



Scottish Power Goal : to make Process Safety risks as visible as Health and Safety Risks?

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Angela Wands – Process Safety Manager Amor Group

Introduction

Safety and Business Benefits

Making Process Safety Risks Visible

The goal: to become a “High Reliability Organisation”

Implementing HSG 254

Process Safety KPI Dashboard

Summary

Agenda

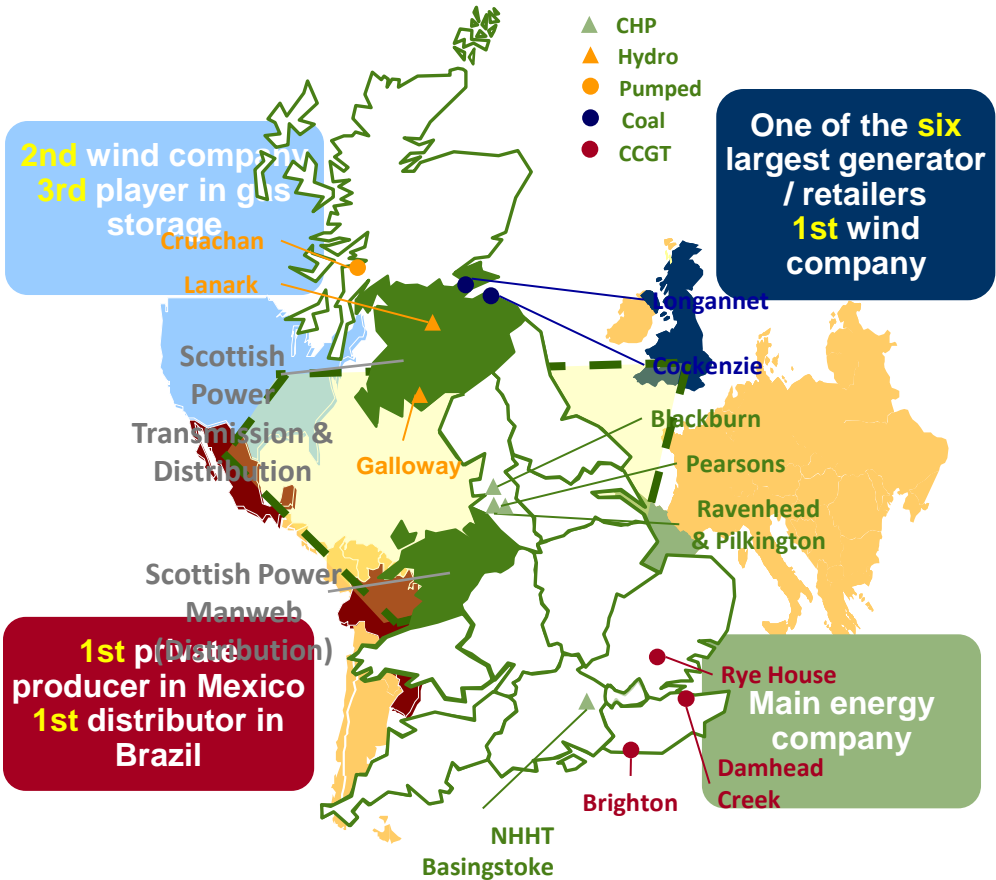
Supply 5.2 million customers

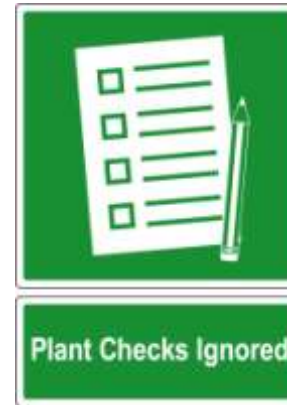
Over 8,000 employees

6GW of coal, gas & hydro generation across the UK

SP Renewables largest onshore wind operator in UK (1200 MW)

Distribution area of over 35,000 square kilometres





Scottish Power Goal : to make Process Safety risks as visible as Health and Safety Risks?



HSE Case Study

Judith Hackitt CBE



We need more Leaders to adopt the ScottishPower approach and to consider innovative ways of making process safety an integral part of everyone's role

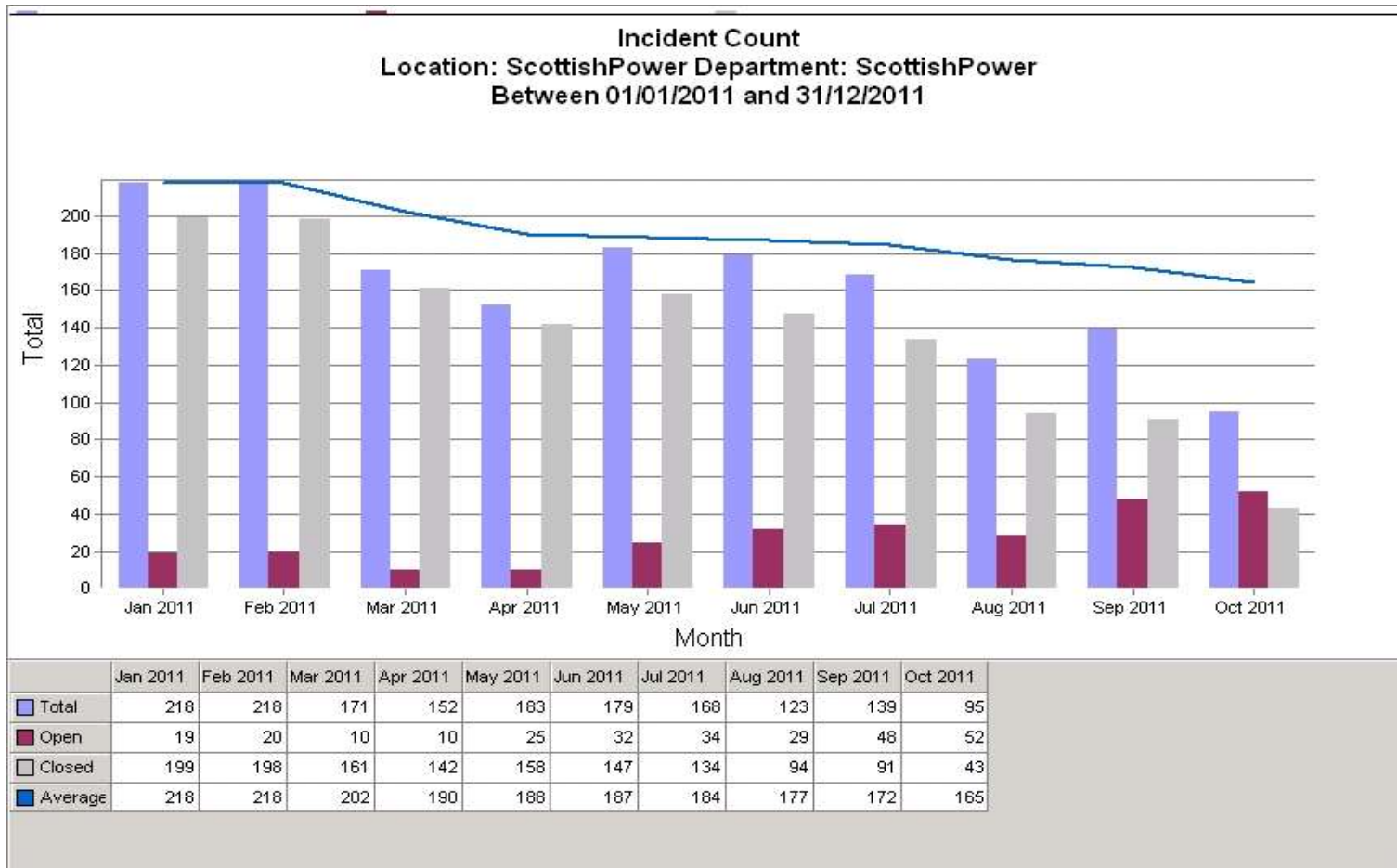
**Judith Hackitt CBE, Chair of HSE UK
June 2011**



- Relationship spans 15 years +
- Aim to help other companies fast track a similar approach
- Best of breed Industry and implementation knowledge
- Providing access to recognised Industry leading expertise
- Providing access to proven tools and delivery methodology
- Jointly developed range of tool kits and training material
- Integrating technologies to deliver a sustainable solution

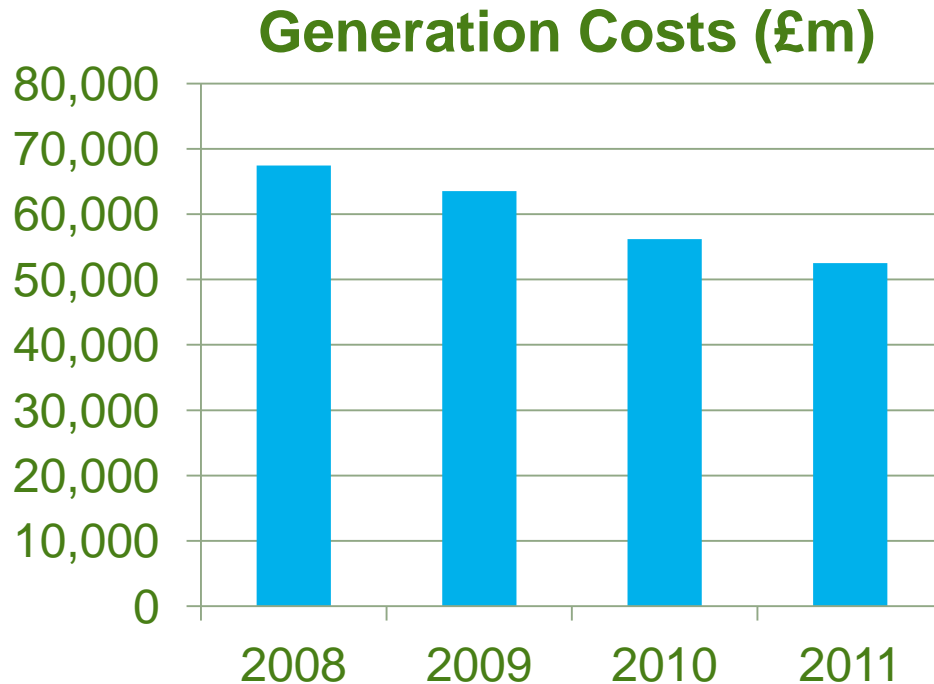


Incidents and severity now starting to fall...



Significant benefits have been realised to date.....

	2008	2009	2010	2011
Plant Availability	64.5%	77.0%	83.9%	86.9%
EFOR ¹	10.1%	7.5%	6.4%	5.5%



- 29% reduction in Operations and Maintenance costs
- 22% increase in plant availability
- 50% reduction in plant forced outage rates
- 10% Reduction in Insurance costs and deductible period



Generation Strategy

Driving light into the future

The electricity generation industry is facing significant challenges...

A “High Reliability Organisation” is one that produces its product relatively error free over a long and sustained period of time.

The two main attributes of a High Reliability Organisation are:

Have a chronic sense of unease – they lack any sense of complacency.

Make strong responses to weak signals - they set their threshold for intervening very low.

“High Reliability Organisation”



Global Operational Integrity Plan



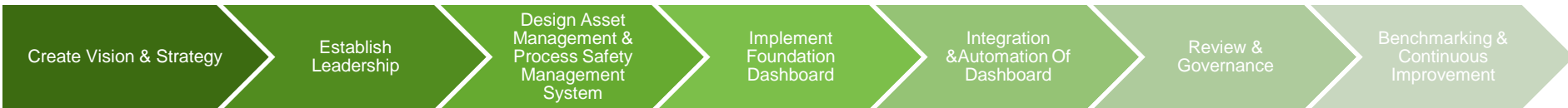
Delivering Common Processes and Practices across the Iberdrola Group



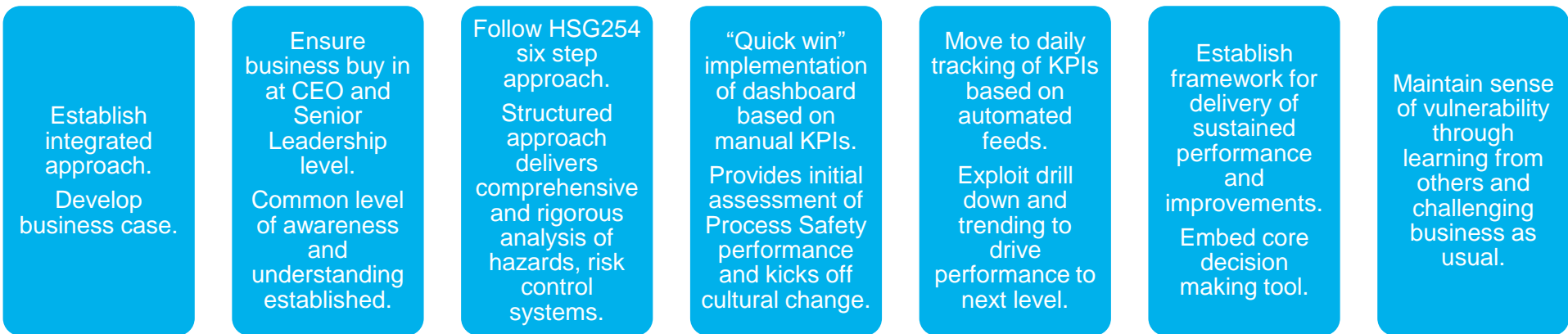
Our 7 Step Approach (High Reliability Organisation)



Asset Management & Process Safety Integrated RoadMap



Pathway To A “High Reliability Organisation”



Building a strong capability in Asset and Process Safety Management...

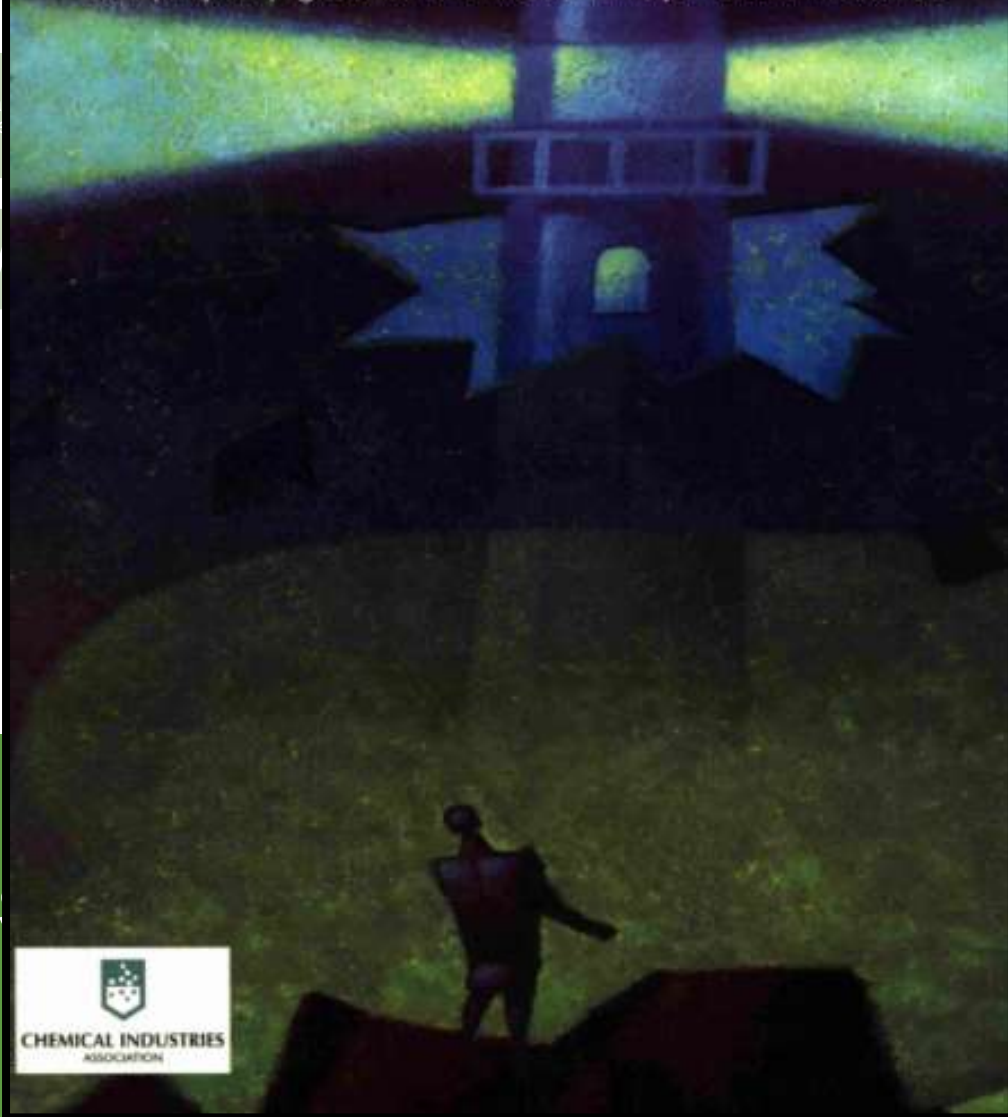




Health and Safety
Executive

Developing process safety indicators

A step-by-step guide for chemical and major hazard industries



Set Vision & Strategy

Estab
Lead

Review &
Governance

Benchmarking &
Continuous
Improvement

Pathway

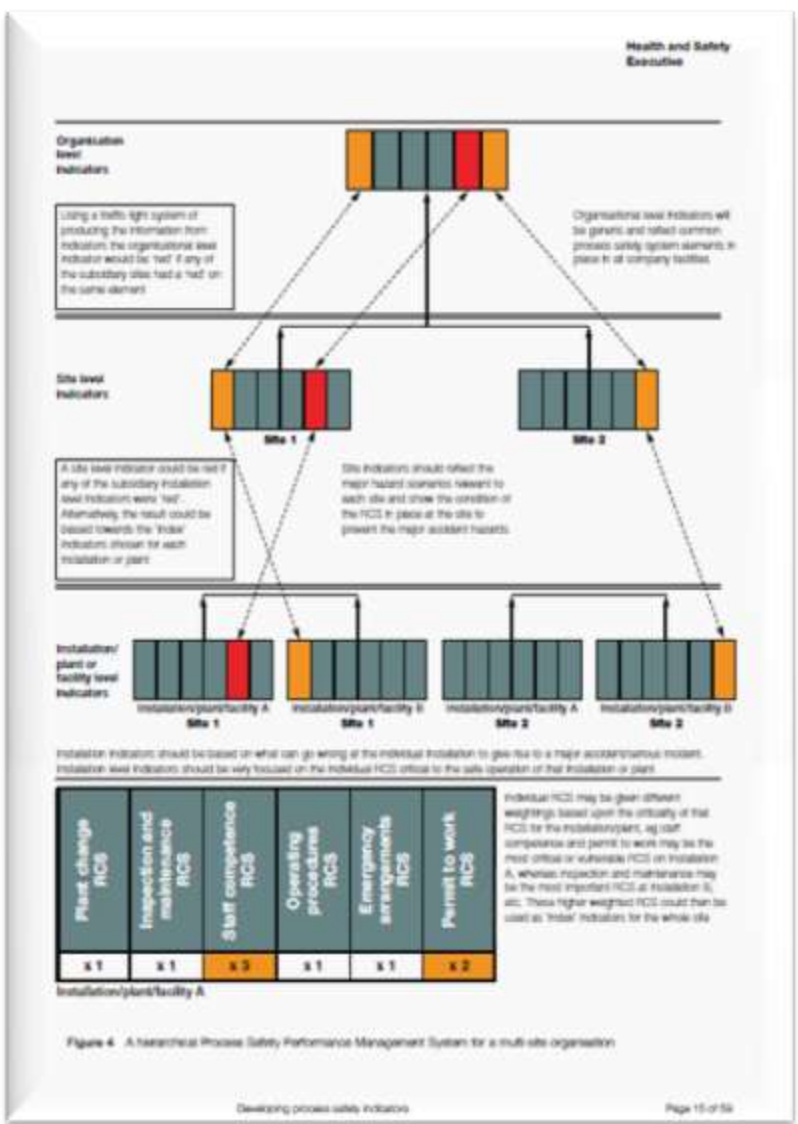
“sation”

Design Process

System

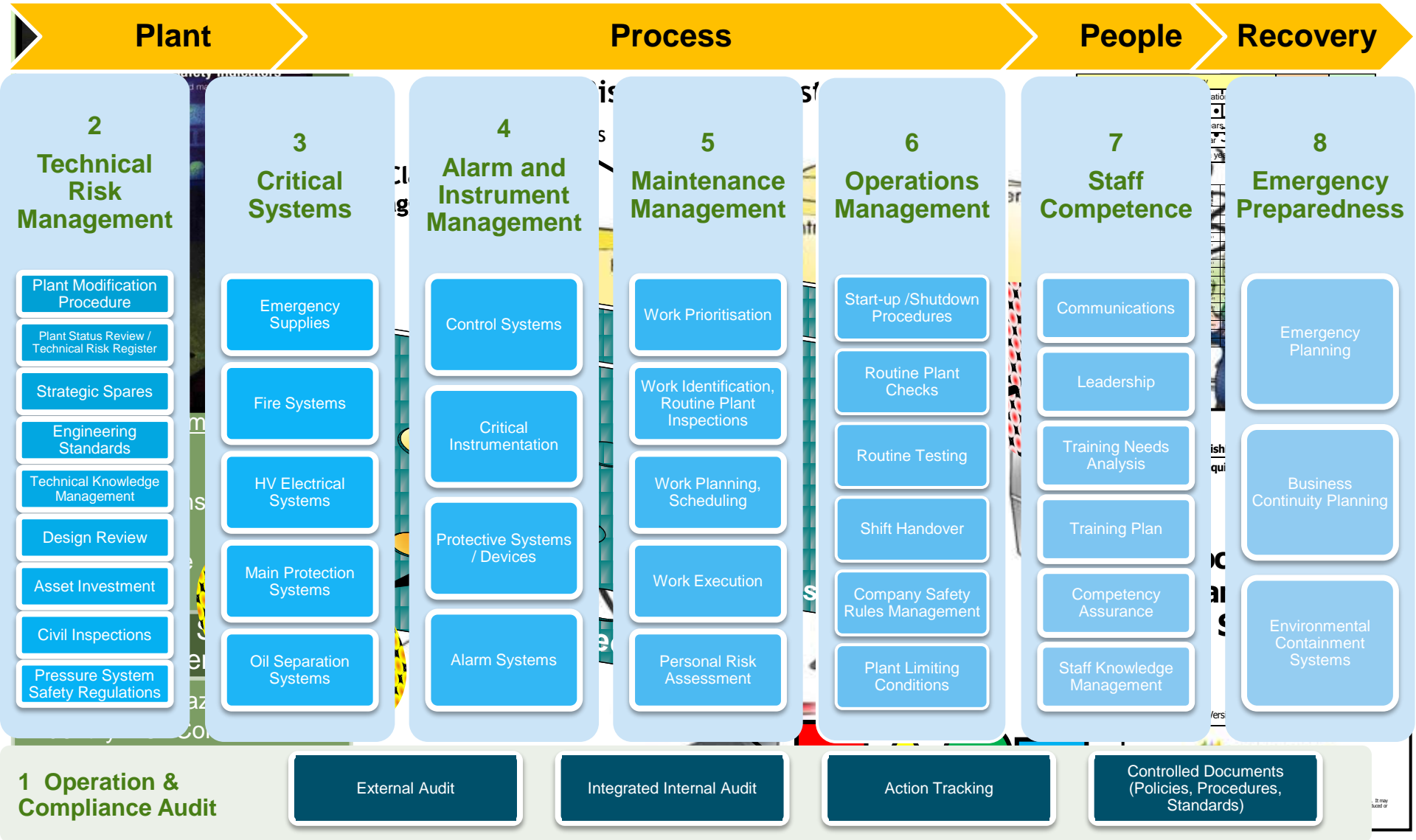
Development of KPI Dashboard

Based on Key Concepts in HSG 254...



Swiss Cheese Model

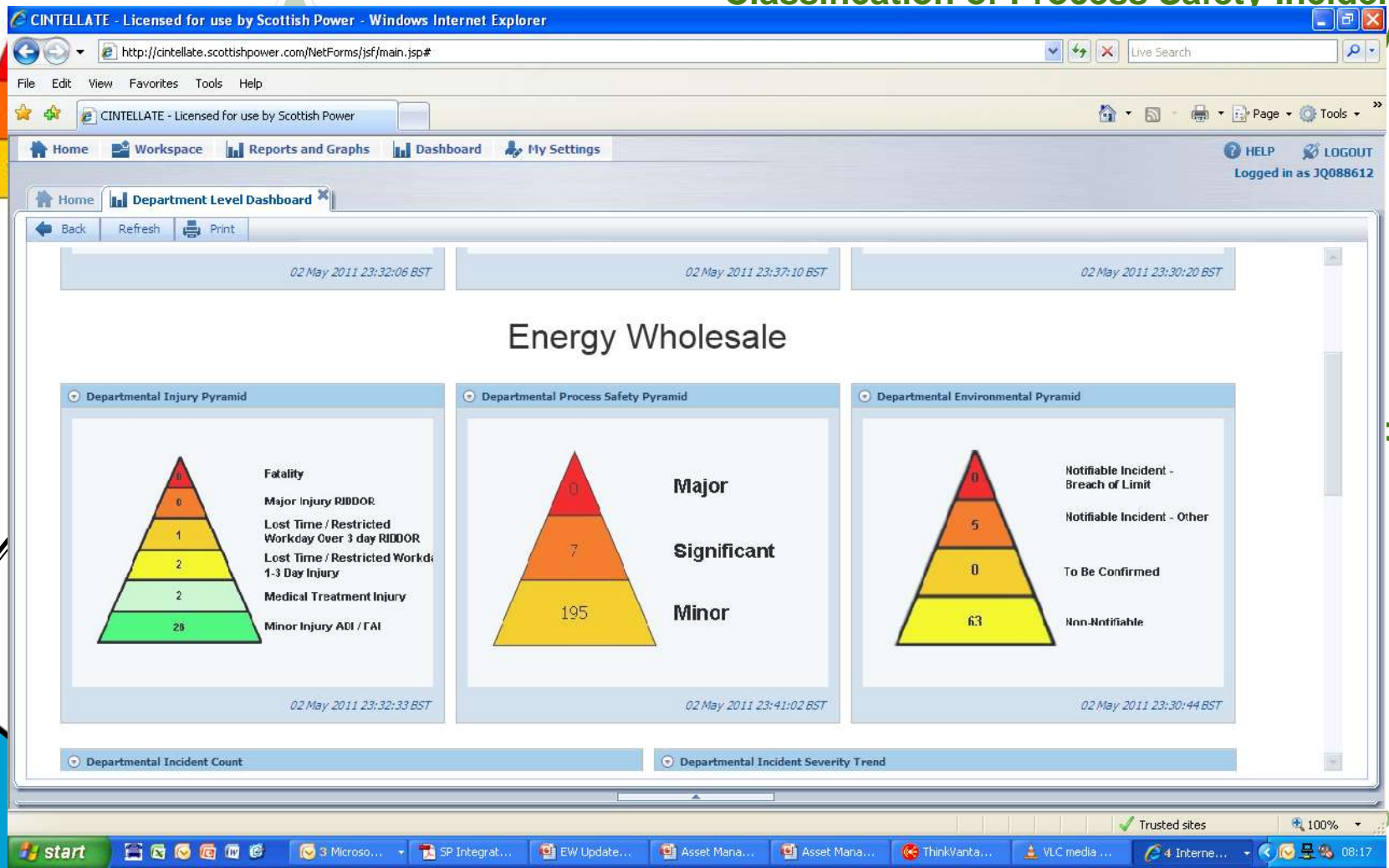
Understanding hazards & creating barriers (People, Process & Plant)...



Classification Of Incidents

3 tier approach based on API guidance...

Classification of Process Safety Incidents



API

00k

- Breaches of plant limiting conditions

SCOTTISHPOWER Energy Wholesale

Process Safety Management System

KPI Details

Name	Preventative Maintenance Compliance
KPI Type	Loading
Specified By	Sean Macdonald
Owned By	Maintenance

Objective

The objective of this KPI is to ensure the timely compliance to the sign order priority model for all Preventative maintenance work orders.

Effective management of this measure will ensure that all preventative s are being planned to recognise their importance as defined within the v

Definition

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KPI Data Recording

How to Complete and Close 'Preventative' Work Order

The 'One Way' Prioritisation Model within Maximo, is based on the 'Asset/Location Criticality' - 'WO Priority'. This is a combination of the work's 'Preventative Target Completion' and 'Asset/Location Criticality'.

Asset/Location Criticality	Description
9	Critical safety protection device
8	Critical environment system
7	Critical to safety alarm system
6	Critical to non-unit safety
5	Critical to plant safety
4	Critical to efficiency
3	Stand-by unit or critical to standby use of non-critical non-unitary equipment
2	
1	

WO Priority	Description
9	Immediate threat to safety of people
8	Immediate threat to environment
7	Immediate threat to safety of plants
6	Immediate threat to safety of availability / controllable losses targets
5	Working ability to meet efficiency / controllable losses targets
4	Hazardous situation, people, equipment or plant not intended
3	Will affect operations after three
2	Reduction of plant integrity
1	General improvement / maintainability goals

Calculated Priority	Target Completion
9-5	2 days
4-7	1 week
1-3	1 month

Work Orders should have the 'Status' set to 'Completed' ('COMP') within the 'Completion' times, from the 'Target Start'. Once Completed, it is important that the 'Status' is set to 'Closed' ('CLOSE'), once all assets have been entered and verified.

The Work Order will also need the requirements for the KPI.

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KPI Functional Definition

Risk Control Area	Maintenance Management
Risk Control System	Work Identification - Routine Plant Inspections / Reliability Engineering
Data Capture Frequency	Daily Snapshot
Data Capture Method	Automated

Data Source

Default Granularity	Monthly
Calculated or Provided	Calculated

This data for this measure will be provided automatically via an interface to Maximo. The Maximo interface will run at the given capture frequency and extract a snapshot of relevant work orders applicable to this KPI (and other KPIs related to Maximo data).

From the snapshot, the KPI engine calculates the following:

- (a) 'Preventative' Cards that have been Completed or Closed (in last Month) ('COMP' or 'CLOSE') within the timeframes defined in the Scotlandflow Prioritisation Model, based on the 'Target Start'.
- (b) Cards that have been Completed or Closed (in last Month) ('COMP' or 'CLOSE').

The KPI is calculated as (A) / (B) expressed as a percentage.

Note: The definition of 'Preventative' activities is that the 'Work Type' is not in one of the 'EXCLUDE' ('EXCL') categories: 'EVENT', 'CBM', 'ADDITIONAL Outage' activities ('OUT').

Note: Work Order Cards can be set to a Status of 'WOOUT - Awaiting Outage'. WOOUT cards are excluded from this KPI.

Data Aggregation Requirements

The data is captured as a daily response creating daily KPIs to be generated.

However, the default view is monthly. If viewing historical monthly values, the last calculated daily KPI value will be displayed for each month. If viewing within the current month, the most recent, calculated daily KPI value will be displayed.

(Note: by the person who specified the KPI).

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Target Completion

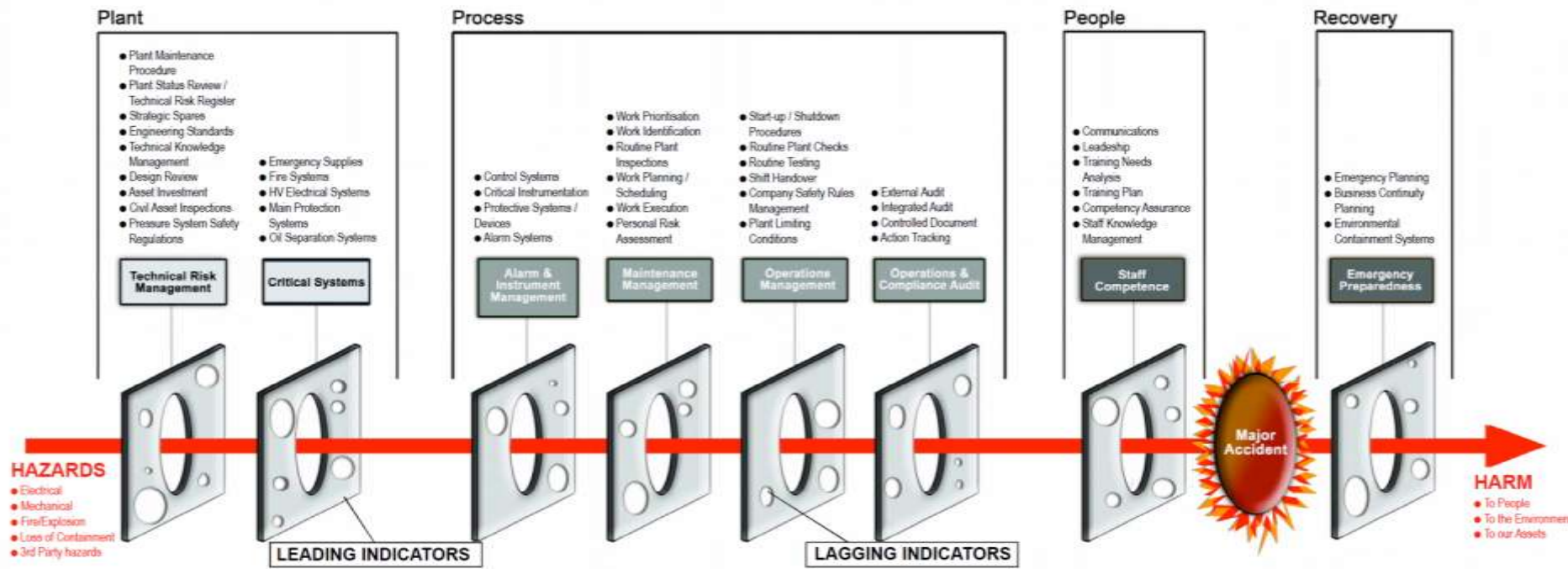
The 'Target Completion' status from the 'Reported Date' or 'Target Start', the KPI.

Finally a Work Order can be set to a Status of 'WOOUT - Awaiting Outage', to exclude it from the KPI.

- **Fully defined KPI, including:**
 - Objective
 - Definition
 - Data Source
 - Data Aggregation / Calculation
 - Targets
- **Data Recording Guidelines**
- **Formal sign off by senior managers**

Process Safety Dashboard

Philosophy is to visualise Swiss Cheese Model.....



Operational Control Indicators



- #### Lagging Indicators
- Active Monitoring and Logging:
 - Breaches Of Plant Limiting Conditions (eg overpressure, overspeed, overtemp)
 - Control Loops Out Of Control
 - Equipment In Manual
 - Operation of protection systems
 - Failure of protection systems

- #### Leading Indicators
- Inspection and Maintenance of Control Systems and Critical Systems
 - Alarm Management
 - Control Loop Performance
 - Completion Of Operational Routine Checks / Testing
 - Shift Logging & Handover
 - Plant Overrides and Defeat of interlock
 - Safety Critical Systems not available

Generic

- #### Lagging Indicators
- Incident Reporting and Investigation:
 - Near Misses (eg demand on safety system)
 - Loss Of Containment (eg release of high pressure steam)
 - Process Safety Incident (eg major equipment damage)

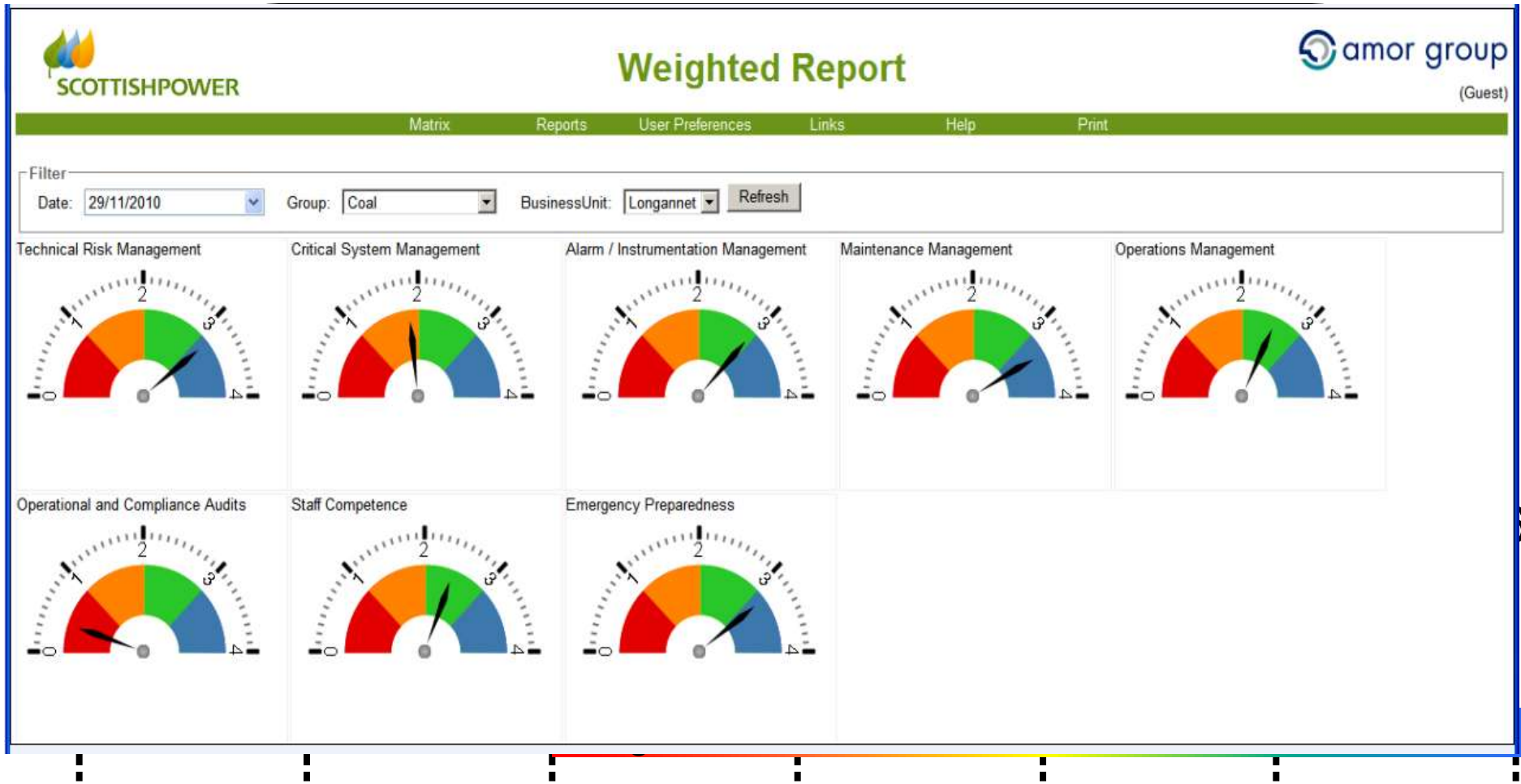
- #### Leading Indicators
- Critical processes undertaken correctly
 - Operations
 - Maintenance
 - Engineering

Programme Indicators

- #### Leading Indicators
- Statutory Inspections Completed (eg PSSR)
 - Audits To Programme
 - Action Closure
 - Training and Competence
 - Procedures Up To Date
 - Improvement programmes

KPI Ranking

Operational Indicators are the key to avoiding incidents...



Major Hazard Accidents

Indicators Need To Be Visible to prevent accidents....

Deepwater Horizon USA
11 lives lost with significant environmental and financial loss due procedure failure.

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Fire Systems Not Available

Start Up Procedures Not Followed

Sayano-Shushenskaya Russia
75 lives were lost after poor maintenance and high vibration levels were accepted.

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Protection System Override

Emergency Response Plan Not Tested

BP TEXAS CITY USA
15 lives were lost after failure to check and test key instrumentation and controls.

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Plant Checks Ignored

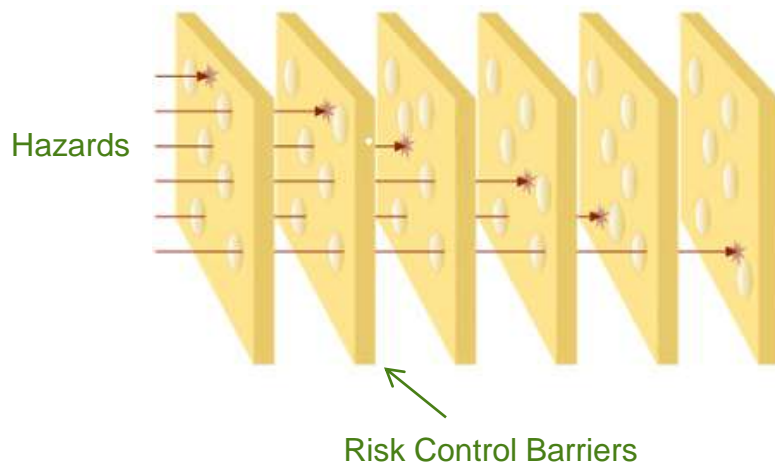
Safety Critical System Not Available

DANGER Control Loops on Manual

Shift Handover Not Complete

Making the warning signs visible to ALL Instantly !

Swiss Cheese Model



Start Up Procedures Not Followed

Safety Critical System Not Available

Shift Handover Not Complete

Protection System Override

Plant Limits Exceeded

Plant Checks Ignored

Competence Plans Incomplete

Fire Systems Not Available

Change Ahead

Management of Change Not Followed

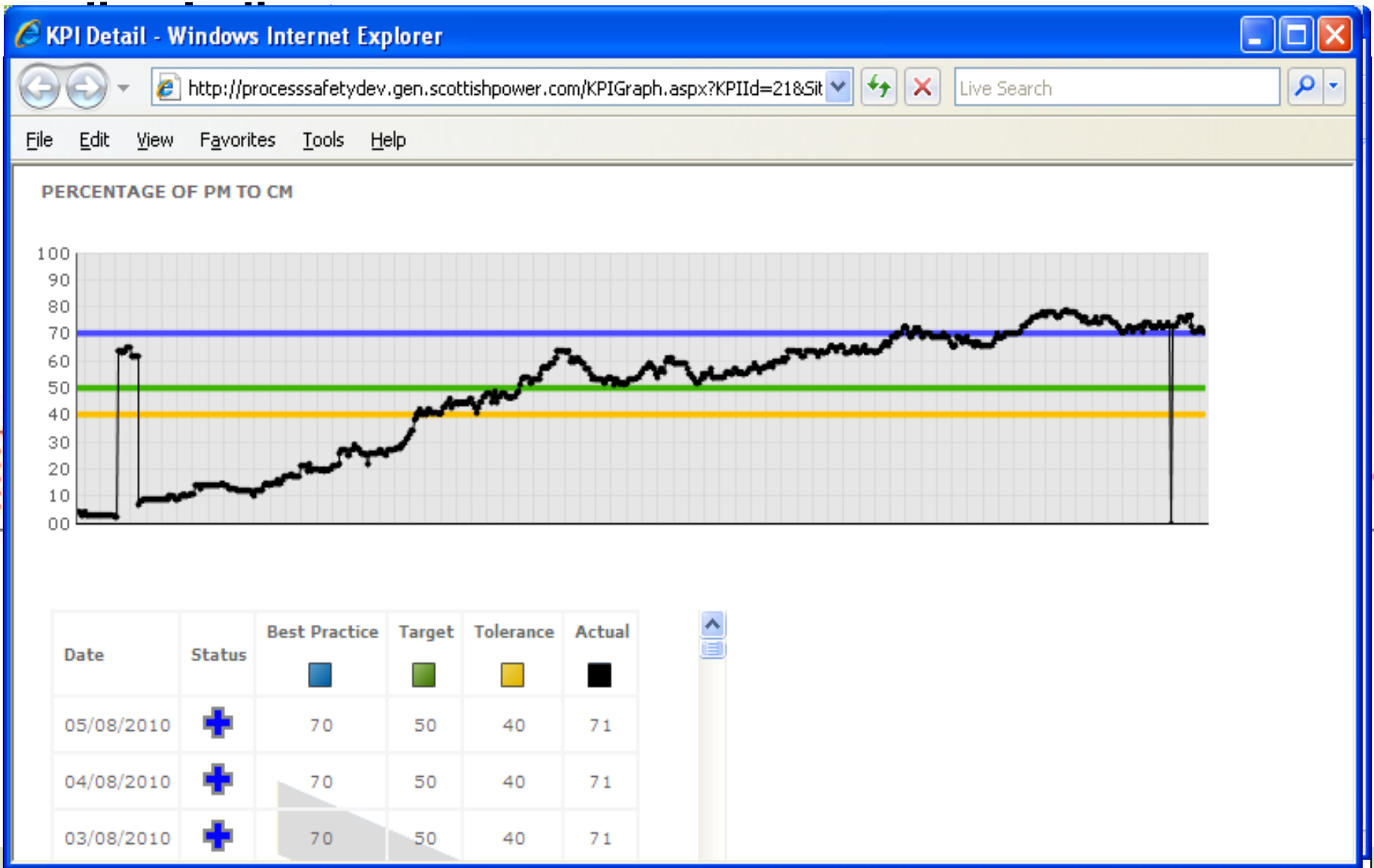
Process Safety KPIs

Process Safety

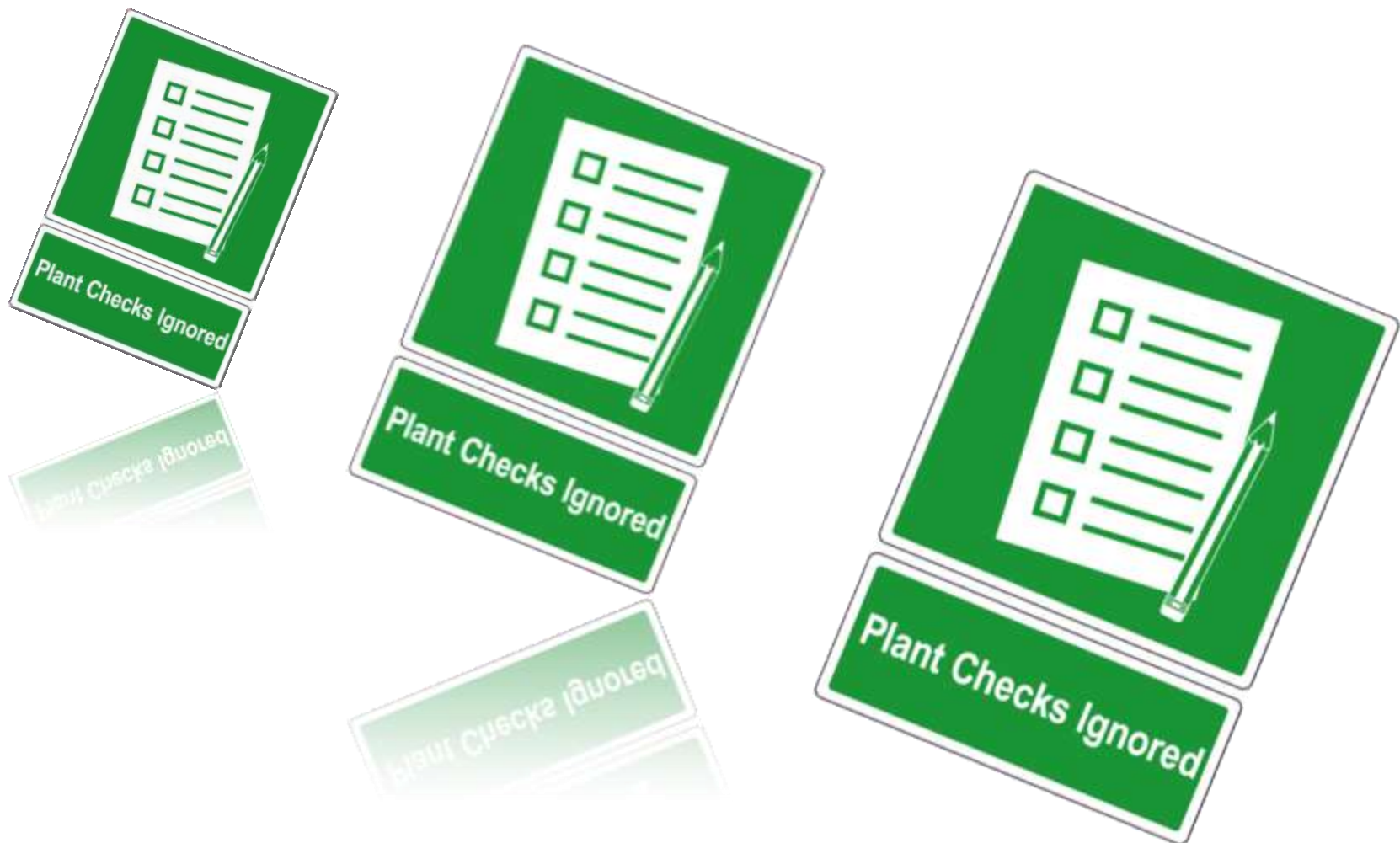
This block contains a row of nine safety warning signs. Each sign is a square or triangle with a specific icon and a text label below it. The signs are: 1. A yellow triangle with a black border and a black silhouette of a person running, labeled 'Start Up Procedures Not Followed'. 2. A red square with a white icon of a thermometer and a gear, labeled 'Safety Critical System Not Available'. 3. A green square with a white icon of a person running, labeled 'Shift Handover Not Complete'. 4. A blue circle with a white icon of a padlock, labeled 'Protection System Override'. 5. A red circle with a white icon of a factory and a red prohibition sign, labeled 'Plant Limits Exceeded'. 6. A green square with a white icon of a checklist, labeled 'Plant Checks Ignored'. 7. A yellow triangle with a black border and a black silhouette of a person, labeled 'Competence Plans Incomplete'. 8. A red square with a white icon of a fire extinguisher and a flame, labeled 'Fire Systems Not Available'. 9. A yellow triangle with a black border and a black silhouette of a person, labeled 'Change Ahead'. Below the signs, the text 'Process Safety KPIs' and 'Process Safety' is visible.

KPIs Based On 4 Icons

A simple concept that all staff can buy in to...



Key Operational Indicators...



Visibility Of All Routine Operations Plant Checks...



- EXP Handheld Plant Check Comp (2321 of 2325)
- OMS Handheld Plant Check Comp (48 of 55)
- Routine Plant Check Compliance (43)
- Plant Trip Rates (0 of 0)



Leading Trend - Windows Internet Explorer
http://inet.berdrola.es:106/npDashboard/LeadingTrend.asp?pid=505&businessUnitId=3

Leading Trend

SCOTTISHPOWER Energy Wholesale

amor group
Martin Sedgwick (Group Manager)

Back to KPI Details

Rye House, EXP Handheld

Month	Status	Pr...
Nov 2011	●	10
Oct 2011	●	10
Sep 2011	●	10
Aug 2011	▲	10

Best Practice	Target	Tolerance	Actual
100	95	5	99
100	95	5	99
100	95	5	99
100	95	5	99

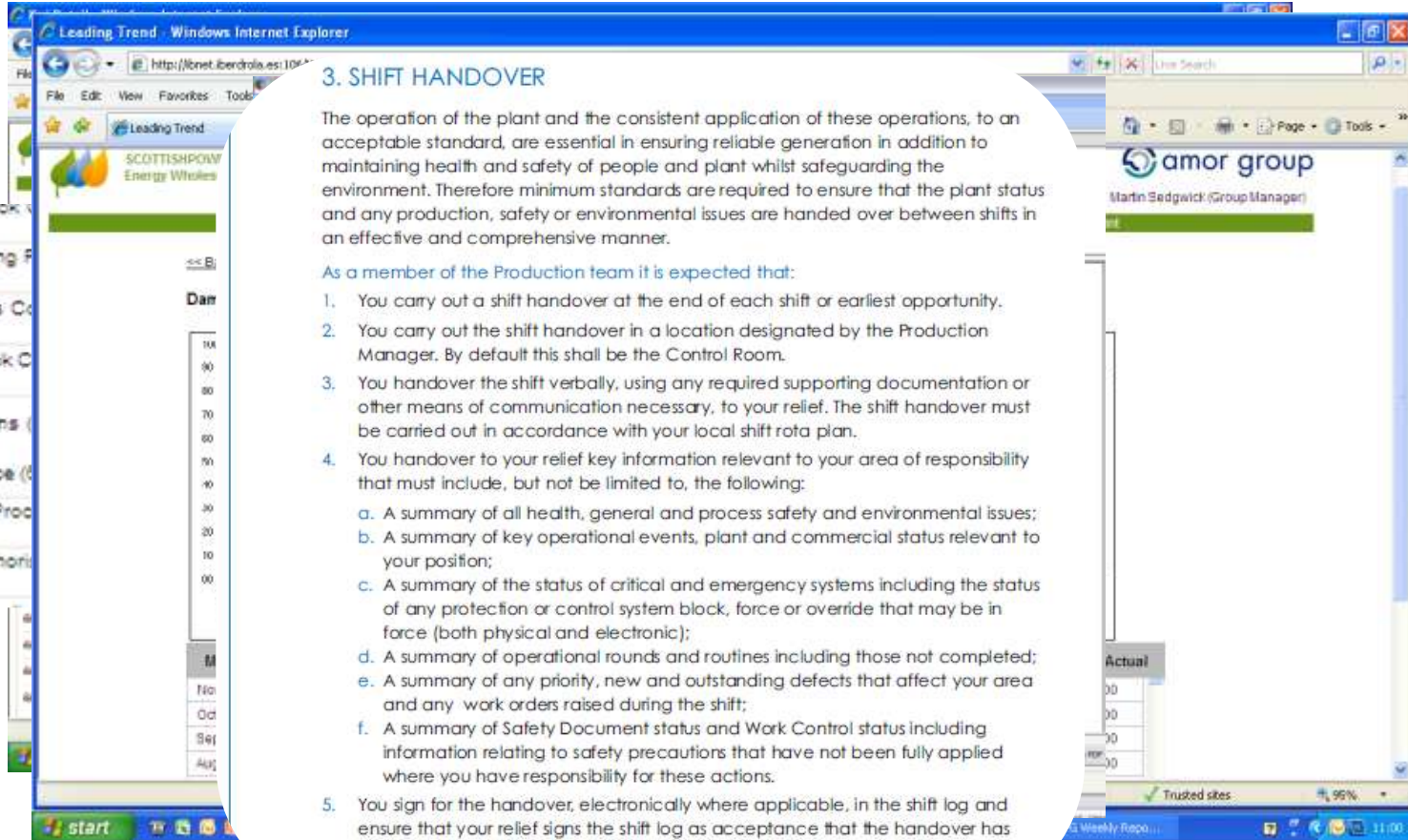


Key Communication Tool...





- OWC Handheld Plant Check (118 of 130)
- Routine Operational Testing Compliance (193 of 193)
- Safety Rule Audit Process Co of 1)
- EXP Handheld Plant Check (10044 of 10044)
- Expiring SAP Authorisations (
- Shift Handover Compliance (
- Start Up and Shut Down Proc Compliance (2 of 2)
- ies Author



3. SHIFT HANDOVER

The operation of the plant and the consistent application of these operations, to an acceptable standard, are essential in ensuring reliable generation in addition to maintaining health and safety of people and plant whilst safeguarding the environment. Therefore minimum standards are required to ensure that the plant status and any production, safety or environmental issues are handed over between shifts in an effective and comprehensive manner.

As a member of the Production team it is expected that:

1. You carry out a shift handover at the end of each shift or earliest opportunity.
2. You carry out the shift handover in a location designated by the Production Manager. By default this shall be the Control Room.
3. You handover the shift verbally, using any required supporting documentation or other means of communication necessary, to your relief. The shift handover must be carried out in accordance with your local shift rota plan.
4. You handover to your relief key information relevant to your area of responsibility that must include, but not be limited to, the following:
 - a. A summary of all health, general and process safety and environmental issues;
 - b. A summary of key operational events, plant and commercial status relevant to your position;
 - c. A summary of the status of critical and emergency systems including the status of any protection or control system block, force or override that may be in force (both physical and electronic);
 - d. A summary of operational rounds and routines including those not completed;
 - e. A summary of any priority, new and outstanding defects that affect your area and any work orders raised during the shift;
 - f. A summary of Safety Document status and Work Control status including information relating to safety precautions that have not been fully applied where you have responsibility for these actions.
5. You sign for the handover, electronically where applicable, in the shift log and ensure that your relief signs the shift log as acceptance that the handover has been completed and the shift transferred to him. NB: This may be via telephone for remote sites.

Set Vision & Strategy

Establish
Leadership

Design Asset
Management &
Process Safety
Management
System

Implement
Foundation
Dashboard

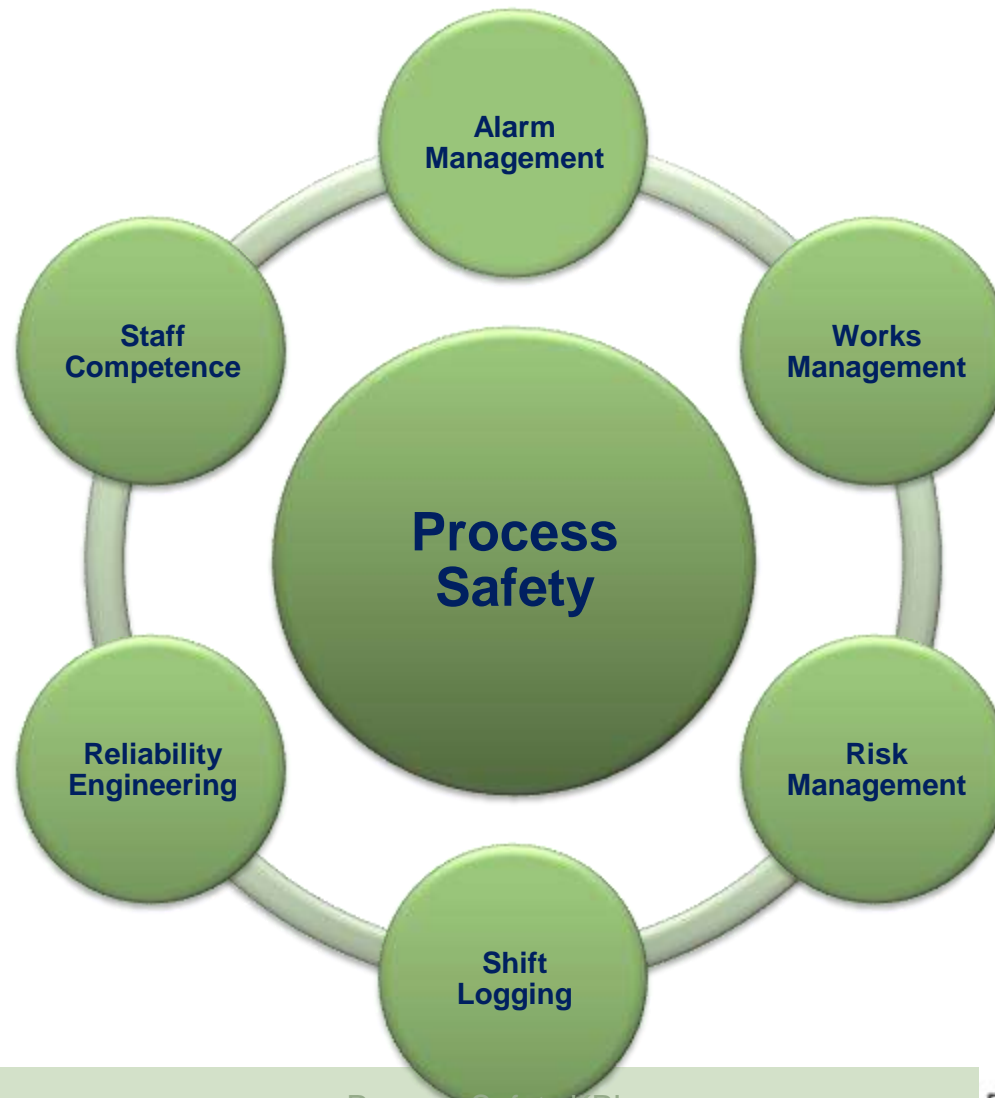
Integration
&Automation Of
Dashboard

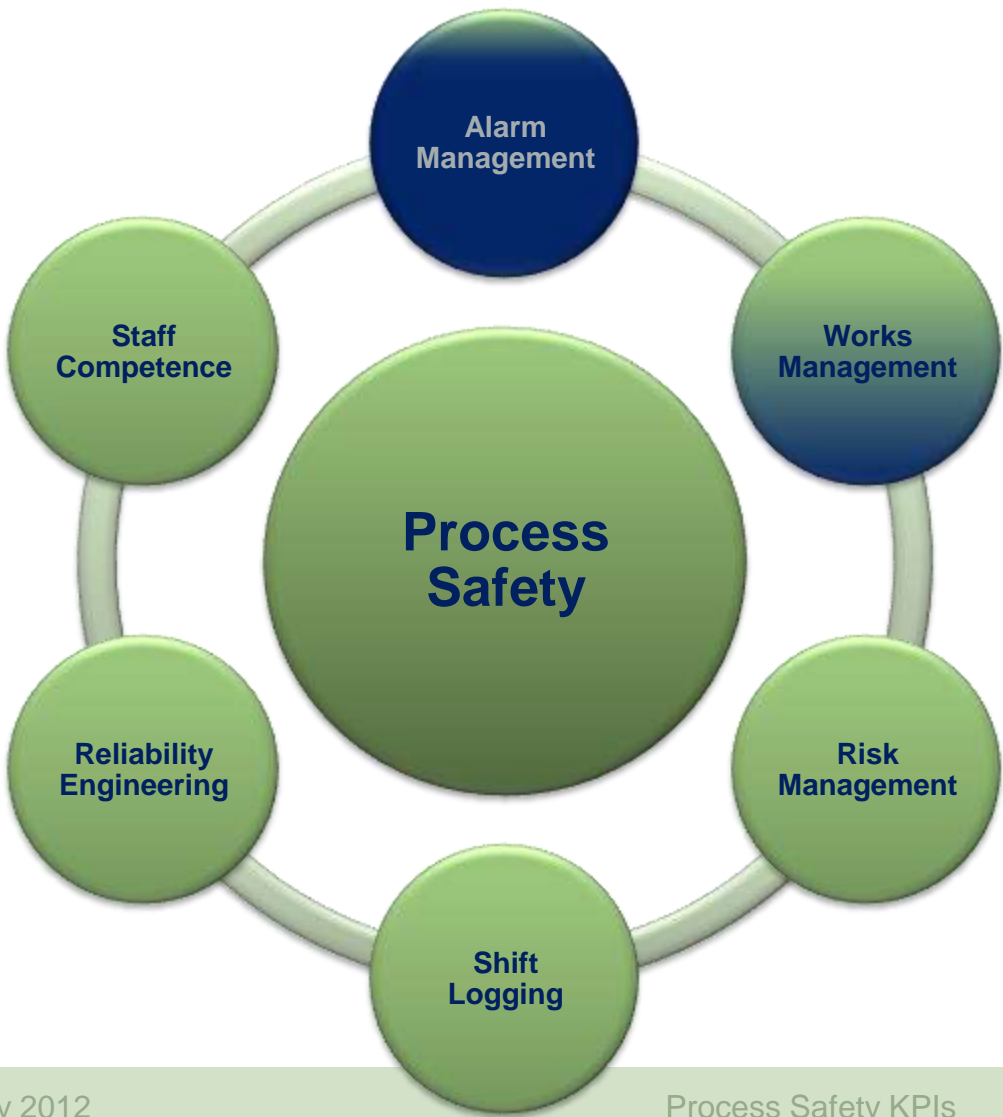
Review &
Governance

Benchmarking &
Continuous
Improvement

Pathway To A “High Reliability Organisation”


Integration & Automation Of Dashboard





Alarm Management

- Proving real-time trend analysis of all alarms throughout the organisation
- Improvement plans developed for all sites



Works Management

- Single solution and set of processes defined and implemented across the asset estate
- Scheduling capabilities used outside core works management




Risk Management

- Single, fully integrated risk management, incident management, action tracking, audit tool



Shift Logging

- All Control Rooms and Unit Desks using standard electronic logging system
- Automatic feeds developed from plant information (OSI PI)



Reliability Engineering

- All sites using hand held technology for Operator Routes
- Automatic monitoring through single system



Staff Competence

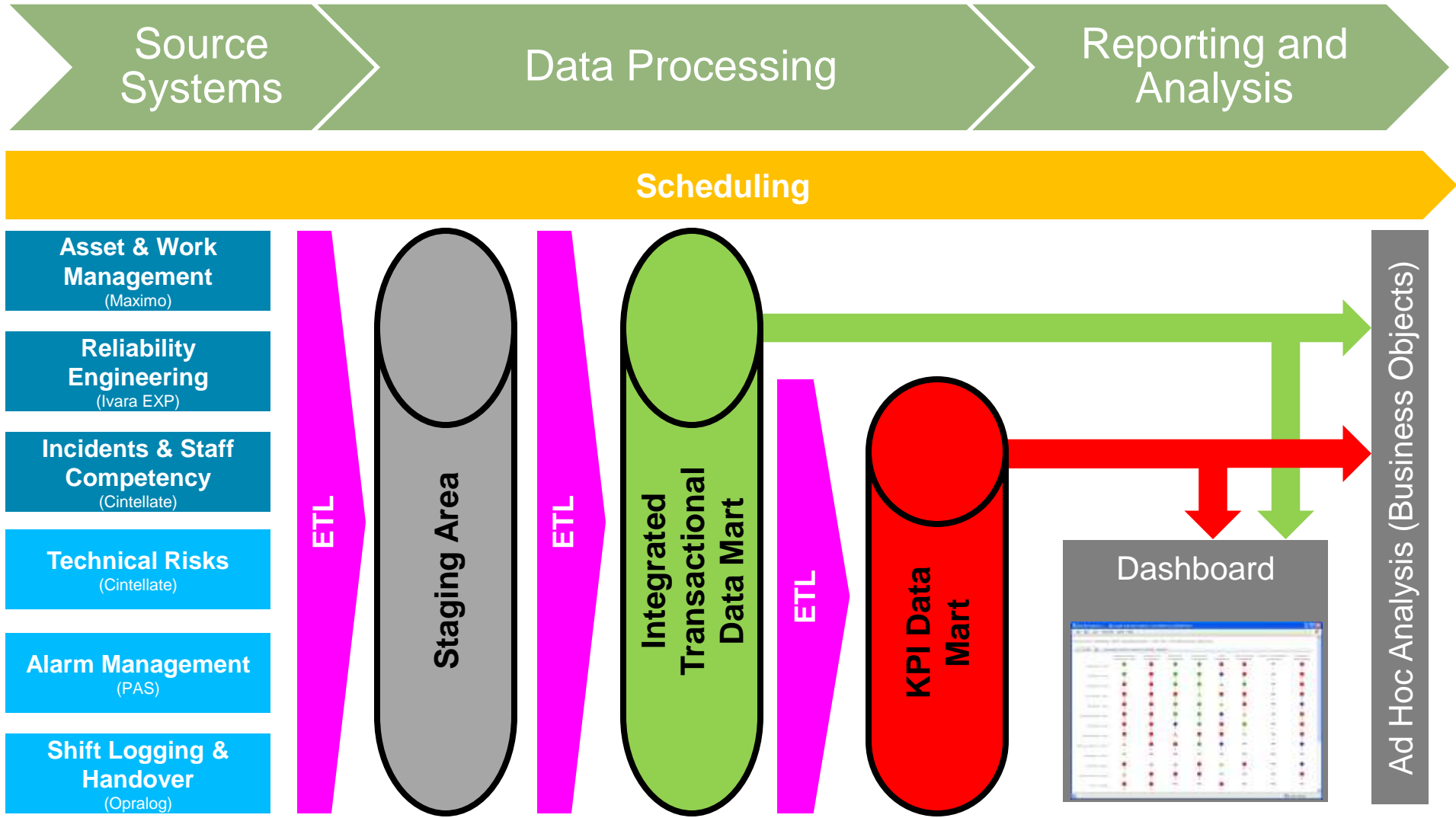
- Operations standards introduced
- Start up and shutdown / shift handover competencies in place and monitored

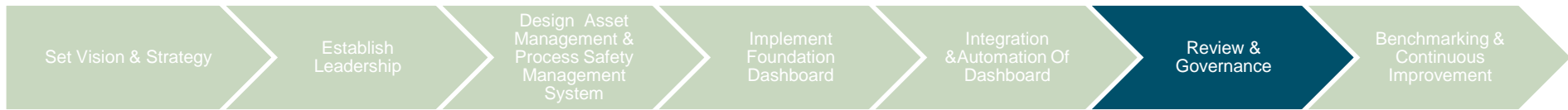




KPI Dashboard Architecture

An enterprise scale solution...





Pathway To A “High Reliability Organisation”

Review & Governance

Group Governance Process

Cascade up approach...

Review Level	Governance Body			Review Guidance	Frequency
Energy Wholesale	Energy Wholesale Board			Consolidated Indicators Major or Key Incidents	Monthly
Generation	<u>Operational Risk Group (ORG)</u>			Business Wide Indicators Significant Incidents Trends	Monthly
Generation Groups	Coal PRM	Gas PRM	Hydro PRM	Group Indicators Significant & Moderate Incidents Close-out rates	Monthly
Power Stations	LN, CK, DD	RH, DC, SH, BB, HT	CN, GW, LK	Local Indicators All Incidents	Daily

Process Safety Dashboard



Monthly Reports – support Operational Risk Governance meetings...

The dashboard displays various metrics and reports for process safety. Key elements include:

- Monthly Report (December 2011):** Shows overall performance with donut charts for 'Current Month' and 'Change M1/M2'. Metrics include 'Lagging Status' (26/31), 'Current Month' (21/22), and 'Change Current Month / M1' (No Change).
- Assess/Control Table:**

Assess/Control	0	No Change	0	No Change	0	No Change	0	No Change
% of Blue & Green	87.37%	-0.77 ↓	88.14%	0.76 ↑	87.38%	1.61 ↓	85.77%	
TOTM	792	22 ↑	768	14 ↑	745	No Change	-148	
- Comments:**
 - Lagging indicators:** A total of 11 process safety incidents were reported in the month. 2 Major, 6 Significant and 28 Minor.
 - Operational & Compliance Audit:** A number of energy related audit actions are overdue and these are currently being addressed.
 - Technical Risk Management:** There is a generally improving picture in relation to the PSM KPIs since the changes were made following approval at the impact 300. There is no overall an issue with the Governing High Risk Items. 4% (20 items) remain above any open high risk items as the mitigating actions assigned to them cannot mitigate them to a low level. Subsequent to this has been held between Grand Engineering and the area to review the position.
 - Operations Management:** All processes are green for the first time since introduction of the RR dashboard.
 - Maintenance Management:** The Maintenance Management KPIs are all at target or better across all sites. There are 107 KPIs have been added which are associated with open Work Order Cards. These are all red as well as all sites but an action plan has been developed to improve the position.
 - Start Commission:** No live for start operations and maintenance completion has not been completed to date due 231 assemblies have been carried out. All start Engineering completion is now under way.
 - Other System Management:** steady progress is still being across Longmear and Cochrane within Critical Systems. Carloway steady on top of their critical system cards. The change is getting the remaining processes affected enough so that the preventative work is anticipated in enough time to be changed and executed within the open start schedule of the card.
 - Management Management:** Alarm and Control Loop Management KPIs are now on the 1 year KPI Dashboard and action plans have been produced for all sites.
 - Emergency Procedures:** New Emergency Management systems have now been implemented across all sites.
- Summary for Goal:**

Series	Current Month	Change Current Month / M1	Month -1	Change M1 / M0	Month -2	Change M2 / M1	Month -3
▲	0	No Change	0	No Change	0	No Change	0
▲	5	5 ↑	0	No Change	0	No Change	0
●	11	11 ↑	0	No Change	0	No Change	0
Total	16	16 ↑	0	No Change	0	No Change	0
- Summary for Hydro:**

Series	Current Month	Change Current Month / M1	Month -1	Change M1 / M0	Month -2	Change M2 / M1	Month -3
▲	0	No Change	0	No Change	0	No Change	0
▲	0	No Change	0	No Change	0	No Change	0
●	2	2 ↑	0	No Change	0	No Change	0
Total	2	2 ↑	0	No Change	0	No Change	0

Overview of standard agenda items...



- **Leading Indicators Performance (KPI Dashboard)**
- **Incident Reviews (Cintellate)**
- **Technical Risks**
- **Benchmarking**
- **Legislation Update**

Key learning points from ScottishPower's journey to date...

- For the first time, senior management is given near time visibility of core processes
- Introduction of Process Safety KPIs has driven improvement across the business
 - Maintenance improvements – backlog, preventative maintenance, planning
 - Technical Risk – visibility and mitigation
- Business benefits also now being realised – e.g. insurance, plant availability increasing, opex and capex reductions
- Key success factors
 - Buy in and commitment from senior management
 - Involvement of staff in designing, developing and embedding
 - Clear definition of each KPI is essential
 - Common processes across all business units
 - Delivery of sustainable solution can only be achieved using integrated IT platforms – ie automatic generation of KPIs



- Supports business drivers of improving plant availability, reliability and cost reduction
- Reduces the Frequency and Severity of system failures and their impacts.
- Save lives, time, careers, & money!



Question Time



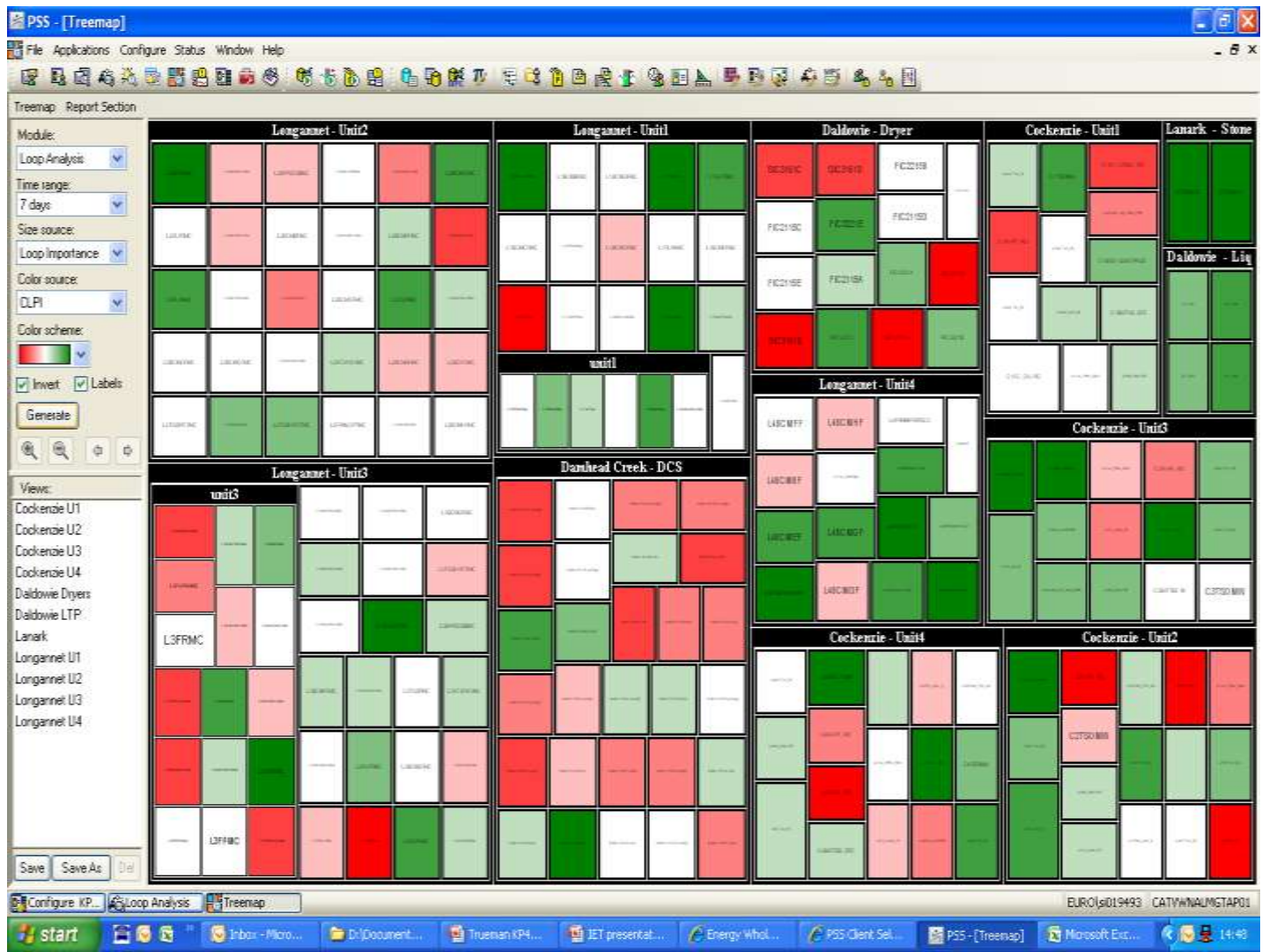
Control Loop Management

Visibility of Control System Performance...



DANGER
Control Loops on Manual

Control loops on Manual
DANGER





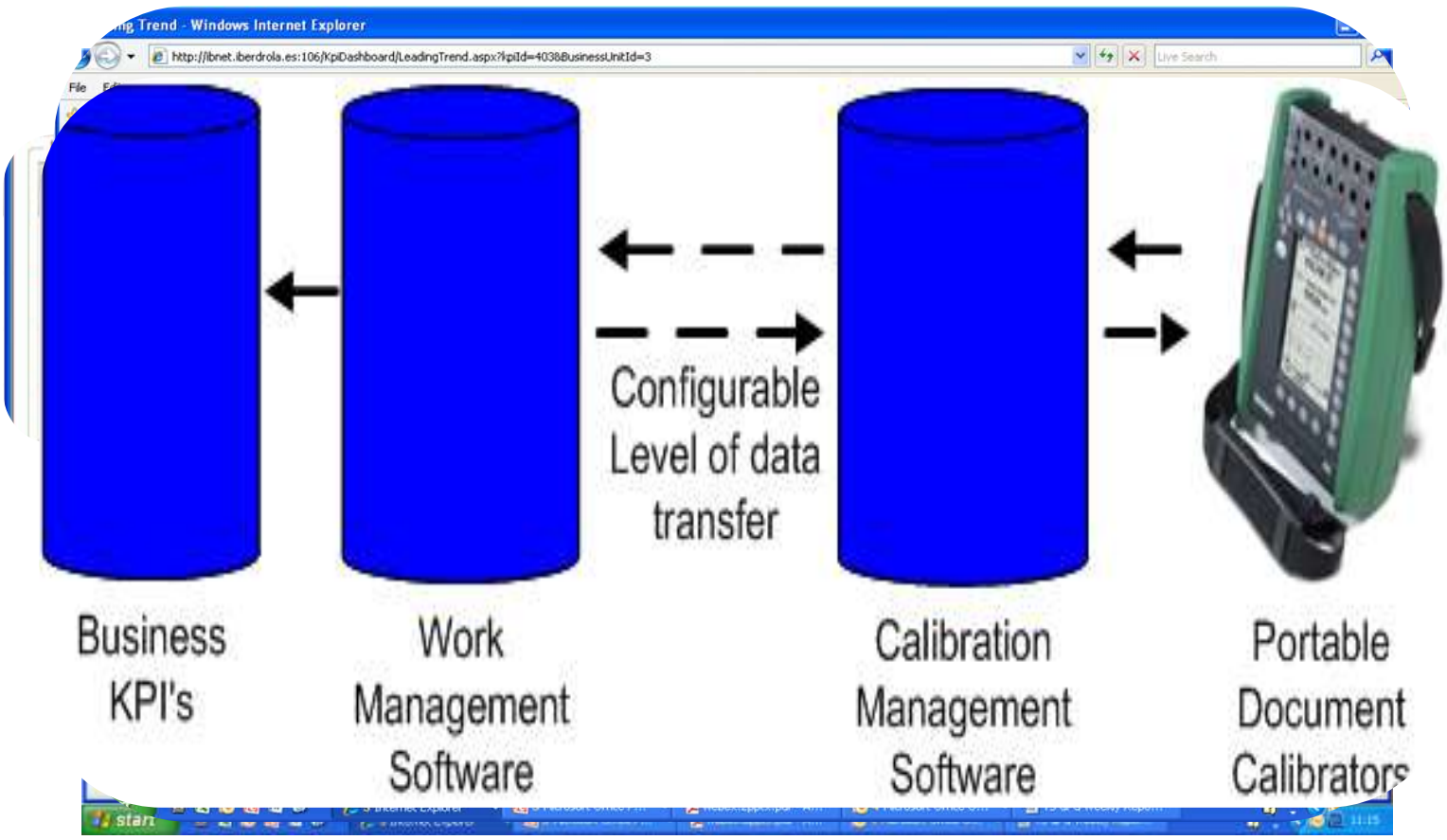
Safety Critical Systems

Standard Approach to Monitoring & Proof Testing...



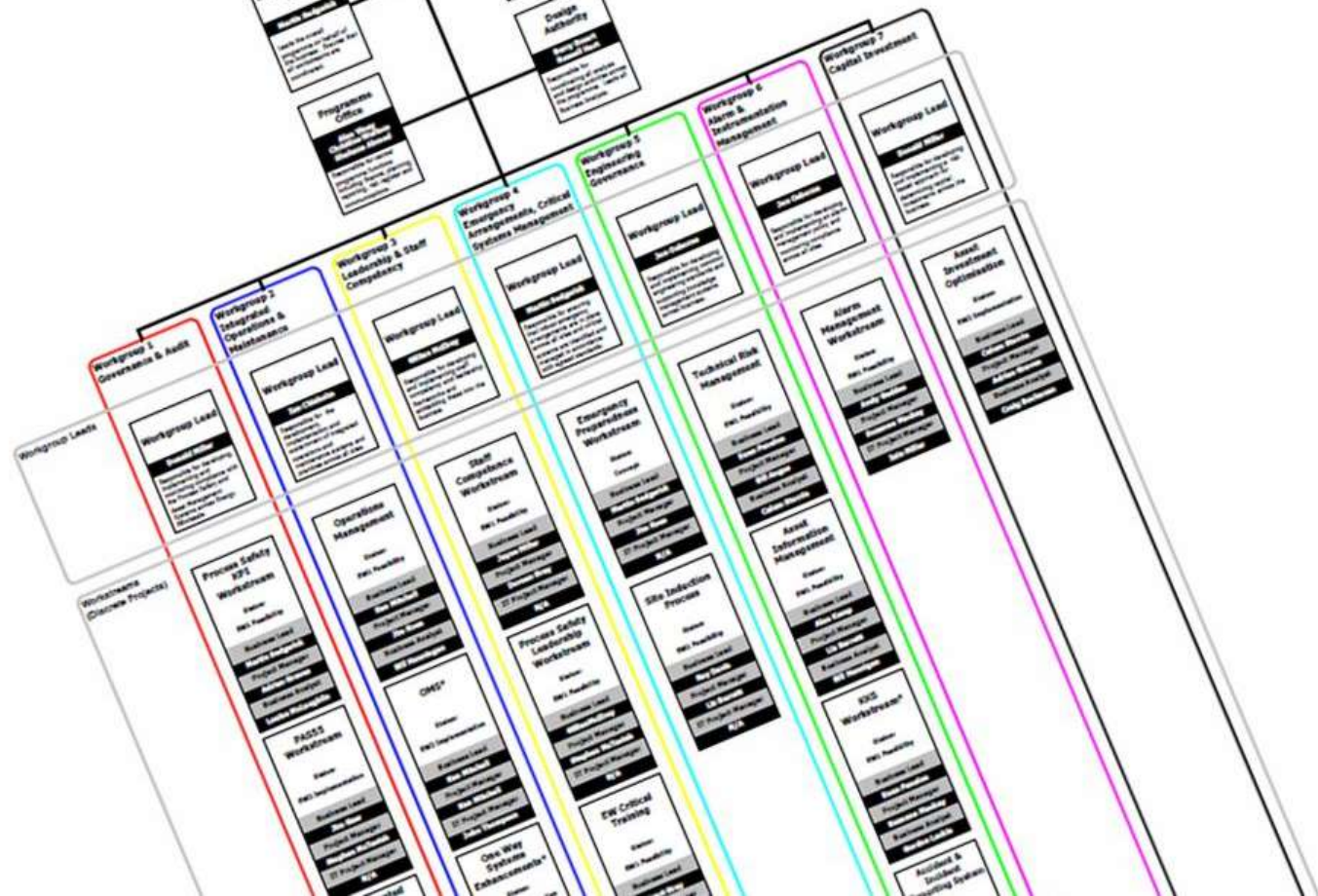
Safety Critical System
Not Available

Not Available
Safety Critical System





Process Safety Approach



Operational Transformation Programme

Centrally coordinated, business driven approach...