EPT Operations, HSSE & Engineering

engineeringcenter

Rationalisation – Learnings from Practice

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Introduction

Name: Ian Pinkney

Company: BP PLC

Department: Upstream Engineering Centre

Team: ICE (Instrument Control & Electrical

Disciple: Instruments and Protection Systems

Team Leader: Zaid Rawi

Current Role: Alarm Management CI Project Leader

BP Continuous Improvement Project

Project

A team of Control and Automation Engineers located in Houston and Sunbury, each progressing an activity designed to improve and sustain good alarm management throughout BP E&P.

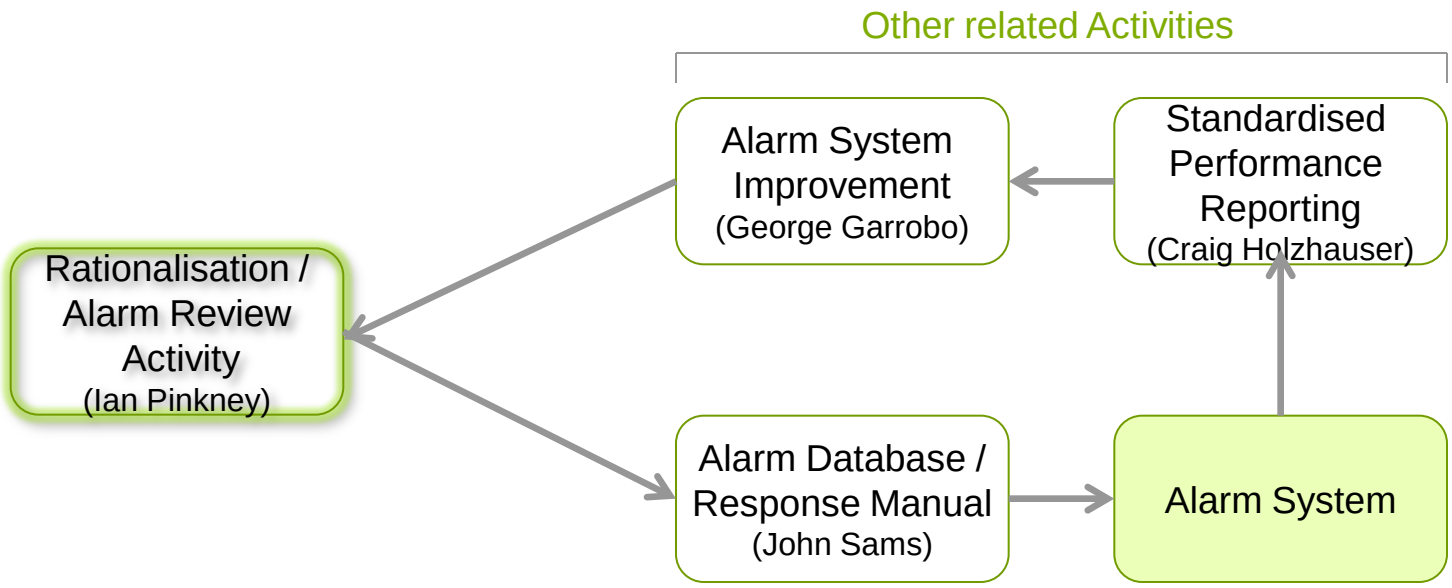
Objectives:

- To identify and address the causes of poor alarm management within BP E&P
- To increase the capability within BP to:
  - Design and build better alarms and alarm systems
  - Manage and improve existing alarms and alarm systems
- To identify, develop and prove best practices - codify as a ‘Guidance Notes’
- To identify / develop tools to support consistent application and quality of results

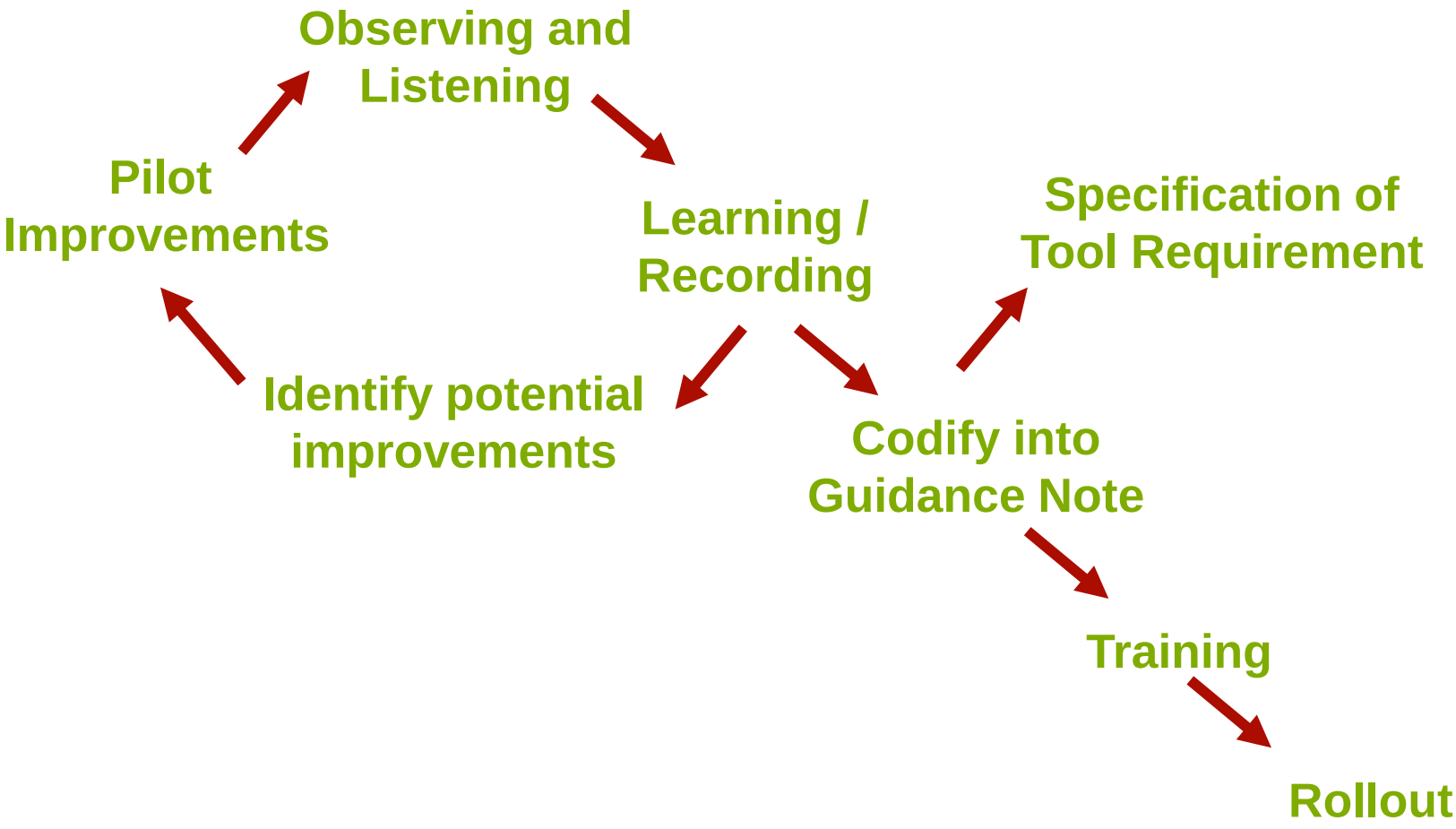
Rationalisation Activity

Timeline: April 2011 to June 2012

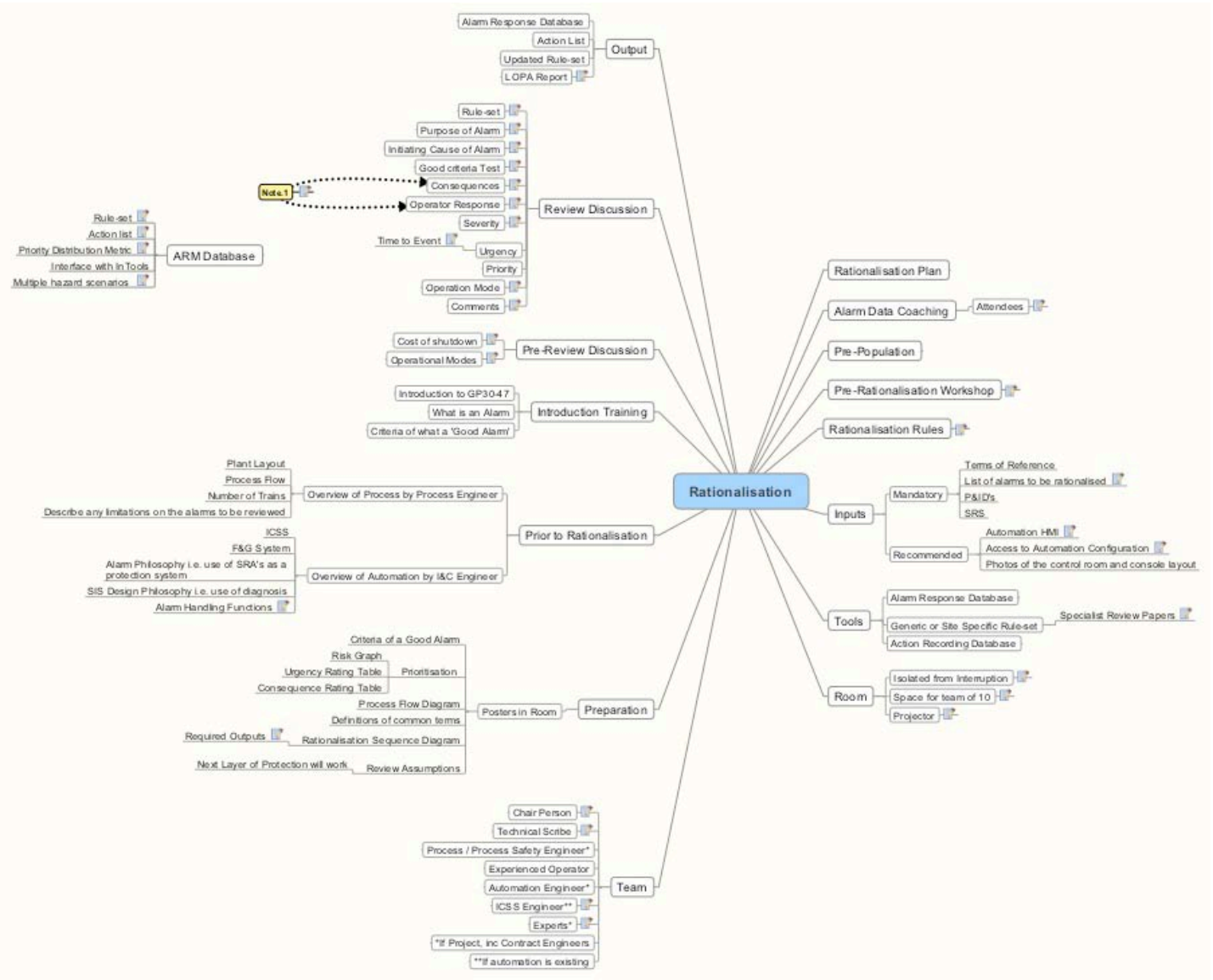
Rationalisation: *Process for reviewing the quality of an alarm, defining guidance for operators and determining the appropriate priority. For Projects it is often referred to as an '*Alarm Review*'.*



Rationalisation Activity Scope



Rationalisation Mindmap



Pre-Rationalisation Preparation

The Rationalisation Process can differ slightly depending on whether the objective is to review the alarms on an existing control system or review alarms being proposed on a Brown or Greenfield project.

Appoint Alarm Management Lead

Identify who on the site or on the project will be responsible for managing the alarm related activities and the alarm database.

Plan

Rationalisation / Review plan based on the following steps, should ensure the appropriate level of preparation is carried out.

Identify Boundaries

Boundaries could be a section of plant, alarms with poor dynamic performance (e.g. standing alarms), defined scope of project, etc.

Warning: Potential for inconsistency if Alarms are rationalised at different times with different teams. This can be minimised with a standardised process and coaching.

Identify Templates

- Sections of the process that are approximately identical e.g. multiple compressors. Select one as a template (careful to include any additional alarms from the other systems.)
- Plant items commonly found across the site e.g. export pumps, well heads, metering tube.
- Areas of the plant that are approximately identical e.g. fire zones for each compressor. Select one as a template.

Pre-Rationalisation Preparation

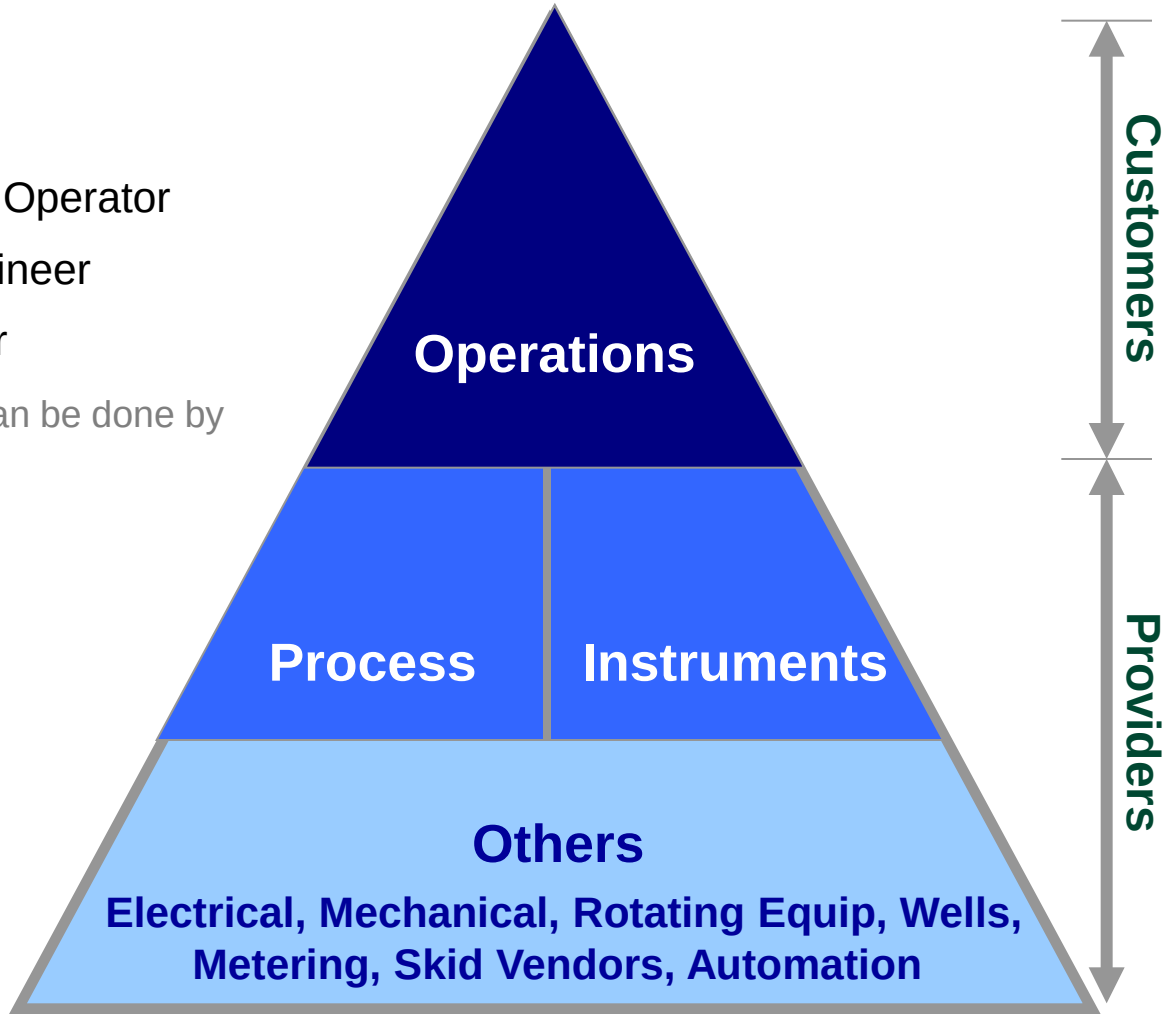
Identify Review Team

Core team:

- Chairman
- Experienced Operator
- Process Engineer
- I&C Engineer
- Scribe (this can be done by the chairman.)

Additional as Required:

Electrical Engineer, Machines Engineer, Automation System specialists, etc



Pre-Rationalisation Preparation

Competency of Team	All members of the team shall be competent with the fundamentals of Alarm Management. The Chairman should be experienced with the company practice and the expected delivery quality
Plan for Coaching	If the Chairman is not experienced to the company practice, they would be expected to fulfill a competency assessment beforehand and a coach should be organised to attend the first week of the review. If the team has not carried out an alarm review in the past 12 months: Plan a one day coaching event, include all member of the team. (See Pre-Rationalisation workshop)

Pre-Rationalisation Preparation

Alarm Database Pre-population

The database should be pre-populated before the ‘Rationalisation’ or ‘Alarm Review’.

Mandatory Pre-Population	Recommended Pre-Population	Rationalisation / Review Fields
Tag Number	Purpose of Alarm	Purpose of Alarm
Tag Descriptor	Recommended Operator Response(s)	Initiating causes of the alarm
Safety Related Alarm (Y / N)	Operational Mode Dependency	Consequence if alarm is missed
Alarm Type		Recommended Operator Response(s)
Alarm Setting		Operator Response Time
Minimum Time to Event		Priority

Rule Set Definition

Rule-set: A default set of pre-populated alarm database fields which would be valid for a specified alarm condition

Rationalisation Fields	Rule-Set: Gas Detector Beam Block Alarm
Purpose of Alarm	Notification that the Gas Detector is not functioning
Initiating cause(s) of the alarm	Object or medium is blocking the 'source light' from reaching the detector.
Consequence if alarm is missed	Increased risk of undetected gas accumulation Safety to personnel
Recommended Operator Response(s)	**Action**: Inform field operator to investigate cause **Condition**: If field operator can not immediately rectify **Action**: Apply SORA requirements
Operator Response Time	Prompt
Priority (Severity x Urgency)	High
Operation Mode(s)	Not Applicable

Warning: Rule-sets improve consistency, however they must be used with caution. Each suitable alarm should still be reviewed to ensure that the rule-set is valid.

Pre-Rationalisation Preparation

Collate Input Documents

Mandatory: Terms of Reference, Site Alarm Rule-set (if no site rule-set, use generic rule-set), P&ID, Site Layout, Control Room Layout, HAZOP and LOPA report.

Recommended: Automation System HMI (preferably viewable computer monitor or projector.) Photos of the control room. Operating envelop (for existing sites this can be extracted from the data historian.)

Calibrate Default Rule-set

If using the default rule-set: Select alarms from Alarm database that represent each rule-set condition, identify any additional rule-sets that may need to be defined. Plan for all these alarms to be reviewed first.

Calibrate Commercial Consequence Table

Identify costs related to unit / plant shutdowns (Calculate costs based on time to investigate shutdown and restart.)

Identify costs related to critical equipment damage (Calculate cost to repair, time to repair and related loss of production.)

Pre-Rationalisation Workshop

Refresher Training of: Criteria of a good Alarm (examples of bad alarms), 'Review process', the use of 'Templates' and 'Rule-sets', the purpose of 'prioritisation'.

A rationalisation exercise, designed with some challenging alarms. Allowing plenty of time for discussion.

Pre-Rationalisation Preparation

Rationalisation / Alarm Review:

Venue

The venue should be isolated from day-to-day interruption.

Space to enable the team size to expand and contract (suggest space for 10 people.)

Recommend two VDU's – a. Alarm Database b. Reference Material e.g. P&ID or Automation System Displays. (At least one VDU mandatory for Alarm Database.)

Posters

The following posters displayed in the room will help as reminders and prompts:

'Criteria of a Good Alarm', 'Urgency determination graph and rating table', 'Severity rating table', 'Definition of common terms', 'Review sequence flow-diagram', 'Chairman's Rules'.

Recording Tools

Alarm Database (The agreed results for the alarms should be directly entered for all to see.)

Action List (Recorded on a separate List and cross-referenced with the Alarm Database.)

Site Specific Rule-set (Copy of the Generic rule-set enabling site specific modifications.)

Start Rationalisation

Rationalisation Population

Review Pre-Population	Rationalisation / Review Fields
Tag Number	Purpose of Alarm
Tag Descriptor	Initiating cause(s) of the alarm
Safety Related Alarm (Y / N)	Consequence if alarm is missed
Alarm Type	Recommended Operator Response(s)
Alarm Setting	Operator Response Time
Minimum Time to Event	Priority (Severity x Urgency)
	Operation Mode(s)

These two can be done in order.

Rationalisation Process

Closer review of key database fields:

Purpose of Alarm

"*What is the abnormal situation that the alarm is required to notify?*"

"*Is the alarm unique in notifying the operator of this abnormal situation?*"

If not unique determine if there is a reason for both alarms to be configured.

Initiating Cause(s)

"*What conditions can cause this abnormal situation?*"

If more than one; list each in turn with bullet points.

Consequence of missing the Alarm

"*What would the consequences be if the alarms was missed?*"

Assume that other Layers of Protection work correctly.

Do not take into account long-term effects such as corrosion or erosion unless severe.

Recommended Operator Response

Assuming more than one initiating cause:

"*How does the operator identify the cause of the alarm?*"

For each initiating cause:

"*How should the operator respond to the alarm?*"

List only enough steps to transfer the situation to a defined procedure e.g. Operating, maintenance or emergency procedure.

Rationalisation Process

Severity

"How does the consequence, of not responding to the alarm, rate against the company severity rating table?"

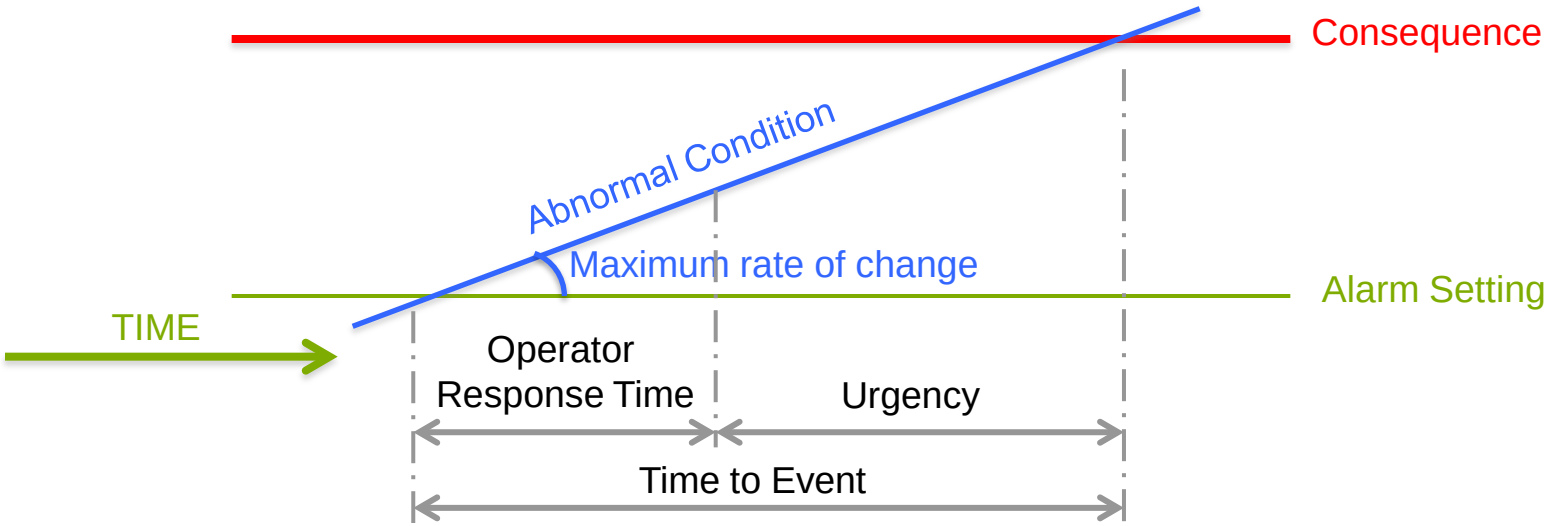
Use a subset of the severity rating table used by the HAZOP / LOPA

Example of a severity rating table:

Severity Rating	Qualification
Large	• Potential Loss of Life • Uncontrolled loss of containment • Commercial impact > $5million
Medium	• Potential Lost time accident • Controlled loss of containment resulting in some environmental damage • Commercial impact > $500K
Small	• Potential First aid injury • Controlled loss of containment resulting in minor environmental damage • Commercial impact < $500K

Rationalisation Process

Defining Urgency



Review Time to Event

"*Does the pre-defined 'Time to Event' seem reasonable with the experience in the room?*"

Plus or minus 20%

Operator Response Time

"*How long would be required for: a) the operator to identify the cause of alarm b) action to be taken, and c) the action to have an impact such that the abnormal situation is brought under control?*"

"*Is the difference between the Time to Event and the Operator Response Time >= 10 minutes*?"

If not, the alarm is not 'Timely'. Consider options including demoting alarm to event.

Rationalisation Process

Urgency

"Given other high priority distractions, could the operator respond to the alarm after 30 minutes without severe or escalating consequences?"

If no: Look up the appropriate urgency from the 'Urgency Catagorisation Table'

Example of an Urgency Catagorisation Table:

Urgency	Time to Event – Ops Response Time
Immediate	<= 10 minutes
Prompt	10 minutes to 30 minutes
Soon	> 30 minutes

Rationalisation Process

Priority

Given the determined severity and urgency, look up the priority from the table.

"*The priority is 'x', how does that compare with other alarms we have prioritised?*"

Test priority against other alarms. If concerns are raised, review severity and urgency.

Example of a Prioritisation Table:

	Severity Rating		
Urgency	Large	Medium	Small
Immediate	Priority 0 / 1	Priority 1	Priority 2
Prompt	Priority 1	Priority 2	Priority 2
Soon	Priority 1	Priority 2	Priority 2

Rationalisation Process

Operational Mode Dependency

"*Is the alarm valid for all operating modes and across the operating envelope?*"

"Would alarm logical processing be effective in some operating modes?"

Record results within a operational mode matrix (see example below)

Example of a Operational Mode Matrix:

Operational Mode	Is alarm Effective	Suitable for Logical Processing	Required Logical Processing
Normal Operations	Yes		
Plant / Unit Offline	Yes	Yes	Raise Priority*
Plant / Unit Startup	No	Yes	Startup Override
Back Flushing	No	Yes	Auto-shelving
Wet Gas Processing	Yes		
Depressurisation	Yes	Yes	Auto-Setting Change*

*These features may not be available on the current Automation System.

Rationalisation Process

Review Fields for each Alarm

Continue the cyclic review of each alarm, until all alarm within the scope have been rationalised.

Test for Consistency

Rationalisation Chairman / Alarm Management Lead should compare the alarms reviewed that day with a sample of alarms that had been reviewed days / weeks earlier, to ensure that consistency of inputs is being maintained.

Complete Rationalisation

Implement and Test Results

Priority Distribution

Static Priority Distribution Test

Alarm Management Lead to determine the priority distribution of **ALL** alarms configured to annunciate on an operator console.

Priority distribution should aim to achieve company or EEMUA 191 metrics

Dynamic Priority Distribution Test

Alarm Management Lead to monitor the priority distribution of **ALL** alarms annunciated on an operating console.

Priority distribution **Shall** achieve the company or EEMUA 191 metrics.

Example of % Distribution Metrics

Priority band	% alarm configured and annunciated
Priority 0	< 1%
Priority 1	< 10% (Fire & Gas Included)
Priority 2	< 20%
Priority 3	About 70%