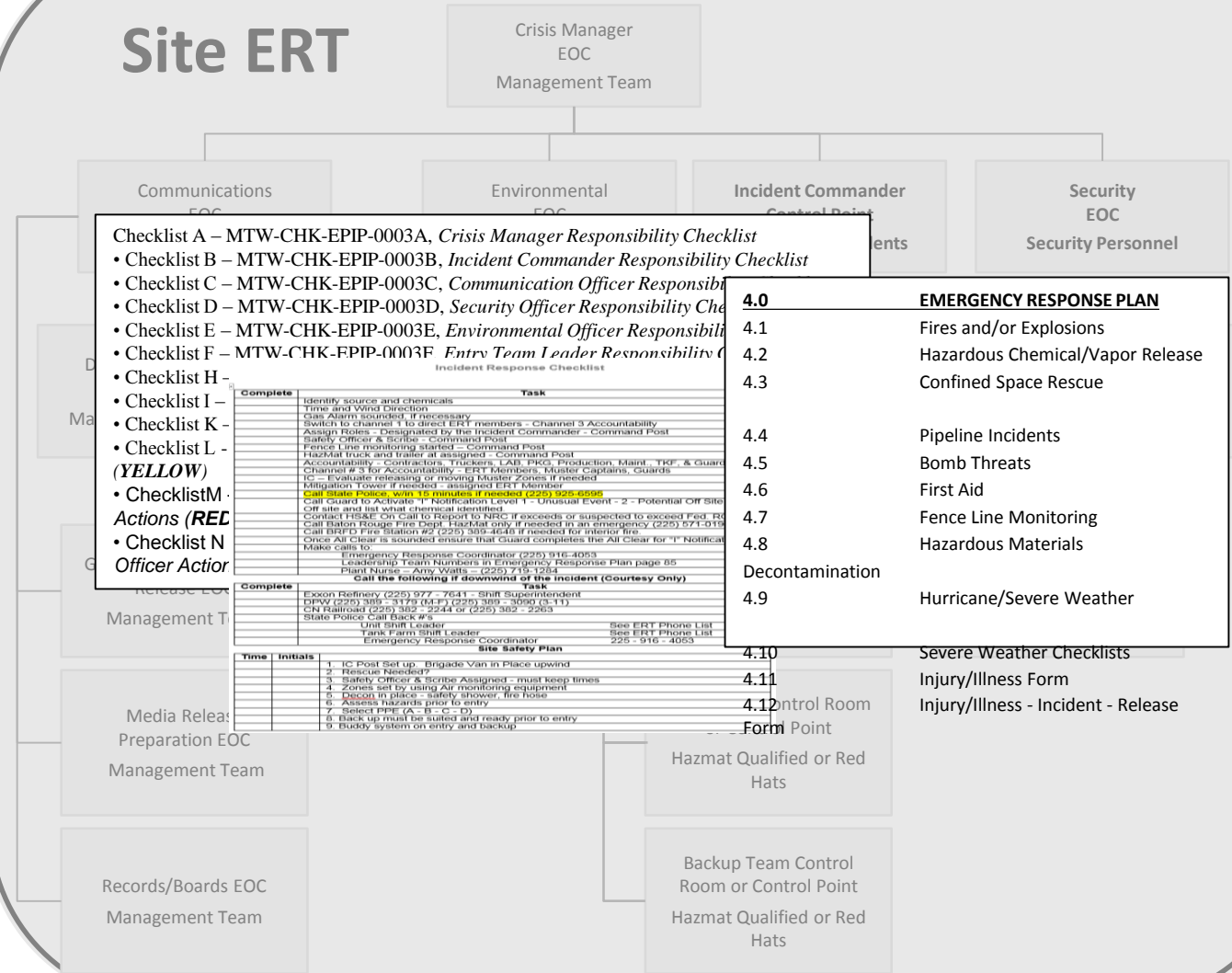
Corp HSE

Site Mgmt

Site Team

Emergency
Response
Team

Site ERT





Improving Emergency Response

Corporate Leadership

VP



Site Team

Emergency
Response
Team

Site ERT

Crisis Manager
EOC

Incident Workflow

ID	Incident Type	Source	Location	Operator	Progress	Description
597	REPOPULATION	TF_GasDetec_0...	/Facility/Industrial/Head Office	Imaging		Repopulation_Head_Office
595	GAS LEAK	TF_GasDetec_0...	/Facility/Industrial/Head Office	Administrator	Steps 14 of 14	Gas leak_Head_Office

Gas leak 11/16/2016 15:53:38

Summary

Priority: ☒ Urgent

Incident ID: 595

Location: /Facility/Industrial/Head Office

Description: Gas leak_Head_Office

☐ Remove Incident

Comments

Response Steps

- 11/16/2016 16:05:12 - Administrator: Lock certain Access entry points. ☒
- 11/16/2016 16:07:26 - Administrator: Issue any additional information through the PA system. ☒
- 11/16/2016 16:09:26 - Administrator: Check the mustering points and call mustering screen to see mustering counts. ☒
- 11/16/2016 16:12:34 - Administrator: Monitor spread of Gas and areas getting affected. ☒
- 11/16/2016 16:12:37 - Administrator: Maintain communication with Emergency response team and assist them with required information and search and rescue if needed. ☒
- 11/16/2016 16:14:04 - Administrator: Confirm the leak is stopped or controlled and area is safe for occupation with the Emergency response team. ☒
- 11/16/2016 16:14:13 - Administrator: Verify the affected area using nearest camera. ☒
- 11/16/2016 16:17:20 - Administrator: Initiate repopulation procedure. ☒

Summary Statistics:

- In progress incidents: 1
- New incidents: 1
- Total incidents: 2

Buttons: RESPOND, CLOSE INCIDENT

Records/Boards EOC
Management Team

Backup Team Control
Room or Control Point
Hazmat Qualified or Red
Hats

Virtual Reality for Training Field Operators





RealWear HMT-1



- 854×480 pixel display effectively the size of 7 inch tablet held at arms length and viewable in bright sunlight
- Hands-free voice-visual user interface
- Local speech recognition in loud industrial areas
- Hazardous environment certification
- Attaches to safety helmet

Handsfree
process data in
the field



- Public web site (<http://www.asmconsortium.net>):
 - Intro to ASM Concepts
 - Archive of Incidents
 - Published presentations, webinars, journal papers, etc.

ASM Guidelines Documents

The Consortium has compiled guidelines in several areas that represent best practices as demonstrated through research and application by member companies. These documents have been through several revision cycles and through numerous peer reviews over the past decade. They reflect many years of experience in the successful application of human-centered design in the management and automation of plant operations.

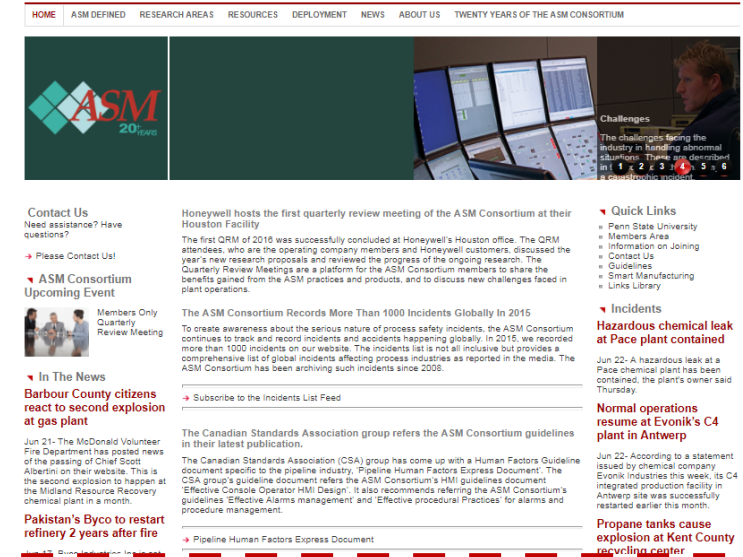
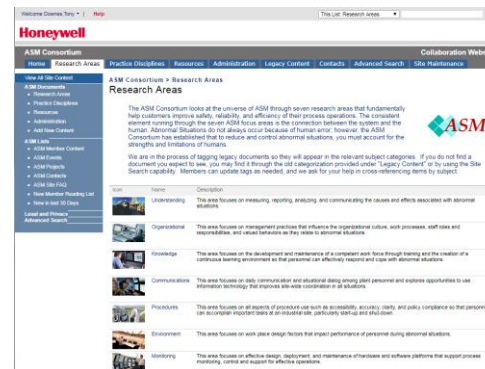
Available for purchase:

Effective Console Operator HMI Design Practices (ISBN: 978-1514203859)
Visit <https://www.createspace.com/5540086> to purchase.

Effective Alarm Management Practices (ISBN: 978-1442184251)
Visit <https://www.createspace.com/3384799> to purchase.

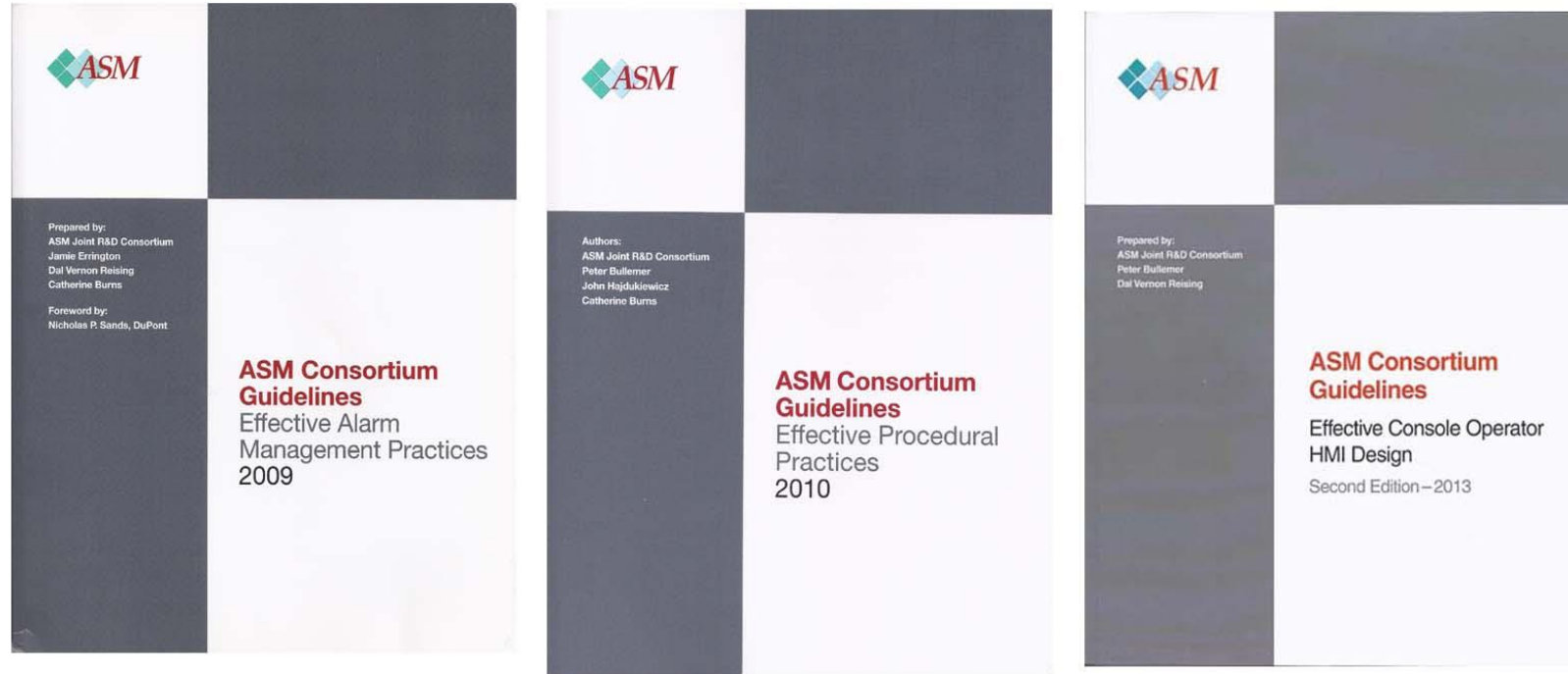
Effective Procedural Practices (ISBN: 978-1452893877)
Visit <https://www.createspace.com/3456983> to purchase.

- Members Site:
 - Substantial body of knowledge: Over 1000 reports: Status, Gate Reviews, about 250 Final Reports, substantial User Member In-kind report archive
 - Search Engine



Resources: Guidelines

New ▾	Actions ▾
Title	Revised Date
Topic : Effective Procedural Practices (2)	
Topic : Effective Operations Practices Guidelines 2013 (1)	
Topic : Effective Console Operator HMI Design - Second Edition Revised (1)	
Topic : Effective Change Management Practices in HMI Development- final (1)	
Topic : Effective Alarm Rationalization Practices (1)	
Topic : Effective Alarm Management Practices (1)	



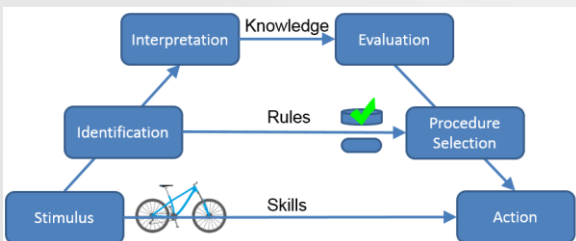
Available for purchase, See ASM Consortium web site

A Summary in Guideline Form of ASM Findings, Summarizes <10% of Research

Honeywell is building a smarter, safer,
and more sustainable world

THAT'S THE POWER OF **CONNECTED**
THAT'S THE POWER OF **HONEYWELL**

Connected Aircraft • Connected Automobile • Connected Home • Connected Building
Connected Plant • Connected Supply Chain • Connected Worker



Honeywell
THE POWER OF **CONNECTED**

**1 alarm per 10 minutes
and No Floods**