Technical workshop proceedings: Process safety management framework

TECHNICAL WORKSHOP PROCEEDINGS: PROCESS SAFETY MANAGEMENT FRAMEWORK

EI PSM WORKSHOP

First edition

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Contents

FOREWORD

Technical workshop proceedings: process safety management framework provides a non-verbatim summary of the presentations and discussions from a technical workshop held on Thursday 7 July 2016.

The target participants were process safety specialists from the various energy industry sectors who have either implemented a process safety model, whether Energy Institute (EI) *High level framework for process safety management (PSMF)*, or other, and have some experience to report, or were at a lower level of maturity such that they were considering implementing a process safety model. There were some 20 workshop participants.

Participants were by invitation only and were drawn from:

- EI Process Safety Committee members (or colleagues).
- EI Technical Partner companies via other EI committees.
- EI Technical Company Members, EI member companies and EI individual members.
- Various stakeholders (European Process Safety Centre and Tank Storage Association).

For delegates, the workshop helped by capturing issues, tips for implementations and experiences shared regarding use of the EI *PSMF* and *Process safety management guidelines (PSMG)*. For the EI, the workshop set some direction on how to optimise the *PSMF* and *PSMG* in due course (e.g. by capturing what isn't working in the framework/guidelines and how to improve it/them).

In conclusion, the need to revise the PSMF and PSMG was confirmed by the workshop participants, and the potential improvements were discussed.

The ultimate deliverables, should the recommendations in these proceedings be adopted, would be a revised PSMF and PSMG which will provide better guidance as to how companies can assure a high-level of process safety management (PSM).

The EI cannot accept any responsibility, of whatever kind, for damage or alleged damage arising or otherwise occurring in or about facilities to which this guidance has been applied. Suggested revisions are invited and should be submitted through the:

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The workshop was commissioned by the EI Process Safety Committee and developed by a sub-group who prepared and facilitated the workshop:

Martin Ball	Bossiney Consulting
John Briggs	Kuwait Petroleum International
Mahmoud Gawish	Eni
John Pond	Independent consultant
Dr Mark Scanlon	Energy Institute

The proceedings were prepared by Sam Daoudi (EI).

The Institute wishes to record its appreciation to the workshop participants:

Dr Ali Al-Zubaidi	Consultant - Integrated Management Systems Associates (IMSA)
Lee Allford	European Process Safety Centre
Graeme Beale	ENGIE
Terry Cooper	Total
Denise Costa	Essar Oil
John Hart	Greenergy
Jeff Hulance	RWE
Chris Martin	ENGIE
Gary Mowat	Tullow Oil plc
Gavin Ramsden	Woodside
Martin Ray	RWE
Andrew Re	Woodside
Barrie Salmon	TSA
Stuart Sealey	Certas Energy
Raman Sridhar	BP Oil UK Limited.

Affiliations refer to the time of participation.

1 BACKGROUND

1.1 INTRODUCTION

In 2010, the EI published the *PSMF*, which defines what PSM should involve. Divided into four focus areas (process safety leadership, risk identification and assessment, risk management, and review and improvement) and sub-divided into 20 'elements', it sets out a framework of activities major accident hazard organisations should undertake to ensure PSM. Each element lists a number of high level activities organisations should meet (expectations).

EI *PSMG* is a series of 20 publications ('guidelines') that build on the PSMF. Commissioned by the EI Process Safety Committee (PSC) each guideline captures and presents current industry good practices and guidance on how organisations can meet the expectations set out in each element of the *PSMF.*

The PSM workshop was convened to enable reflection on the *PSMF* and *PSMG*, with a view to optimising the resources going forward.

Key topics discussed during this workshop included the following:

- Tips for implementation in businesses (nature of the business: large vs. small, corporately vs. individual business units).
- International application (use of *PSMF* and *PSMG* by international companies, use where there is limited local legislation, viability of transposing the framework to an international standard).
- Using *PSMG* performance measures (PMs).
- Any omissions in the framework and what should be added if revised.
- Communicating the *PSMF* and *PSMG* to leaders through to workers.
- Conflicting systems (integrating systems that are essentially all the same).

1.2 DOCUMENTATION

- *High level framework for process safety management.*
- *Guidance on meeting expectations of EI process safety management framework:*
  - *Element 1: Leadership, commitment and responsibility*
  - *Element 2: Identification and compliance with legislation and industry standards*
  - *Element 3: Employee selection, placement and competency, and health assurance*
  - *Element 4: Workforce involvement*
  - *Element 5: Communication with stakeholders*
  - *Element 6: Hazard identification and risk assessment*
  - *Element 7: Documentation, records and knowledge management*
  - *Element 8: Operating manuals and procedures*
  - *Element 9: Process and operational status monitoring, and handover*
  - *Element 10: Management of operational interfaces*
  - *Element 11: Standards and practices*
  - *Element 12: Management of change and project management*
  - *Element 13: Operational readiness and process start-up*
  - *Element 14: Emergency preparedness*
  - *Element 15: Inspection and maintenance*

- *Element 16: Management of safety critical devices*
- *Element 17: Work control, permit to work and task risk management*
- *Element 18: Contractor and supplier, selection and management*
- *Element 19: Incident reporting and investigation*
- *Element 20: Audit, assurance, management review and intervention*

1.3 WORKSHOP AGENDA

The following agenda was issued for the workshop:

9:15 – 10.00 Registration/tea/coffee

10:00 – 10:15 Chairman's opening remarks

- Review workshop objectives.
- Review 'house' arrangements/welcome.
- Reminder of EI anti-trust statement.
- Background and purpose of the workshop.

10:15 – 10:30 Introduction on the history of EI PSM
(Delegates should be familiar with implementing the *PSM Framework* and *PSM Guidelines*.)

10:30 – 11:00 Presentation from Eni

11:00 – 11:15 Break

11:15 –11:45 Presentation from Woodside

11:45 – 12:15 Presentation from ENGIE

12:15 – 13:00 Lunch and networking

13:00 – 13:45 Discussion session – Continuous improvement of the framework and guidelines

- Framework.
- Guidelines.
- Suggested PMs.

13:45 – 14:15 Feedback on Session 1

14:15 – 14:30 Break

14:30 – 15:15 Session 2 – Learnings from implementation

- What has gone well?
- What could have gone better?

15:15 – 15:45 Feedback on Session 2

15:45 – 16:00 Closing remarks

- Wrap up.
- Feedback.
- Revisit objectives from start of day.
- Follow-up.
- Close.

2 SCENE-SETTING PRESENTATIONS

2.1 INTRODUCTION ON THE HISTORY OF EI PSM

John Pond, Chairman, independent consultant and ex-chairman of EI's Process Safety Committee.

The programme for the day was opened with a definition of PSM; 'Managing the systems and procedures that prevent the uncontrolled release of energy'. PSM is vital to ensuring safe and continued operations in major accident hazard organisations. However, PSM is a multifaceted process, and a number of high profile incidents since 2005 have suggested that without a holistic understanding of the various factors required for effective PSM it can be difficult and inefficient to ensure, and measure performance.

EI has 'four steps' to go good process safety management:

– EI *PSMF*;
– EI *PSM guidelines*;
– performance measures, and
– EI Process Safety Survey (EIPSS).

EI PSMF was published in December 2010 and was downloaded more than 2 500 times in over 40 countries. It was adopted by UK Health & Safety Executive as their basis for assessment of PSM arrangements.

The set of 20 PSMGs were downloaded 5 100 times in over 55 countries.

There were three scene-settings presentations from operating companies namely Eni, Woodside and ENGIE. The presentation slides can be found in Annex B – Scene-setting presentations.

2.2 APPLICATION OF HIGH LEVEL PSMF TO AGEING ASSETS

Mahmoud Gawish delivered a presentation on the application of high level *PSMF* to ageing assets for Eni's business. Eni carried out a full assessment against the structured and comprehensive PSMF and associated PSMG. Most elements were adequate to Eni's application and after reviews and discussions from key personnel, several elements were selected and tailored to the company's needs.

It was suggested that the *PSMF* could be improved by:

– adding a specific element regarding human factors issues;
– incorporating more *PSMF* expectations from HSE's KP4 asset life extension (ALE) programme for ageing assets;
– considering value in inclusion of sub-element perhaps relating to onshore maintenance planning, backlog and deferral processes, and
– avoiding duplication in some elements.

2.3 BUILDING PROCESS SAFETY MANAGEMENT CAPACITY

Gavin Ramsden (Woodside) provided an overview on building process safety management capacity at Woodside. The company went through a major project to clearly identify and improve its PSM systems. An assessment of external best practice was undertaken to provide project basis and the decision was made to use the EI *PSMF* on the following basis:

– Peer company input.
– Comprehensive and holistic.
– Aligned with Woodside language.
– Adopted by similar companies.

A workshop was held with multiple stakeholders to agree common principles, vision, scope of PSM and definitions.

EI *PSMF* was translated into corporate procedure and additional guidance was provided to identify how conformance can be demonstrated. Facilitated assessments of Woodside's assets and functions helped identify gaps against the procedure. Engagement sessions provided the platform to launch the programme and its improvements. It was noted that all employees have a responsibility for process safety and how it applies will change depending on the role.

Four key areas of improvement were identified resulting in significant improvement date within Woodside:

– Competency and capability.
– Process safety risk assessment.
– Integrity envelope and alarm management.
– Safety critical element (SCE) management.

Implementation of the improvements enabled greater process safety performance.

2.4 INTRODUCTION TO OPERATIONAL EXCELLENCE

Graham Beale (ENGIE) provided an overview on process safety and operational excellence in the power industry. ENGIE has developed an operational excellence framework based on the EI *PSMF*. The generic framework has been re-written in 'power station language'. The framework contains 22 elements which are further split into 79 objectives. Each objective has an associated 'evidence statement'. The various stakeholders work through the objectives and, using the evidence statements, are rated from one to four. Minimum requirements are given a weighting factor of 2. The weighted score for each element are added up and averaged in a scoring spreadsheet which produces a spider diagram.

The operational excellence framework and the assessment process has been well received at all assets engaging in the process. The framework was updated in 2015 using two years of feedback and suggestions from power plants.

Other issues arising from scene-setting presentations include:

– Potential for combining elements.
– Define 'operations envelope'.
– Define minimum requirements.
– Link 'evidence' to element/expectation.
– Is there a conflict with the definition of asset integrity and process safety?

The rest of the workshop was divided into two sessions where delegates discussed several topics.

Workshop session 1 – Continuous improvement of the framework and guidelines
The purpose of this session was for the breakout groups to review how to improve the framework and guidelines.

Workshop session 2 – Learnings from implementation
The purpose of this session was for the breakout groups to review learnings from Implementation.

3 AFTERNOON SESSIONS

3.1 SESSION 1 – CONTINUOUS IMPROVEMENT OF THE FRAMEWORK & GUIDELINES – WHAT NEEDS TO BE IMPROVED?

- **Framework**
  - **What should be added?**
    - Commercial management.
    - HSE requirements (ALARP).
    - COSHH/DSEAR requirements.
    - Operational excellence.
    - Visibility of leadership/culture.
    - Human factors.
    - Environmental.
    - How PSM is interpreted.
    - Consider elements added by other businesses.
    - Inherent safety needs to be visible in the framework.
  - **What should be removed?**
    - No parts were suggested to be removed.
  - **What should be modified?**
    - Duplication in Element 7 and 8, and Element 10 and 18. It was suggested to maybe combine these elements.
    - Re-align focus areas.
  - **Have you found alignment or conflict with other systems?**
    - Difference between asset integrity and process safety.
    - Consider terminology: e.g. 'expectation' vs. 'requirements'.

A discussion started on the following elements:

- **Element specific discussions**

- **Element 14 Emergency preparedness – Capturing worse case**

It would be beneficial to look at worst case/low probability incident. It was noted that emergency response should be defined by risk assessment, using a risk matrix.

- **Element 15 Inspection and maintenance**

It was noted that the title might be misleading. Consider integrity rather than inspection and maintenance.

- **Element 16 Management of safety critical devices (SCDs)**
  - Defining SCD criteria.
  - Safety critical function e.g. safety critical control functions.
  - Basis for defining criticality on a register of SCDs.
  - Is it a function of the system?
  - Degree of criticality.
  - If not on register it is considered not critical?
  - Giving wrong direction in some cases.
  - Explicit reference to environmental issues e.g. safety and environmentally critical elements (SECE).

– **Guidelines**

Despite the number of downloads, it was noted that there was a lack of awareness of the guidelines. Increased marketing would be beneficial to create awareness and clarify purpose. It was suggested that it would be beneficial to differentiate between minimum requirements and guidance.

It was noted that the guidelines could have different uses:

– as review tool;
– as audit too;
– as reference, or
– use in their entirety.

It was suggested to create a tool or guidance which would aid implementation of the guidelines.

– **Suggested PMs**

It was agreed that the PMs were useful to measure 'process steps'.

It was noted that some PMs were identical across elements. This is purposeful and enables their aggregation up to board level reporting (see Element 20). In-line controls are for reality checks on site.

3.2 SESSION 2 – LEARNINGS FROM IMPLEMENTATION

– **What has gone well?**
  – Integrated PSM into SSHE management system (not adding another system).
  – Customised EI *PSMF* into business management system (use of evidence statements).
  – Can be used to benchmark across businesses – share best practices.
  – Use of spider diagrams.

– **What could have gone better?**
  – More helpful guidance on SCDs.
  – Lack of senior management support/sponsorship.
  – How to implement PSM in diverse businesses.
  – Better marketing of PSMF and PSMG.
  – Acknowledging that implementation depends on size of the business and available resource.
  – Recognising the difference in need for smaller independent vs. major organisations and in upstream vs. downstream oil and gas sectors.

– **What would you do differently to overcome these issues?**
  – Drive from senior management/ sponsorship.
  – Start by getting support from CEO.
  – Detail the benefits for implementation.
  – Develop an awareness presentation which would promote the benefits of implementation.
  – Liaise with insurers.
  – Timeframes (resource, implementation).

- Degree of bias.
- Faster delivery of PSMG.
- Promote where there is no local legislation.
- Aim resources to regions with less mature legislation.
- Develop a tool or guidance to aid implementation.

3.3 SUMMARY OF KEY WORKSHOP FINDINGS

Revision of PSMF and PSMG was proposed, and this could be covered by the following key issues:

- Rationalise principles, e.g. process safety vs. asset integrity vs. operational excellence.
- Combine some elements, e.g. inspection/maintenance and SCDs.
- Revise some elements, e.g. define criticality of SCDs, consider SCD scope (e.g. refer to SECE), review stakeholder engagement vs. American Chemistry Council 'responsible care'.
- Add some new elements, e.g. environmental management, having carefully defined its boundaries (from major accidents to the environment (MATTEs) through to operational environmental issues such as waste, energy and permits).
- Define key terms such as 'operations envelope', 'minimum requirements', 'expectation' vs. 'requirements' (to align with ISO management systems standards).
- Link 'evidence' to elements/expectations.

Participants also encouraged EI to develop tactics for successful implementation guidance.

The workshops findings, and the detail that builds on them, will be evaluated by PSC with a view to improve the PSM resources, e.g. by revising *PSMF*, and in due course, revising *PSMG,* and considering developing implementation guidance.

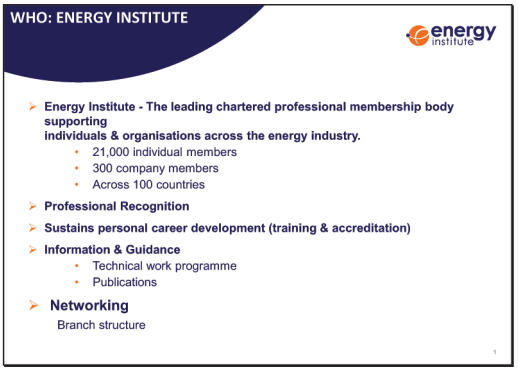
ANNEX A
GLOSSARY OF ACRONYMS AND ABBREVIATIONS

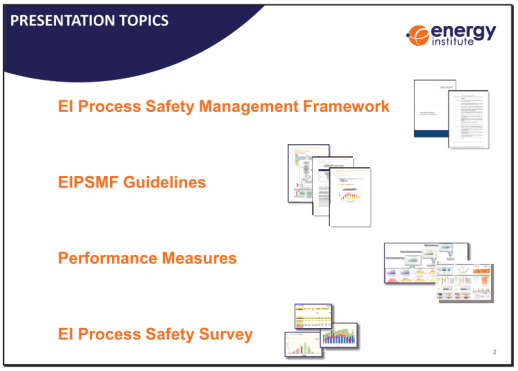
A.1 GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ALARP	as low as reasonable practible
COSHH	Control of Substances Hazardous to Health (Regulations)
DSEAR	Dangerous Substances and Explosive Atmospheres Regulations
EI	Energy Institute
HSE	Health and Safety Executive
MATTE	major accident to the environment
PM	performance measure
PSM	process safety management
PSMF	High level framework for process safety management
PSMG	process safety management guidelines
SCD	safety critical device
SCE	safety critical element
SECE	safety and environmentally critical element

ANNEX B
PRESENTATIONS

B.1 INTRODUCTION ON THE HISTORY OF EI PSM – JOHN POND





PROCESS SAFETY MANAGEMENT

What is Process Safety Management (PSM)?

"*Managing the systems and procedures that prevent the uncontrolled release of energy*"

PSM: What the energy industry should do on a strategic, tactical and day-to-day basis to deliver operational excellence.

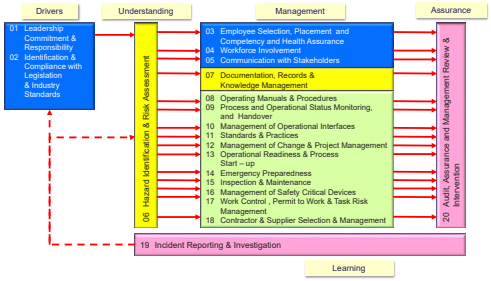
PSM: Incorporates all of the disciplines, processes and procedure essential in ensuring the integrity of energy industry assets (AIM).

CONTEXT

EI PSM FRAMEWORK STRUCTURE

- **Focus Areas** – **4 High level key components of the Framework.**
- **Elements** – 20 key aspects of the operation we need to manage appropriately in order to assure the integrity of the operation.
- **Expectations** – 202 things we should be doing in order to assure the integrity of the operation.
- **Guidelines** – How to meet the Expectations Good Practices + PI's (PSPI's)

EI PSM FRAMEWORK IN OPERATION



PSM FRAMEWORK 'ELEMENTS'

01 Leadership Commitment & Responsibility
02 Identification & Compliance with Legislation& Industry Standards
03 Employee Selection, Placement and Competency and Health Assurance
04 Workforce Involvement
05 Communication with Stakeholders

06 Hazard Identification & Risk Assessment
07 Documentation, Records & Knowledge Management

08 Operating Manuals & Procedures
09 Process and Operational Status Monitoring, and Handover
10 Management of Operational Interfaces

11 Standards & Practices
12 Management of Change & Project Management
13 Operational Readiness & Process Start – up
14 Emergency Preparedness
15 Inspection & Maintenance
16 Management of Safety Critical Devices
17 Work Control , Permit to Work & Task Risk Management
18 Contractor & Supplier Selection & Management

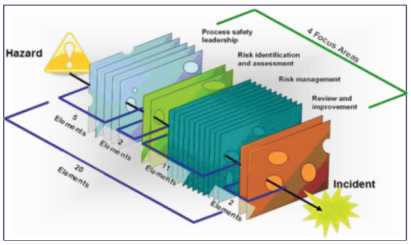
19 Incident Reporting & Investigation
20 Audit, Assurance and Management Review & Intervention

ASSET INTEGRITY MANAGEMENT (KP4 and EIPSMF)

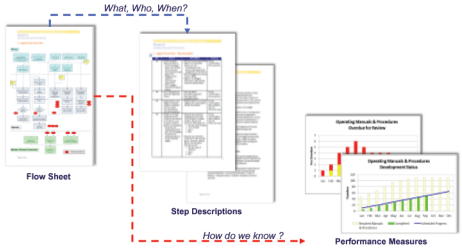
- **EIPSMF provides a comprehensive approach to Process Safety Management (and Operational Integrity) which encompasses the KP4 requirements and addresses asset lifecycle integrity management.**
- **Asset lifecycle integrity management & asset life extension are business as usual issues for many in the downstream.**
  - Many refineries date from the immediate post war era and are well beyond their original design life.

Element	Expectations	KP-4 Applicable
1 Leadership, commitment and responsibility	15	4
2 Identification and compliance with legislation and industry standards	5	5
3 Employee selection, placement and competency, and health assurance	14	13
4 Workforce involvement	6	5
5 Communication with stakeholders	6	0
6 Hazard identification and risk assessment	15	13
7 Documentation, records and knowledge management	8	8
8 Operating manuals and procedures	6	3
9 Process and operational status monitoring, and handover	8	8
10 Management of operational interfaces	4	0
11 Standards and practices	11	8
12 Management of change and project management	17	15
13 Operational readiness and process start-up	10	0
14 Emergency preparedness	10	3
15 Inspection and maintenance	10	10
16 Management of safety critical devices	10	10
17 Work control, permit-to-work and task risk management	11	0
18 Contractor and supplier, selection and management	8	8
19 Incident reporting and investigation	14	13
20 Audit, assurance, management review and intervention	13	11

PSM FRAMEWORK 'BARRIERS'

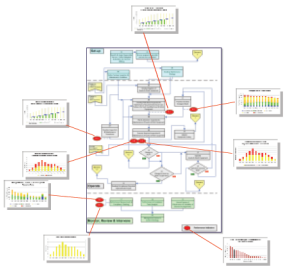


EI PSM FRAMEWORK GUIDELINES



EI PSM FRAMEWORK GUIDELINES

- Simple logical representation of what should be in place.
- Performance measures mapped to the Flow-sheet.
- Approach mimics process design
  1. Develop process flow-sheet
  2. Define how process will be controlled



EI Process Safety Survey Compliance Assessment

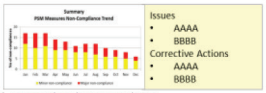
Are you set-up for success?

- Self-assessment of compliance with Expectations of EIPSMF
- Benchmarking against selectable internal peer groups
- Benchmarking against selectable industry sector and geographical peer groups
- Online service – launched 2012
- Real time information
- Participants can join at any time
- Independent - Energy Institute
- Anonymity assurance
- Does not require EI Membership

Performance Measurement & Reporting

High Reliability Organisations measure failure or non-compliance (How often they failed to do what they were required to do)

- Identify, understand and correct what has not been done
- Eliminate the Red and the Yellow



- Reduces clutter in reports
- Improves focus on required corrective interventions
- Simplifies aggregation

Avoid tendency to measure success (% complete)

EI Process Safety Survey Compliance Assessment

Enables senior executives and managers to :-

Have a clear and consistent understanding of compliance levels across their organisations on an absolute basis and relative to their peers.

Identify areas of strength and weakness

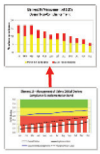
Understand whether they are set up to have

"an incident free day tomorrow"

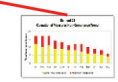
Have a sound basis for development of compliance / performance improvement plans

PERFORMANCE MEASURES
How do we know?
What do we need to measure?

- Performance Measures address issues which must be controlled (by someone) in order to manage the risk of incidents and shielding of developing issues



Aggregated View
- Trending of non-compliances?
- Red –Major & Amber -Minor
- Drill down for more detail



Outcome Measures
What outcome are we achieving?
Are the arrangements working?
"Lagging Indicators"

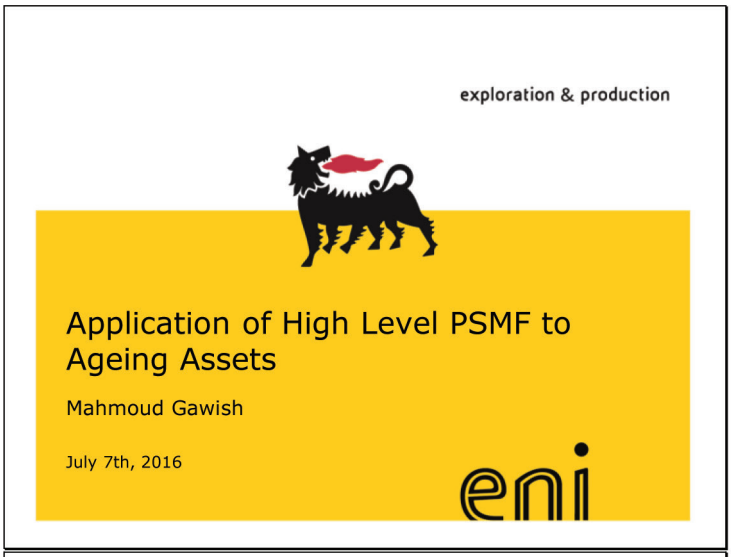
Compliance Measures
- Do our arrangements meet the Expectations of the Framework?
- Are we set up for success ?
- "Leading Indicators"

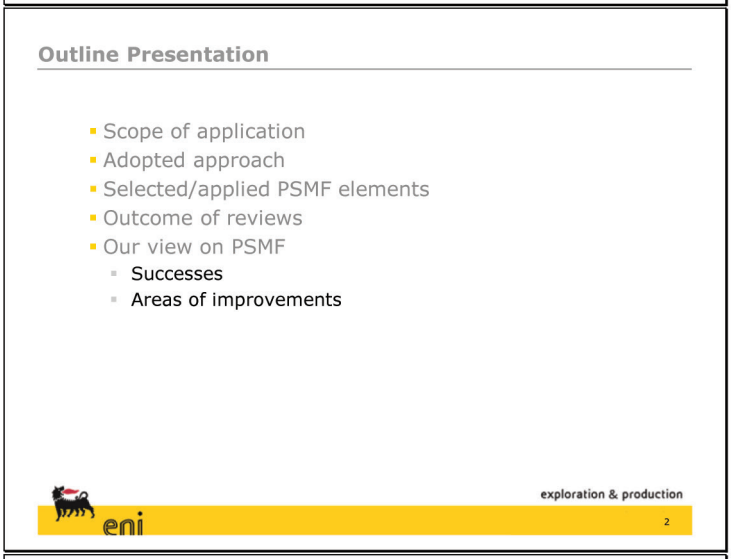
Operational Measures
- Are we doing what is required by our arrangements?
- Is there an unsafe situation developing
- Is our performance sustainable?
- "Leading Indicators"

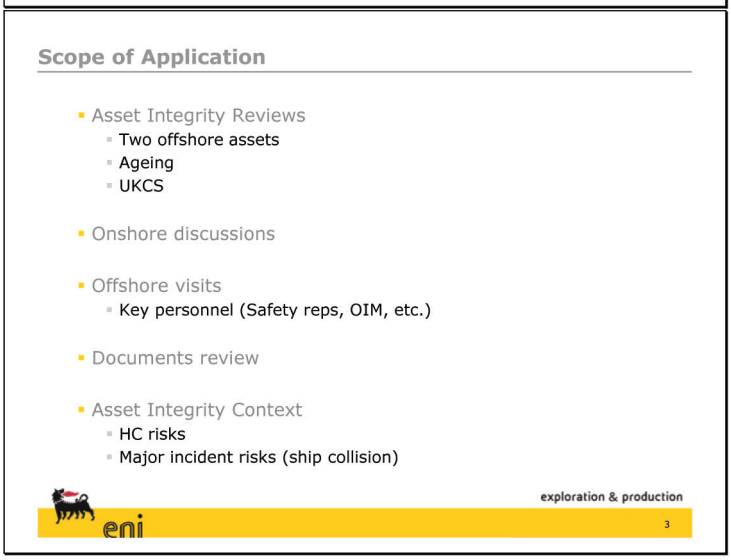
EIPSM USED WORLWIDE

- *PSM Framework*
  Published December 2010
  >2500 downloads in >40 Countries
  Adopted by UK Health & Safety Executive as their basis for assessment of PSM arrangements – 2013
- *PSM Guidelines*
  >5100 downloads in >55 Countries

B.3 APPLICATION OF HIGH LEVEL PSMF TO AGEING ASSETS – MAHMOUD GAWISH







Adopted Approach

- High Level Reviews of Asset Integrity
  - Major effort to carry out a full assessment against the detailed PSMF and associated PSMG
  - High-level approach required simplification into dual stages:
    - high level stage for first year
    - detailed level in subsequent years
  - A review (rather than audit) based approach
- Selection and application of relevant PSMF elements
  - Review of the framework and preparation of questions
  - Exclusion of a number of elements (scope)
- Personnel interviews/structured discussions
  - Key personnel (Directors, Managers, TAs, etc.)
  - Each question set was tailored to the individual being interviewed
  - Further queries raised arising from the interview responses

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Selected PSMF Elements

- Element 3 – Employee Selection, Placement and Competency, and Health Assurance
  - Process Safety Management responsibilities
  - Specific Process Safety competencies
- Element 4 – Workforce Involvement
  - How are employees and contractors engaged in improving process safety performance?
  - Specific process safety programmes in place
- Element 6 – Hazard Identification and Risk Assessment
  - Types of risk assessments and action tracking
  - Risk assessment training and consideration of HF issues
  - Monitoring quality of risk assessments
  - Onshore/offshore communication with respect to risk assessments

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Selected PSMF Elements

- Element 1 – Leadership, Commitment and Responsibility
  - Leadership message on Asset Integrity
  - Responsibilities for managing process safety
  - Process safety targets and rewards
  - Barriers to improving process safety performance
- Element 2 – Identification and Compliance with Legislation and Industry Standards
  - Implementation of latest process safety related legislation, guidance and standards
  - Access to the latest standards
  - Tracking and status of compliance

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Selected PSMF Elements

- Element 7 – Documentation, Records and Knowledge Management
  - Access to procedures offshore
  - Availability of Safety Case offshore
- Element 8 – Operating Manuals and Procedures
  - Validity of procedures for key items/processes
  - Do procedures contain safe operating envelopes?
  - Procedural review periods
  - Tracking of utilisation and access of correct procedures
  - Tracking of compliance with procedures
- Element 9 – Process and Operational Status Monitoring and Handover
  - Definition and excursions beyond SOEs for assets
  - Shift handover arrangements

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Selected PSMF Elements

- Element 10 – Management of Operational Interfaces
  - Third party selection and management
  - Management of bridging documents
- Element 12 – Management of Change and Project Management
  - MoC process and effectiveness
  - Consideration of HF issues
  - Management of specific projects
- Element 13 – Operational Readiness and Process Start-up
  - What is the pre-start up procedure?
  - What problems have arisen in the past?

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Selected PSMF Elements

- Element 15 – Inspection and Maintenance
  - Overview of inspection and maintenance programme
  - Main challenges and problem areas
  - Current status, backlogs, etc.
- Element 16 – Management of Safety Critical Devices
  - SCE register in place/current status?
  - Allocation of management responsibilities of SCEs (role of TAs)
  - Procedures in place for deactivating or by-passing SCEs
  - SCE backlog status and reporting it to management

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Selected PSMF Elements

- Element 17 – Work Control, Permit-to-Work and Task Risk Management
  - Assessment and management of sensitive process safety work
  - Levels of risk assessments linked to various PtW
  - Task Risk Assessment process
  - Compliance measurement and reporting
- Element 19 – Incident Reporting and Investigation
  - Process for incident investigation and reporting
  - Team selection and competence
  - Action Tracking and Close-out
  - Sharing and incorporation of lessons learned
- Element 20 – Audit, Assurance, Management Review and Intervention
  - Specific process safety audits/reviews undertaken

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Review Timeframe

- Asset Integrity Review
  - 2 full-time specialists
  - 1 day (PSMF review)
  - 4 mandays
    - 12 personnel interviewed onshore
    - 5 personnel interviewed offshore
- Report preparation time

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Outcome of Reviews

1. Identified areas of good practice
   - Competence Management System
   - Open forums for identification of operational efficiencies
   - In-house fabrication maintenance team
   - Workforce involvement
   - Hydrocarbon Release Reduction Initiative
   - Work construction supervisor
   - Annual Asset Integrity audits

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Outcome of Reviews

2. Areas of significant challenges
   - Restricted bed space particularly on satellites
   - Structural integrity issues (e.g: redundant equipment)

3. Areas of identified improvements
   - Management/co-ordination of marine and subsea related Asset Integrity risks
   - Applying CBT courses to contractors and vendor personnel
   - Accessibility of procedures offshore
   - Inclusion of specific Asset Integrity competencies on personnel development profiles
   - **Development of an appropriate set of Asset Integrity KPIs**

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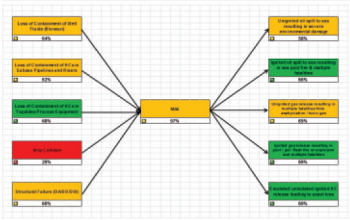
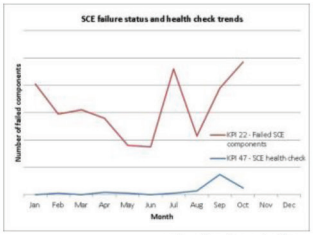
Example of Improvements Made





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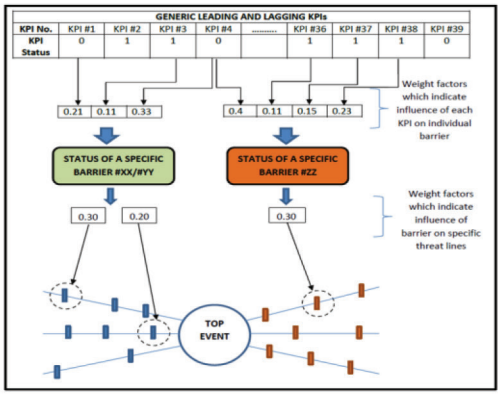
Concept Summary



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Our View – PSMF Successes

1. Comprehensive and structured approach to PSM
2. Majority of elements were adequate for our application
3. PSMF elements and sub-elements prompted the right queries during the discussion
4. Assisted us in identifying areas of PSM:
   - good practice
   - potential improvements
   - significant challenges

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Our View – PSMF Areas of Improvement

1. Value in adding a specific element/focus area regarding HF issues
2. Value in incorporating more PSM expectations from HSE's KP4 programme (ALE) ageing assets
   - Captured through focus on the following areas:
     - Element 15 – Management of Safety Critical Devices
     - Element 16 – Inspection and Maintenance
3. Value in inclusion of sub-element perhaps relating to onshore maintenance planning, backlog and deferral processes
   - Element 15 – Management of Safety Critical Devices

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Our View – PSMF Areas of Improvement

4. Small number of elements pointed to the same direction
   - Some degree of repitition
5. Potential amalgamation of the following elements:
   - Element 7 – Documents, Records and Knowledge Management
   - Element 8 – Operating Manuals and Procedures
   - Element 10 – Management of Operational Interfaces
   - Element 18 – Contractor Supplier, Selection and Management

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B.3 BUILDING PROCESS SAFETY MANAGEMENT CAPACITY – GAVIN RAMSDEN

Building Process Safety Management Capacity

A continuous journey to outstanding process safety performance

Gavin Ramsden – Senior Manager Safety | 7 July 2016

woodside

About Woodside

- Woodside is an Australian oil and gas company with a global presence, recognised for its world-class capabilities – as an explorer, a developer, a producer and a supplier
- We are Australia's most experienced Liquefied Natural Gas (LNG) operator and largest independent oil and gas company
- Our mission is to deliver superior shareholder returns through realising our vision of becoming a global leader in upstream oil and gas

Our Australian business

Producing assets		
1	Karratha Gas Plant	NWS
2	Goodwyn A platform	NWS
3	North Rankin Complex	NWS
4	Okha FPSO	NWS oil
5	Angel platform	NWS
6	Pluto LNG Plant	Pluto LNG
7	Pluto LNG platform	Pluto LNG
8	Ngujima-Yin FPSO	Vincent oil
9	Ngarnhurra FPSO	Enfield oil
Projects		
10	Greater Western Flank Phase 1	NWS
11	Greater Western Flank Phase 2	NWS
12	Persephone	NWS
13	Wheatstone LNG Plant (non-operated)	Wheatstone
14	Wheatstone LNG Platform (non-operated)	Wheatstone
15	Julimar	Julimar, Brunello
Developments		
16	Greater Enfield Oil	Enfield oil
17	Browse Development	Browse
Woodside offices and representative offices		

Disclaimer and important notice

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This presentation contains forward looking statements that are subject to risk factors associated with oil and gas businesses. It is believed that the expectations reflected in these statements are reasonable but they may be affected by a variety of variables and changes in underlying assumptions which could cause actual results or trends to differ materially, including but not limited to: price fluctuations, actual demand, currency fluctuations, drilling and production results, reserve estimates, loss of market, industry competition, environmental risks, physical risks, legislative, fiscal and regulatory developments, economic and financial market conditions in various countries and regions, political risks, project delay or advancement, approvals and cost estimates.

All references to dollars, cents or $ in this presentation are to US currency, unless otherwise stated.

References to "Woodside" may be references to Woodside Petroleum Ltd. or its applicable subsidiaries.

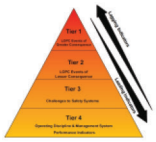
Bringing it all together

Continuous improvements implemented but a more holistic and comprehensive approach was needed

1990s Asset based integrity management systems → **2006/07** Company framework → **2008** Quarterly Board reporting → **2009/10** Company standard → **2013** Global benchmarking



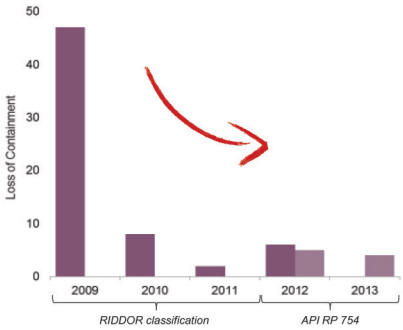




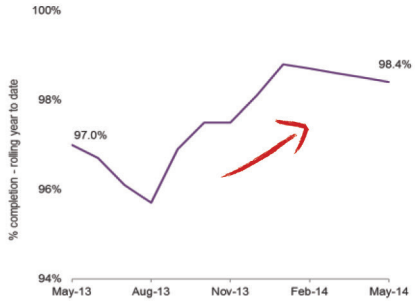
Process safety performance

It was recognised that performance as measured by existing leading and lagging indicators could be improved

LOSS OF PRIMARY CONTAINMENT



SAFETY CRITICAL MAINTENANCE PLANNED COMPLETION



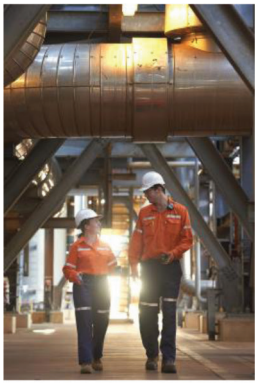
Case for change

Internal and external assessments of our systems highlighted areas for potential improvement

Audits
- Internal audits against our integrity management standard
- Joint venture participant audits
- Regulatory inspection actions
- Third party audit by recognised process safety consultancy

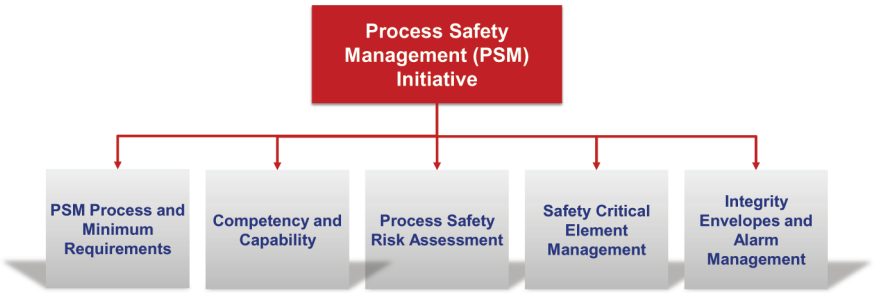
External Review
- Greater engagement with peers to support benchmarking
- Attendance at industry meetings and conferences

Productivity program
- Significant number of continuous improvement projects



Project initiation

A major project was required to clearly identify and improve our PSM systems



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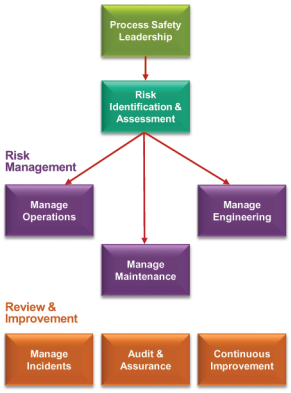
Assessment of best practice

An assessment of external best practice was undertaken to provide project basis

- Drive to maximise use of external standards
- Internal review of available process safety management systems and guidelines
- Decision made to use Energy Institute framework on following basis:
  - Peer company input
  - Comprehensive and holistic
  - Aligned with Woodside language
  - Adopted by similar companies



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Vision

We needed to align multiple stakeholders behind a common understating of process safety

- Recognised importance of aligning all stakeholders behind a common vision
- Workshop held early in project to agree key principles on which project would progress
- Output included
  - Vision
  - PSM compass
  - Key principles
  - Agreement on definition and scope of PSM

We all own, understand and act to control process safety risks

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Driving leadership accountability

Visible and authentic leadership equipped with process safety competence was essential to drive a "line led, risk based" approach required

- Early support from senior operational leadership
- Project VP reporting line and influence
- Formation of senior leadership steering committee with cross-business representation
- Asset manager workshop

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Embedding the Energy Institute framework

We needed a procedure that would be understood and lived by our workforce

- Energy Institute framework translated into corporate procedure
- Assignment of requirements to responsible parties
- Line accountability for implementing
- Additional guidance provided to identify how conformance can be demonstrated
- Individual requirement (element) workshops
- Transition to full integration within a refreshed management system

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Providing a baseline to measure progress

Facilitated assessments of our assets and functions helped identify all gaps against our new procedure

- Procedure provided basis for detailed assessment
- Series of workshops surfaced additional improvement opportunities
- Asset teams responsible for their own assessment
- All actions captured within corporate tracking system
- Run down plans in place to drive improvements governed by Corporate HSEQ

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Engaging the workforce

Engagement sessions provided the platform to launch the programme and its improvements

- New expectations, procedure and project improvements rolled out through series of sessions in Perth headquarters
- Senior leadership deliver each presentation starting with a personal account of what process safety means to them
- Nearly 1000 attendees over initial eight sessions
- Sessions were filmed and sent to assets / country managers to support a leader led cascade to remote personnel

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Getting buy in from all stakeholders

Everyone has a responsibility for process safety and how it applies will change depending on your role

ALL

…at a minimum, everyone should:

- Understand what process safety is and how it differs from personal safety
- Know what the process safety risks are in the area you work in and/or impact on, and the controls in place to reduce these risks
- Behave in accordance with Our Safety Culture
- Recognise the PSM framework and know where to go for associated procedures

SCR

…for a safety critical role:

- Understand your process safety competency requirements. Develop, maintain and demonstrate conformance
- Articulate the 5-7 process safety risks in your work area and the controls in place to manage these risks
- Take accountability for process safety that is in line with your expected role
- Understand the PSM framework and have knowledge of the associated procedures

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Key improvement areas

Four key areas of improvement were identified resulting in significant improvement to date

Competency and capability

- Defined critical roles and required competencies
- Competency assessments undertaken
- Comprehensive training and coaching
- Improved governance and change management

Process safety risk assessment

- New process safety risk assessment procedure
- Creation of multi-discipline risk registers
- Improved tracking of actions arising from assessments
- Coaching and guidelines support consistency

Integrity envelope and alarm management

- Safety related alarms clearly and consistently identified
- All alarms responses populated in control systems
- Visible operating envelopes and integrity limits
- Improved excursion monitoring and reporting

Safety critical element (SCE) management

- Consistency of SCE identification and definition
- Updated performance standards and assurance tasks
- Consistent action following SCE failure / damage
- Improved maintenance system reporting

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Process safety governance

Implementation of the improvements enable greater process safety governance

PROCESS SAFETY METRICS

Metric Specification Sheets

Metric Dashboard

PROCESS SAFETY REPORTING

Monthly Reporting

Tiered Governance Meetings

Going global

As the company expands globally we need robust systems and processes recognised internationally

What next?

Good

Conformance to minimum requirements

Great

Efficient implementation and proactive management of risks

Outstanding

Sustained continuous improvement and recognized leader in process safety management

We all own, understand and act to control process safety risks

Key lessons

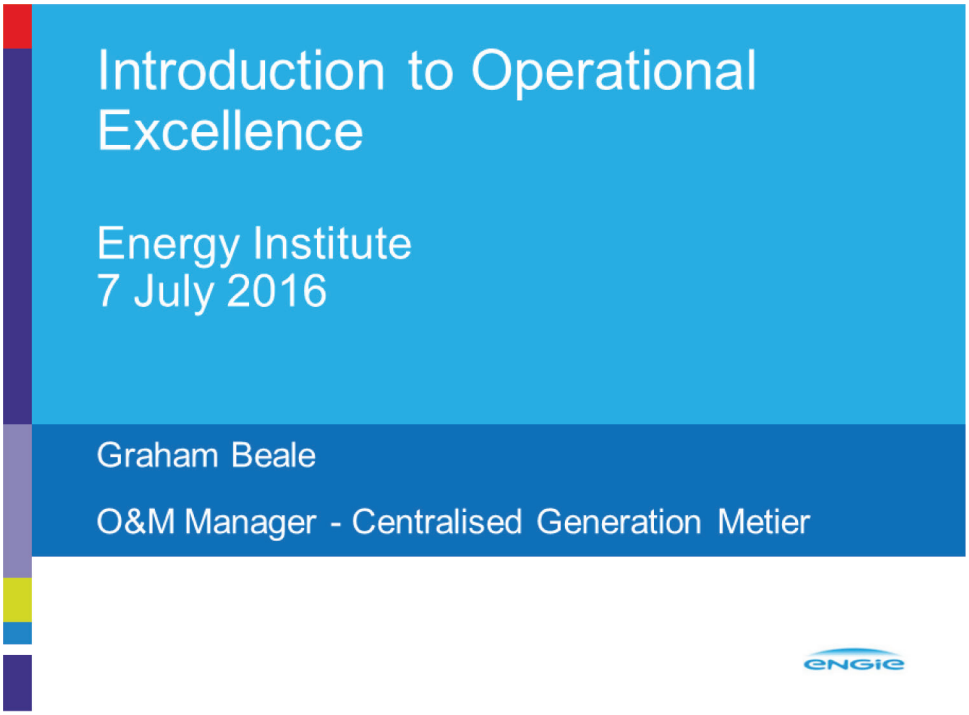
We continue to learn and get better through collaboration

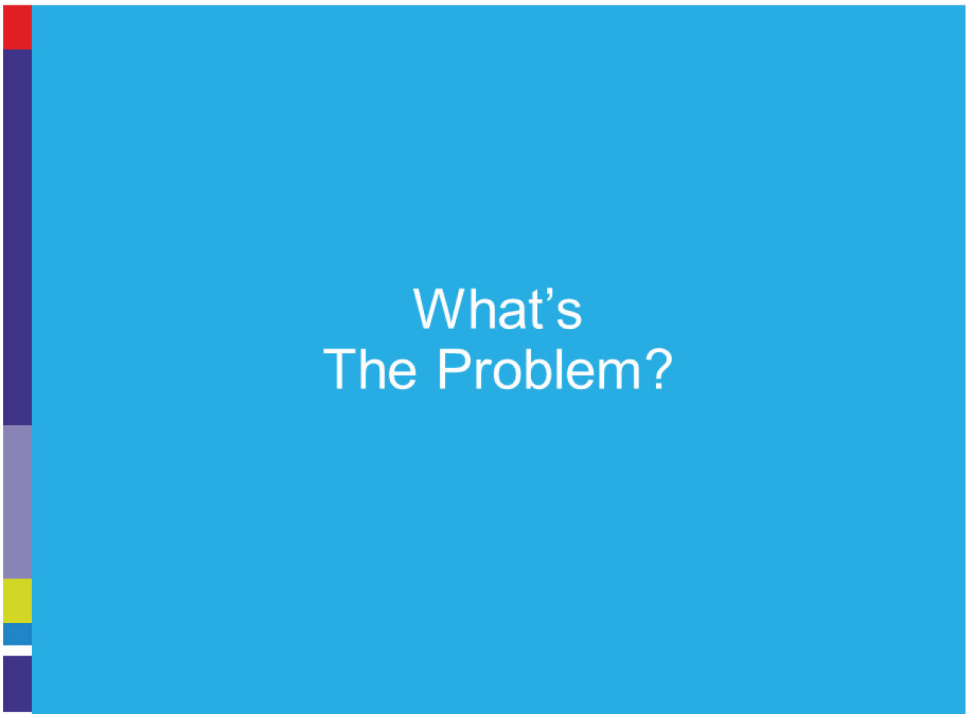
- Visible leadership at all levels
- Accountability and ownership across all stakeholders
- Leverage other programs and be flexible
- Engage with peers and share learnings
- Change overload and burden
- Provide support and training needed to drive changes
- Internal vs external capability

Thank you

Any Questions?

B.4 INTRODUCTION TO OPERATIONAL EXCELLENT – GRAHAM BEALE

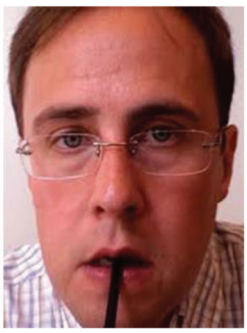




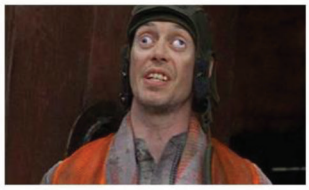
One

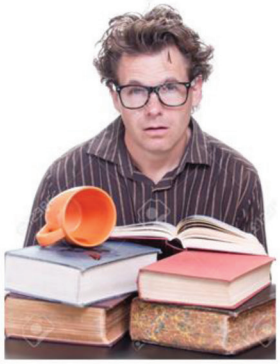
Process Safety

- Wind the clock back a few years …….
- Mention 'Process Safety' on a UK power plant ……

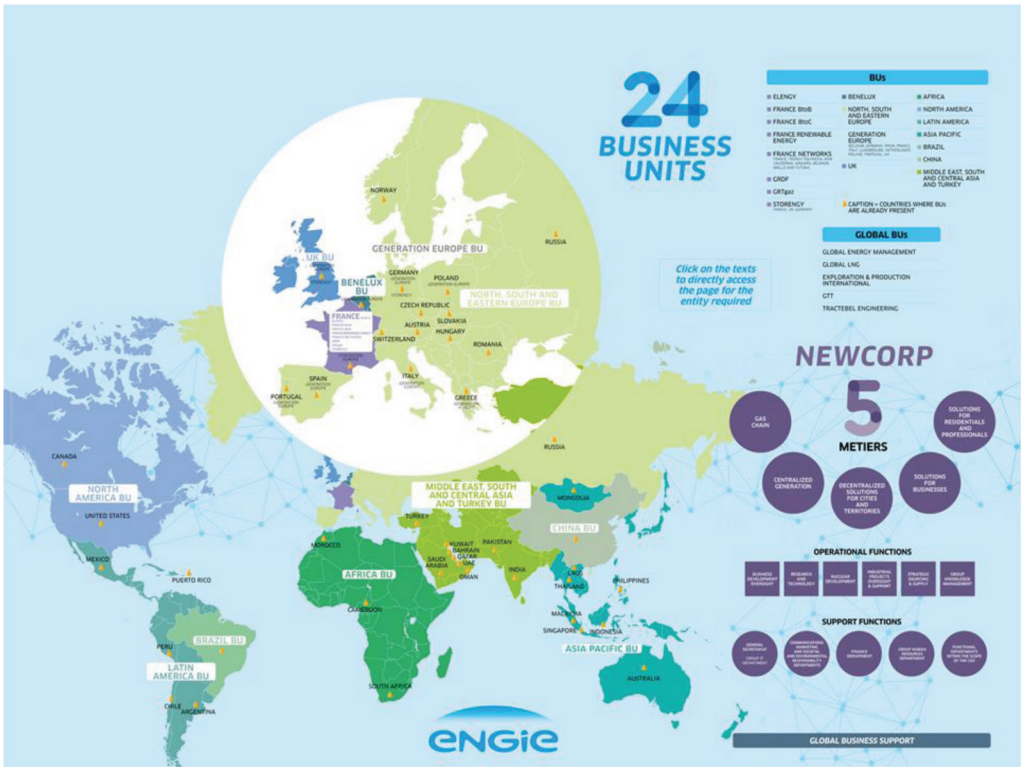


Blank looks all round!



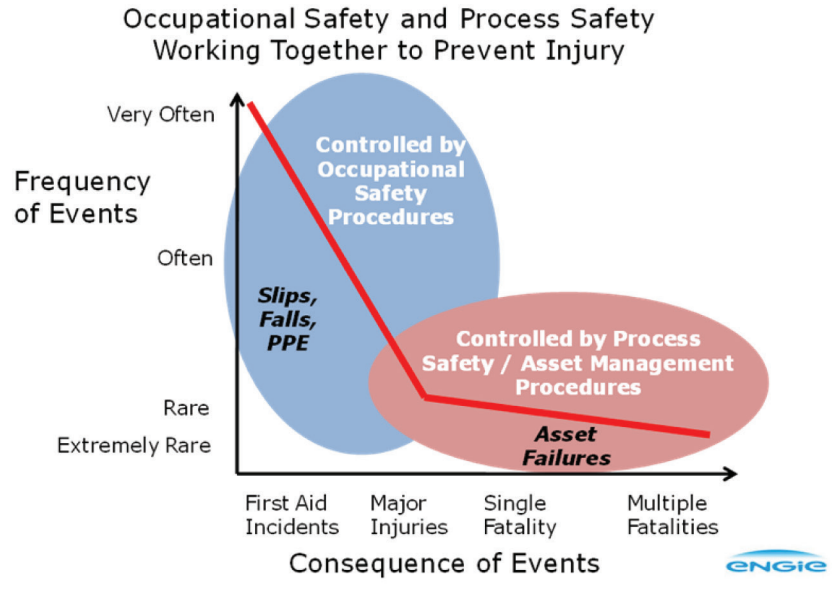


Two



Three

Occupational vs Process Safety



Four

Power Plant Process Safety Incidents

Monterrey ACC Explosion

Rugeley MBFT Exhaust

ISAB CCGT Over Speed

Marafiq Steam Turbine Over Speed

Shuweihat S1 GT Air Filter Fire

Process Safety

- Successful Process Safety requires good Asset Management at all stages in the asset lifecycle from the initial concept and design phases, through construction, commissioning, operation and maintenance, all the way to decommissioning.

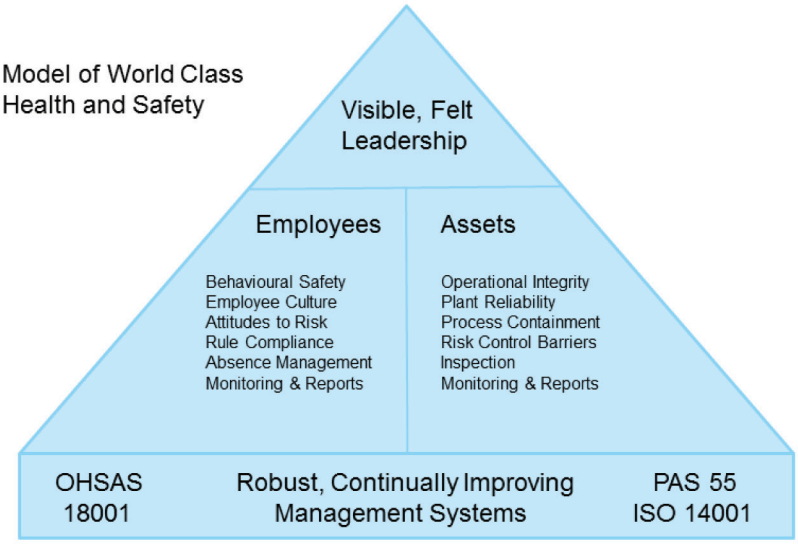
It's about " … keeping the process inside the equipment …"

Paul Evans, COO, UK

- Good Asset Management is the centralised generation operations and maintenance core business – so what's the problem?

A key part of "Total Health & Safety"…

Model of World Class Health and Safety

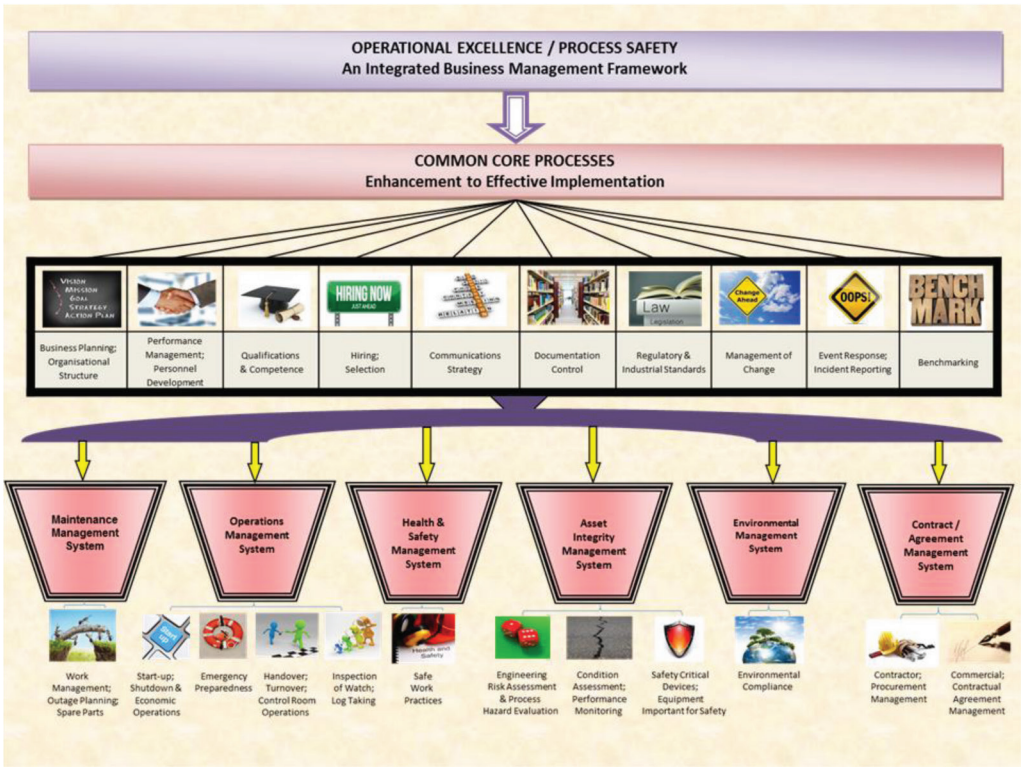


Operational Excellence - Process Safety

- The Central Generation Metier Operational Excellence framework is based on the generic, internationally recognised Process Safety management framework published by the Energy Institute.
- The generic framework has been re-written in 'power station language'.
- 20 elements in the EI framework ➡ 22 elements in Operational Excellence.
- Operational Excellence is approximately 80% Process Safety management and 20% commercial management.

Operational Excellence ....

- An integrated business management framework that enhances existing power plant management systems through management of process safety risk and meeting or exceeding business plan performance targets.
- This overarching framework encompasses common core processes established to enhance the effective implementation of six principal management systems:
  - Maintenance
  - Operations
  - Health & Safety
  - Asset Integrity
  - Environmental
  - Commercial Contracts/Agreements
- Adherence to a set of fundamental standards benchmarked against industrial best practices ensures continuous improvement and resource efficiency.



How Does Operational Excellence Assessment Work?

- The framework consists of 22 'elements', and these are further split into 'objectives'.
- There are a total of 79 objectives, of which 48 are marked with (M). These 48 objectives are seen as the minimum required to manage process safety risks.
- Each objective has an associated 'evidence statement'.
- Objectives marked as (M) are given a weighting factor of 2.

Element 7 - Safety Critical Devices (SCD)/Equipment Important for Safety (EIS)/Protection Integrity

7.1 (M) (IND2 C030-C1) All SCDs/EIS including fire protection equipment, mechanical devices, combustible source detection equipment, sensors, programmed logic, relays, contacts, switches, solenoids and interlocks are uniquely identified on an asset register which provides up-to-date asset lists and equipment records, including location and equipment specification data. The asset register provides a basis for the planning of SCD/EIS testing, inspection, maintenance and change management.

Evidence: The work management database has documentation of each SCD/EIS to include location, specification, manufacturer, contact information, operational tests, inspections and maintenance tasks, history of activities/events and performance/functional test results. The list of SCDs/EIS is derived from the engineering risk assessment and process hazard evaluation activities described in Objective 6.1. The programme task requirements are in compliance with property insurance, regulatory and industrial standards, applicable National Fire Protection Agency (NFPA) codes, to include assurance that all SCDs/EIS exist per prudent utility practices' design.

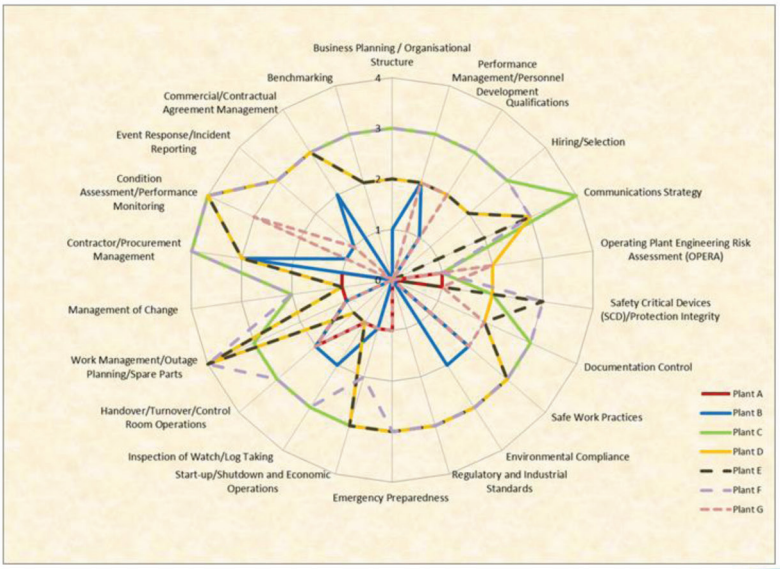
How Does Operational Excellence Assessment Work?

- The generation asset management and staff work through the objectives and, using the evidence statements, determine an appropriate score, from 1 to 4.
- The weighted objective scores for each element are added up and averaged. The score is rounded down to the nearest whole number.

Level	Design	Operating	Results	Action plan
1	✗	NA	NA	required
2	✓	✗	NA	required
3	✓	✓	✗	required
4	✓	✓	✓	optional

- The scoring spreadsheet can be imported directly into INCOME 'MOSAIC', again, avoiding duplication of effort.
- The spreadsheet produces a spider diagram.

Operational Excellence Results Spider Diagram



The Operational Excellence Framework ….

A tool to achieve performance standards

- Tremendous opportunity to identify and share best practices
- Opportunities to match plants with "Elemental" areas of demonstrated strengths with those of exposed performance deficiencies
- Generates a continuous improvement culture
- Designed to ensure asset integrity and achievement of performance targets
- Stimulates critical thinking to streamline processes
- Heightens situational awareness to effectively prioritise capital investments and daily work activities
- Provides a good overview for newly appointed power plant managers
- Creates an accountability infrastructure with Business Unit expectations
- Integrates numerous Business Units into one operating company

Compelling Business Case
Based on an Integrated and Fully Embedded Approach ....

Achieving Safety and Environmental Compliance	
Reducing the risk of catastrophic failure	Avoiding regulatory interventions

Operational Assurance
Confidence that processes critical to the safe operation of assets are in place

Meeting the Challenges of Ageing Plant
Strong handle on the risks that are inherent in assets that have been, or will be, life extended

Demonstrating Responsibility to Stakeholders
Clear strategy for managing the risks that concern your key stakeholders

Maximising Return on Investment
Targeted investments based on solid information

Underpinning Commercial Performance	
Minimising costs – driving out inefficiencies	Maximising revenue – through improved availability

KPIs to Track Progress

- Implementation Level 1 – Operational Excellence Self-Assessments (mandatory objectives only) without Independent Facilitation.
- Implementation Level 2 – Asset receives Operational Excellence 'Train the Trainer' Sessions.
- Implementation Level 3 – Operational Excellence Self-Assessments (mandatory objectives), with Independent Facilitation.
- Implementation Level 4 - BUs develop documented processes within their existing management systems, demonstrating compliance with all Operational Excellence objectives, at generation assets.
- Implementation Level 5 – As Level 4 but also performing Peer Reviews.
- Business Plan Integration.

KPI Details			
Name	OE-PS Assessments with Independent Facilitation		
Ref. No.	TBD		
KPI Type	Leading		
Specified By	HQ OPERATIONS	Owned By	PLANT MANAGEMENT
Objective			
Implementation Level 3: Assessments are completed on prioritised objectives annotated by an (M) for mandatory and placed on the Operations Group Connect site for best practice sharing.			
Metric			
Prioritised objectives within each element are averaged to generate a rating 1 – 4. The respective score is then plotted on a spider chart. *KPI (%) = # of Completed Assessments with Independent Facilitation / Total # of Regional Assets*			
KPI Cross Reference			
PSM Element(s)	All but Element 4: Hiring/Selection		
Elemental Objective(s)	All designated with an (M)		
Data Capture Frequency	Quarterly	Data Capture Method	Spider Chart

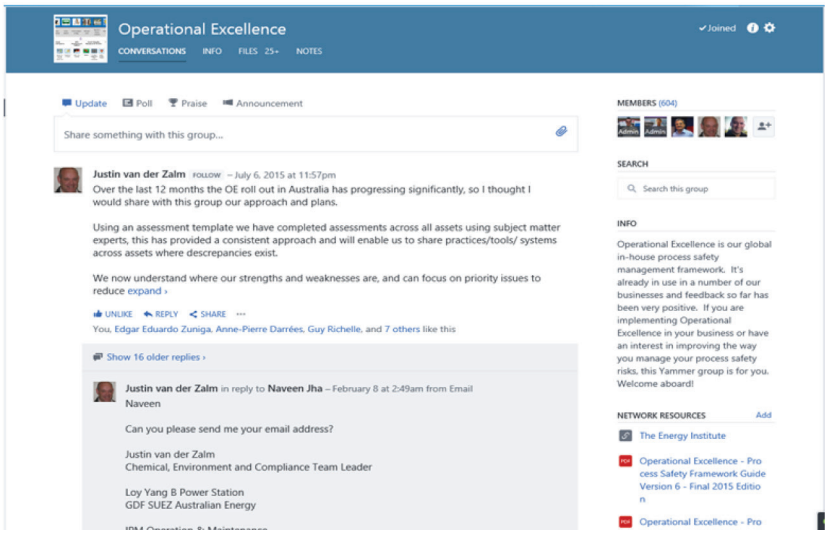
KPI Targets and Tolerances				
Target Level	Tolerance Band	Best Practice	Colour Code	Effective Date
100%	- 10%	Blue (M) and good practices	Green	October 2014
80%	+/- 10%		Amber	
< 70%	Zero		Red	
KPI Authorisation				
Approved By			Date Approved	

The Story So Far ....

- The Operational Excellence framework and the assessment process has been well-received at all assets engaging in the process. Feedback has been positive.
- The Operational Excellence framework was updated in 2015 using 2 years feedback and suggestions from power plants.
- All our Australian generating assets have committed to Operational Excellence.
- UK BU are using it alongside their own process safety programme at all generating assets. The 10 UK embedded generators are also on-board.
- STOMO, Oman committed to Operational Excellence two years ago and are using it as a catalyst to provide consistency across their 6 assets. They were the first business in MESCAT to adopt the framework. Marafiq, PP11, Tihama and Az Zour North have followed. Dedisa/Avon have just committed to Operational Excellence.
- Glow, Thailand committed to Operational Excellence across all their generation assets in 2014. Again, it is being used to streamline process and drive consistency.
- Paiton, Indonesia committed to Operational Excellence.
- LatAm – Peer reviews performed at E-CL, CTA-CTH and Enersur, Chilca in 2013 and at E-CL CTM 1&2 in 2015. Training delivered to E-CL and Enersur in 2015.

Operational Excellence on Yammer

- There is a Yammer group aimed at those implementing Operational Excellence in their business or anyone having an interest in improving the way process safety risks are managed.



Any Questions?

Process Safety Dashboard

GDF SUEZ Process Safety › UK-Europe Overview

PROCESS SAFETY | UK-EUROPE OVERVIEW | ALARM MANAGEMENT

Dashboard Display Date 01/11/2013 Business Entity ALL View Report
KPI Type LEADING Risk Control Areas ALL

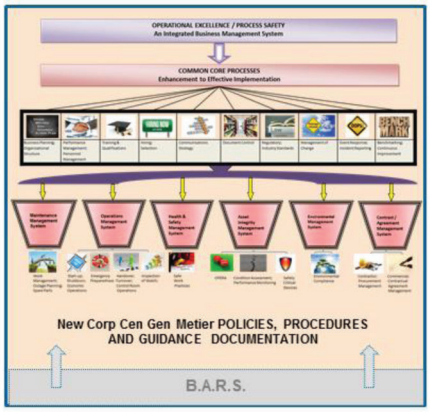
Plant | Process | People | Recovery

Technical Risk Management | Critical Systems | Alarm and Instrument Management | Maintenance Management | Operations Management | Operations & Compliance Audit | Staff Competence | Emergency Preparedness

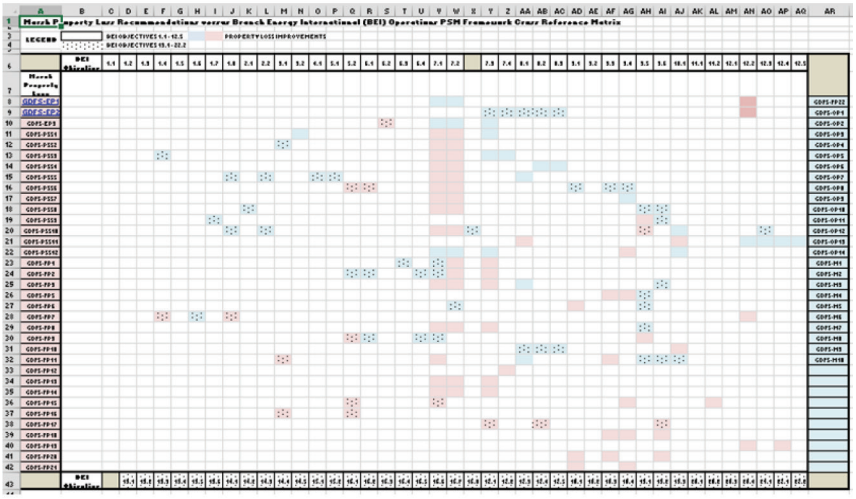
Leading KPI Overview on 01-Nov-2013 for UK-EUROPE

Risk Control Area	Current Status	Status Dist. (Count)	Last Rolling Month KPI Status Dist. (%)	Last Rolling Year KPI Status Dist. (%)
Technical Risk Management	0			
Critical Systems	4	4 2 1 3	31 17 15 37	48 7 11 35
Alarm and Instrument Management	9	9 1 2	83 12 5	72 12 5 11
Maintenance Management	4	4 3 6 6	22 21 27 30	24 23 27 25
Operations Management	4	4 2 2	51 24 25	63 12 25
Operations & Compliance Audit	0			
Staff Competence	0			
Emergency Preparedness	0			

Where does Operational Excellence Fit In?



Operational Excellence vs Insurance BARS (Behavioural Attitude Recommended Standards)



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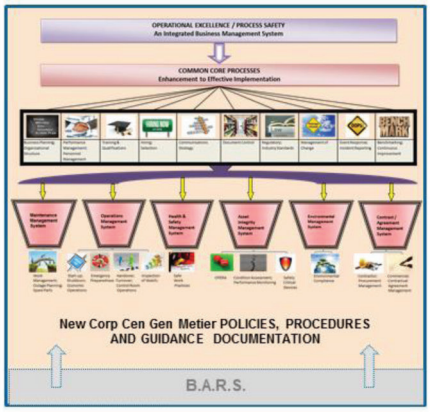

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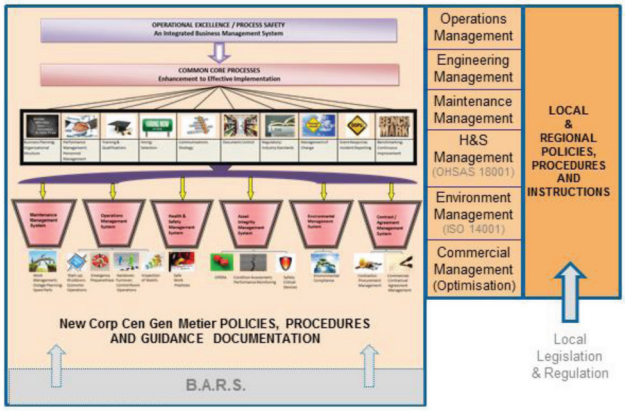

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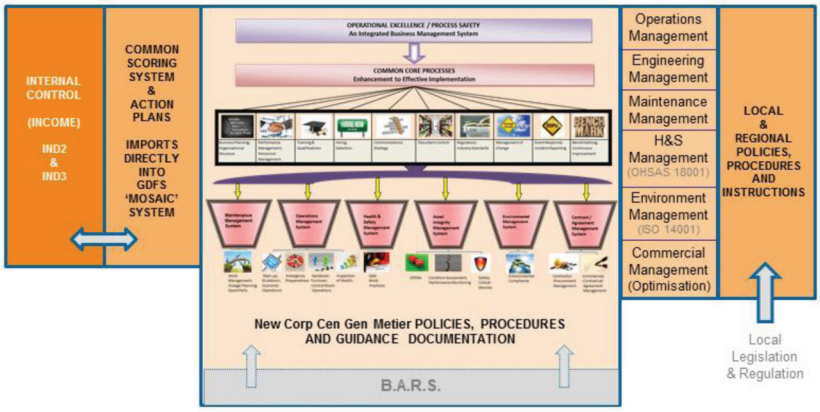

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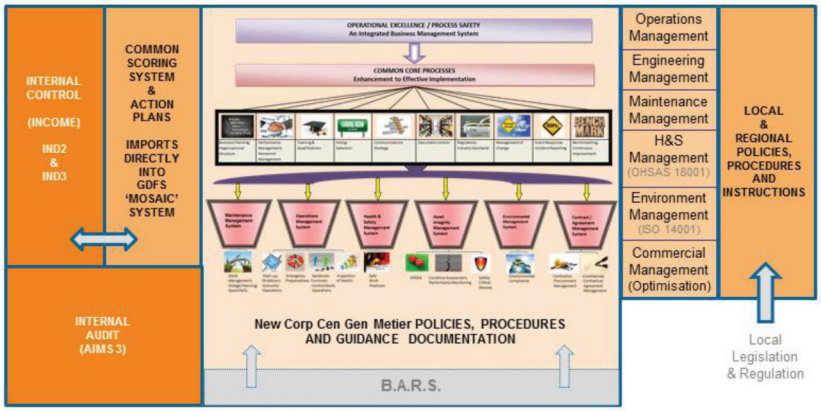

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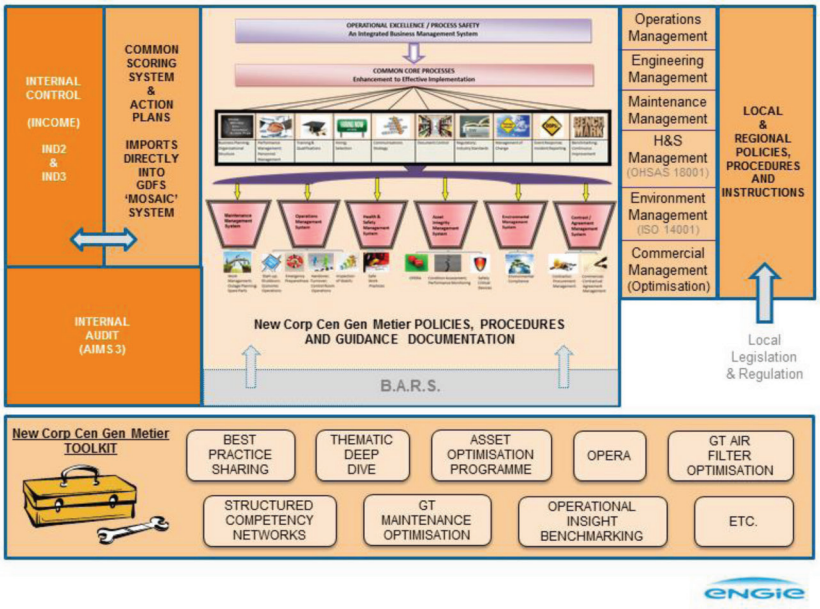
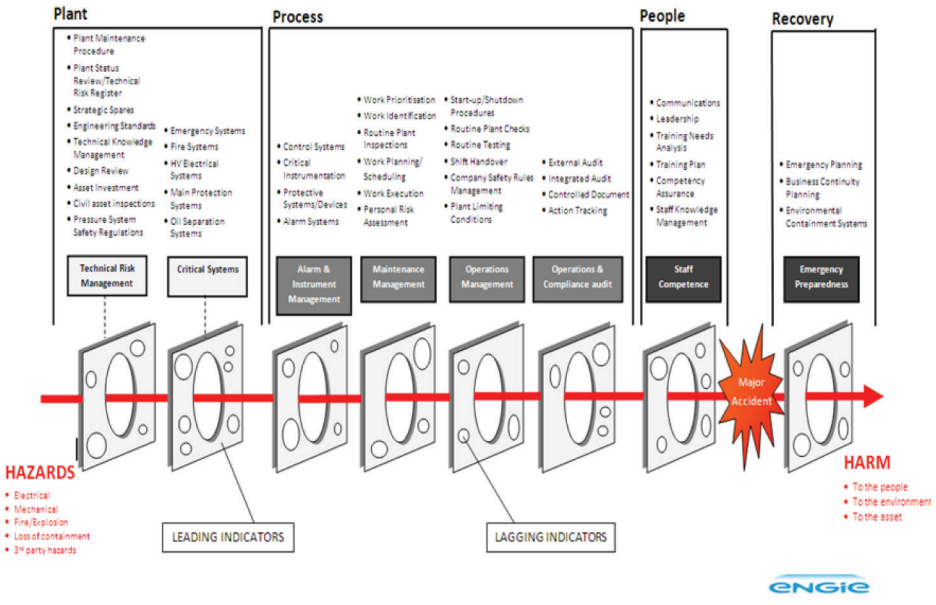


Barriers to Prevent Process Safety Incidents



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