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



2



What is an Abnormal Situation?

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



ASM History



- 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



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.



Display Hierarchy and ASM How the HMI Supports ASM

Effective supervisory control involves processing information at multiple levels of detail Process "Big Picture" LEVEL 1 Status Changes Process erator Mental & Physica State Orienting Evaluating Acting Inputs from Process Outputs to Proce LEVEL 2 Physica and/or (sensors, analyzers, radios, Perception, Interpretation, (SP, OP%, Manua video, instructions, sounds & and/or and/o Respinse adjustments) (3) Projection Discrimination smalls Investigating and Troubleshooting Internal Feedback Assessina LEVEL 3 External Feedback Fractionator The display hierarchy allows LEVEL 4 an operator to move between the "big picture" to the "details" Adjustments nmental and Control Moves as the task or situation requires "Details"

The Display Hierarchy is a Critical Solution for ASM





Condensing 28 Years of Learning

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

Cases 1 &

Cases 3

- Ensure Operators aren't overloaded
 - Rationalize your alarms
 - Make problems obvious
 - Reduce load using automation where appropriate

2. Develop Console Displays based on Human Factors

- Make complex things simple by making it "visual"
- Turn data into information with proper context
- Keep procedures up to date, easy to search, easy to use 3.
 - Address abnormal situations
 - > Automate difficult, complex, or lengthy procedures
- Improve communications 4.
 - Start Up / Shutdown / Shift Change
- Improve Operator Competency 5.
 - Train operators: Be prepared
- Provide a conducive Control Room Environment 6.
 - Ergonomic environment promoting operator performance \geq









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 *



Case Study 2 : Alarm Management

- 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



Case Study 3 : Console Interface

- 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



Case 3: ASM Interface Framework Study

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



VS.







Case 3 cont'd – More than Gray Screens

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





Case 4: Console Interface

- 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



Case 5: Training

- 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





Leadership Wants Better Visibility

And ERT Needs More Effective Response

Improving Emergency Response

Corporate Leadership

ASM



Team



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Dashboard Gives Visibility

And Digitized SOPs Improve Response



Virtual Reality for Training Field Operators



Easiest with new plants (3D models)



Augmented Reality



Enhanced visualization of operational data



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







What's on the ASM Web Sites

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

ASM Guidelines Documents

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



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

	20' _{fave}		The challenges facing the industry in handling abnormal situations. There are described in 1 1 \times 2 \times 3 $+$ 4 \times 5 \times 6 a caustrophic incident.
	Contact Us Need assistance? Have questions? → Please Contact Us! ▲ ASM Consortium Upcoming Event	Honeywell hosts the first quarterly review meeting of the ASM Consortium at their Houston Facility The first QRM of 2016 was successfully concluded at Honeywell's Houston office. The QRM attandese, who are the operating company members and honeywell customers, discussed the year's new research proposals and reviewed the progress of the orgoing research. The Quarterly Review Meetings are a platform for the ASM Consortium members to share the benefits guined from the ASM practices and products, and to discuss new challenges faced in plant operations.	 Quick Links Penn State University Members Area Information on Johing Guidelines Smart Manufsteuring Links Library
ars, journal papers, etc.	Members Only Cuarterly Review Meeting	The ASM Consortium Records More Than 1000 Incidents Globally In 2015 To create awareness about the serious nature of process safety incidents, the ASM Consortium continues to brack and record incidents and acidents happening globally. In 2015, we recorded more than 1000 incidents on our website. The incidents list is not all inclusive but provides a comprehensite into global incidents affecting process industries as reported in the media. The ASM Consortium has been archiving such incidents since 2008.	Incidents Hazardous chemical leak at Pace plant contained s The Jun 22-A hazardous leak at a Pace chemical plant has been contained, the plant so where said
ASM Guidelines Documents	Barbour County citizens react to second explosion	→ Subscribe to the Incidents List Feed	Thursday. Normal operations
	at gas plant Jun 21- The McDonald Volunteer	The Canadian Standards Association group refers the ASM Consortium guidelines in their latest publication.	resume at Evonik's C4 plant in Antwerp
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 oncartions.	Fire Department has posted news of the passing of Chief Scott Albertini on their website. This is the Midland Resource Recovery chemical plant in a month.	The Consider Standards Association (ICSA) group has come up with a Human Factor Guideline document spaceful to the playeline hoursy. They have have not accurate the constant is CSA groups purplet to the playeline hoursent refers to the ASS and Constant. The Effective Constant Constant Human is taken accurate referring the ASM Constant guidelines Effective Alarms management and 'Effective procedural Practices' for alarms and procedure management.	Jun 22- According to a statement Issued by chemical company Evonik Industries this week, its C4 integrated production facility in Antwerp site was successfully restarted earlier this month.
Available for purchase:	Pakistan's Byco to restart refinery 2 years after fire	→ Pipeline Human Factors Express Document	Propane tanks cause explosion at Kent County recycling center
Effective Console Operator HMI Design Practices (ISBN: 978-1514203859)			

HOME ASM DEFINED RESEARCH AREAS RESOURCES DEPLOYMENT NEWS ABOUT US TWENTY YEARS OF THE ASM CONSORTIUI

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		Resources: Guidelines			
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		Monterry	The area focuses on effective design deployment, and maintenance of hardware and software partners that support process managers, control and support for effective operations.		



Published Guidelines



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





THE POWER OF CONNECTED

1 alarm per 10 minutes and No Floods