Case study: Scottish Power

Power generation company gets to grips with process safety

Energy company Scottish Power set out to learn from others about asset integrity, process safety management and key performance indicators. It looked to the chemical and major hazard industries for good practice. It has taken this learning and good practice and made dramatic improvements in its management of risk, delivering significant cost savings to the business.

The Institute of Chemical Engineers recognised this achievement by awarding Scottish Power first prize in the 2010 IChemE category of innovation in process safety.

SCOTTISHPOWER

amor group

Can the chemical and major hazard industries learn from Scottish Power?

Process safety is a priority for the Health and Safety Executive. It is not enough to simply have designed and implemented a process safety management system. Without collecting and acting on information that shows the system is actually working and delivering effective control of risk, you cannot be sure that your major hazards are being controlled and you will be operating blind, hoping and believing that everything is fine but without actually knowing. Reality has a habit of catching up on such companies – frequently with catastrophic consequences. No successful company could stay in business for long without accurate information on its financial performance – so why act differently when it comes to process safety?
Judith Hackitt, Chair, HSE

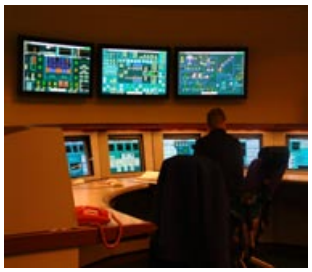
If you want to improve business reliability and profitability – read on.

Who is Scottish Power and what does it do?

Scottish Power Limited is a (vertically integrated) energy company with its headquarters in Glasgow, Scotland. In 2007 it became a subsidiary of the Spanish utility Iberdrola, one of the largest electricity utility companies in the world. It operates the distribution network for the central and southern Scotland and the Merseyside and North Wales regions. The company also supplies electricity and gas to homes and business around the United Kingdom and generates power for supply to the grid.

Energy Wholesale

Energy Wholesale is the part of the business that operates 6200 MW of electricity power in the United Kingdom using coal-fired thermal power stations, gas-fired combined cycle power stations, hydro-electric schemes, pumped storage generation as well as a range of small industrial combined heat and power systems. Energy Wholesale took the lead in developing the process safety approach which is now being adopted by the Transmission and Distribution businesses.

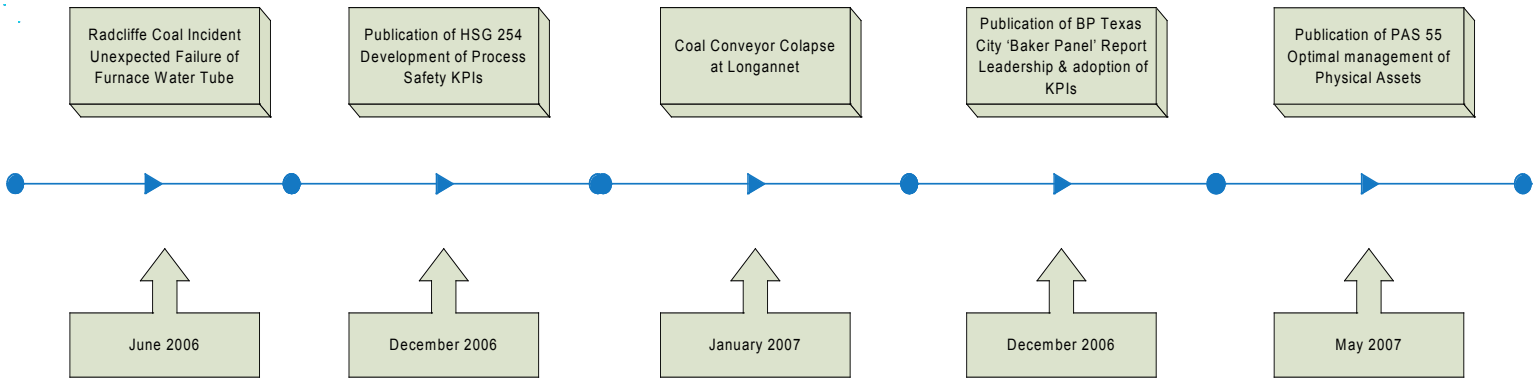


Why did Scottish Power look into process safety?

Generating electricity to feed the national grid and match consumer demand requires high levels of plant reliability. Unplanned plant outages and failing to meet generating contractual obligations have an immediate and detrimental impact on business. The need to stay 'online' is crucial.

Longannet is a 40-year-old coal-powered generating station with 2.3 Megawatt output. Bringing each of the four water tube boilers up to operational temperature and online is an elaborate process lasting many hours. To suffer an unplanned outage due to say a pump or water tube failure once we are up and running is very costly and damages our reputation for reliability with National Grid.
Ewan McMillan, Station Manager

During 2006/07, a series of events in the industry, one being at Scottish Power Longannet, coupled with the publication of various asset integrity guidance, made Scottish Power consider what a similar incident might mean for its business. In particular, it highlighted its vulnerability to a major incident and the need to make process safety management a priority.



Scottish Power:
Timeline for the Development of Process Safety Management Framework

Scottish Power developed a Process Safety Audit Tool comprising of high-level 'have you got one'-type questions. The company scoped out and designed a Process Safety Management System using the steps outlined in HSE's *Developing process safety indicators* HSG254. While this process helped to reinforce existing practices in the business (eg use of permits) it also identified a number of gaps, common across all sites, that highlighted vulnerabilities around process safety. Scottish Power is a mature business that thought it was running and monitoring its plants safely and efficiently – it wasn't!

Can you be sure you aren't in the same position?

Developing and delivering the strategy

In mid-2007 the company established an Asset Management Department to coordinate a common approach to asset management and process safety. An early decision was made to fully implement RR509 *Plant ageing: Management of equipment containing hazardous fluids or pressure* and asset management standard PAS 55 as a way of defining the policy and strategy.

During the same period, the publication of the Baker Panel report into the BP Texas City refinery fire stimulated Scottish Power to carry out an honest examination of whether a similar catastrophic incident could happen within its operations. And, if it could, how well it was managing such risks. This honest self-appraisal made Scottish Power realise that it was vulnerable to a catastrophic incident and that it did not have a structured approach to managing the risks or providing good information about the status of control systems.

We held an away day in July 2008, for process safety managers, generation director and all the station managers. We took them through RR509, HSG254 and the audit findings, highlighted the gaps and recognised we needed good key performance indicators. A key action was to show the US Chemical Safety Board video of the Texas City incident and then balloted each person – scoring 1–10 on how good we thought we were and whether we too could have a Texas City-type incident. We didn't rate ourselves very highly and everyone realised we needed to improve.
Martin Sedgwick, Head of Asset Management

The company decided to implement a process safety management system using HSG254 as a guide. The structured approach in HSG254 helped Scottish Power identify the key process safety hazards throughout its operations.

We realised we had significant gaps in our risk control systems and some parts we just couldn't measure. We followed a structured approach to identifying our hazards – as set out in HSG254. We pulled together ideas about how best to address these gaps and a major transformation was required for the business in order to develop a fully functional process safety management system, involving all the business areas.
Martin Sedgwick, Head of Asset Management

A Roadmap was used to set out the vision for an Operational Transformation Programme as well as the key stages and work to be undertaken.

Our vision was one of business excellence in process safety and asset management – good standards of process safety integrated with asset management. We wanted to learn from other sectors like chemicals and major hazard industries and other people who managed risks well. Through benchmarking with leading companies, we realised that to be successful process safety had to be fully embedded in our business, not a 'bolt on'. To achieve this we put in place a programme that had at its core business-led projects, a focus on strong leadership and an overall objective of changing our culture and establishing a long-term commitment to process safety.
Barry Smart, Programme Manager

The Operational Transformation Programme consisted of 20 projects which were managed under seven workgroups aligned with addressing the gaps in the risk control systems identified by HSG254:

Each project was headed by a business lead to ensure that the programme was owned and adopted within the business. Each business lead was supported as required by a multi-functional team comprising business analysts, project manager and IT analysts.

The Programme elements each had a series of milestones:

- scoping;
- requirements analysis and pilot;
- implementation;
- embed process;
- deliver 'operational excellence'; and
- 'high reliability organisation'.

We set up work groups to look at each aspect, for instance, we identified that alarm management was really important to asset integrity but using HSG254 we recognised that we couldn't measure the effectiveness of this process. So we ran a project to set a common alarm management policy across all sites (based on Engineering Equipment and Materials Users' Association (EEMUA) guidance) and implemented an alarm management system to allow us to measure performance and generate leading indicators.
Barry Smart, Programme Manager

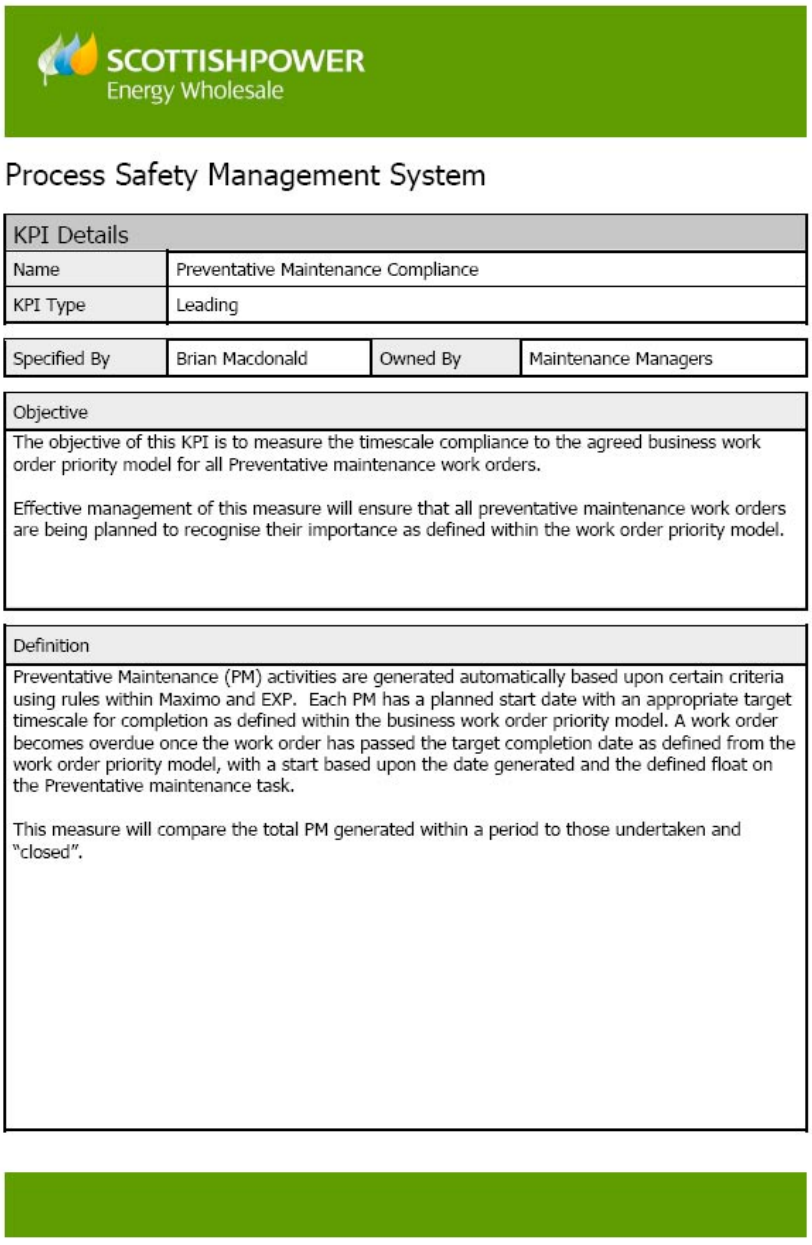
Other systems and arrangements were needed, for instance staff competence. We benchmarked with London Underground and built on their approach to competence assurance. We looked at roles, multifunctional tasks linked to process safety, eg shift handover or plant start up. We used competency assessment to identify safety critical tasks. We thought we would have problems with introducing the competence assessments, but most people recognised the importance of this in relation to process safety and therefore really welcomed this as change for good.
Barry Smart, Programme Manager

Establishing key performance indicators (KPIs)

To deliver the process safety management system, and specifically to establish a comprehensive set of leading and lagging process safety performance indicators, Scottish Power followed guidance in HSG254.

A multi-functional team from the business followed the six-stage approach in HSG254 to identify 90 hazards and the 42 risk control systems (or 'protective barriers') that are required to manage these hazards. The team then reviewed each risk control system to identify one or more leading indicators, crib sheets were used to capture detailed specification for each KPI.

In total 88 leading indicators were identified across all risk control systems.



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Energy Wholesale

Process Safety Management System

KPI Details			
Name	Preventative Maintenance Compliance		
KPI Type	Leading		
Specified By	Brian Macdonald	Owned By	Maintenance Managers

Objective
The objective of this KPI is to measure the timescale compliance to the agreed business work order priority model for all Preventative maintenance work orders. Effective management of this measure will ensure that all preventative maintenance work orders are being planned to recognise their importance as defined within the work order priority model.

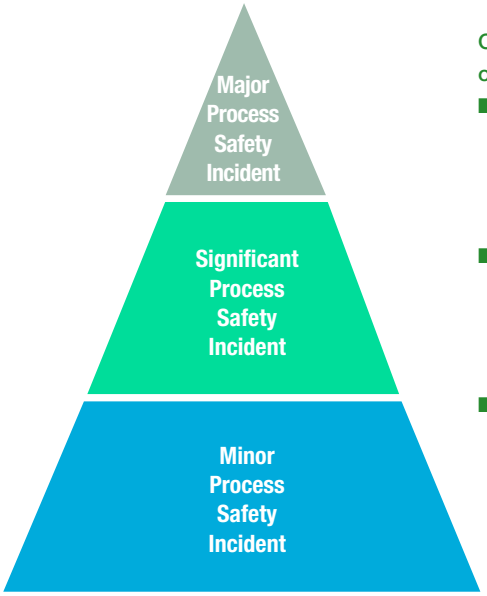
Definition
Preventative Maintenance (PM) activities are generated automatically based upon certain criteria using rules within Maximo and EXP. Each PM has a planned start date with an appropriate target timescale for completion as defined within the business work order priority model. A work order becomes overdue once the work order has passed the target completion date as defined from the work order priority model, with a start based upon the date generated and the defined float on the Preventative maintenance task. This measure will compare the total PM generated within a period to those undertaken and "closed".

We recognised that every generating station would need to adopt exactly the same approach. This was a lot of effort but made good business sense as it allowed a single approach across our business areas that prompted sharing of best practice.
Martin Sedgwick, Head of Asset Management

The 42 risk control systems and 88 associated leading indicators was too large a data set to present meaningful information to the management team so the 42 risk control systems were nested into eight headline risk control areas to form the basis of the Process Safety Management Dashboard that covers:

- operational and compliance audits;
- technical risk management;
- staff competence;
- operational management;
- maintenance management;
- critical systems management;
- alarm and instrument management; and
- emergency preparedness.

Scottish Power took a simple view that incidents and near misses were the single source of lagging indicators. It implemented a new incident management process to capture this data and drive consistent investigation of root causes. Incidents were classified as major, significant or minor (based on API 754 *Process safety performance indicators for the refining and petrochemical industries)* related to one or more of the underlying 42 risk control systems.



Classification of process safety incidents based on benchmarking with HSE and API guidance:

- **Major process safety incident**
  - Equipment damage > £100k
  - Loss of production > 24 hours
  - Injuries/fatalities (RIDDOR)
  - Major environmental impact
- **Significant process safety incident:**
  - Equipment damage > £20k but < £100k
  - Significant release of energy or hazardous matter
  - Fire and explosions
- **Minor process safety incident:**
  - Demand on safety system
  - Process upset - control loops out of control, equipment in manual
  - Breaches of plant limiting conditions

We have implemented a comprehensive incident management system that is used to drive the lagging KPIs. This feeds into our dashboard at risk control system level and is rolled up along with the leading indicator performance to drive the top-level management statistics. The system tracks the status and drives improvements just because everyone can see the data.
Barry Smart, Programme Manager

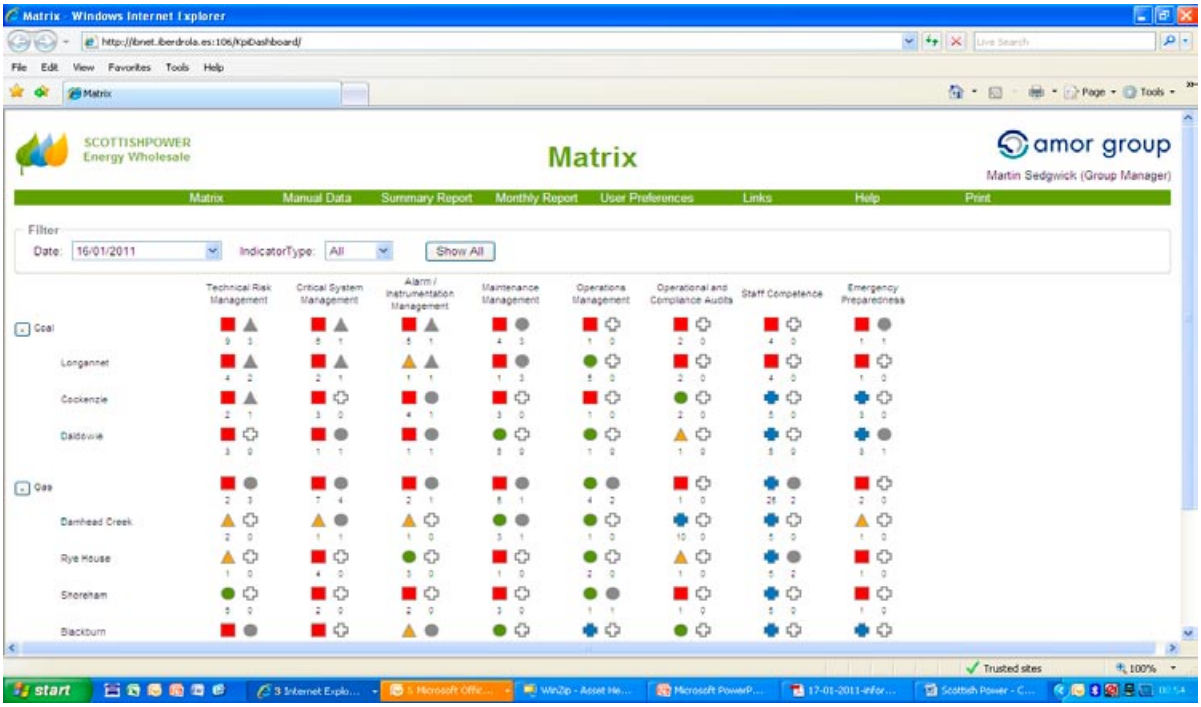
To improve performance and track trends simple colour-coded targets were set for each KPI. Blue shows where performance meets a level that is considered industry best practice. Green indicates performance is on target, amber that it is within acceptable tolerance and red shows where it is below acceptable.

Although we use the same KPIs across the business we set differing targets to reflect the variation in the different age and technology profiles of our sites, this approach makes sure that each site is driving towards realistic performance targets.
When I first saw the results I was expecting no 'reds' but I soon realised that red was OK providing that the improvement actions were in place and performance showed an improving trend against the stretching targets we have set. We don't expect perfection and welcome the upward reporting of good or not-so-good news as it's honest and real information that helps us make the right decisions on process safety management.
Hugh Finlay, Generation Director

An effective IT strategy and system lies at the heart of Scottish Power's success with process safety management. A significant amount of groundwork was performed during 2006–2008 to consolidate the business on a small set of 'best of breed' applications. These applications provided a robust and automated source of data required to derive the leading KPIs on a daily basis. Rather than having lots of different KPI reporting systems Scottish Power chose to adopt a unified approach that has eliminated any conflict over data collection.

Early on in the Programme a partnership was formed with the Amor Group to develop an integrated data management system that pulls perfomance data for KPIs from core operational business applications used to manage the business and asset integrity.

The smart use of IT – including the use of handheld data loggers – means data management systems are integrated into process plant and other 'day-to-day' operational systems. This enables the company to drill down through each headline KPI to reveal the underlying transactions, assess near-time performance of each generating station and to see trending information and progress towards the agreed targets. This allows accurate benchmarking between the company's other comparable assets. The information is available to everyone in the company at anytime enabling them to identify and act upon problems within their system before it affects their business/safety.



This information is not stand alone and is part of a complete programme covering plant, people and process. It sits within an overarching leadership framework where senior management has a good understanding of process safety and the direct links to business performance.

So what's been achieved and what are the benefits?

Scottish Power believes it could not run its business effectively without this process safety framework and KPIs to show real-time performance. It took a couple of years of hard work but the benefits far outweigh the effort. Enhanced plant reliability has led to a reduction in unplanned outages and breakdowns, and a drive to less reactive maintenance has significant cost savings. These benefits can be summarised as:

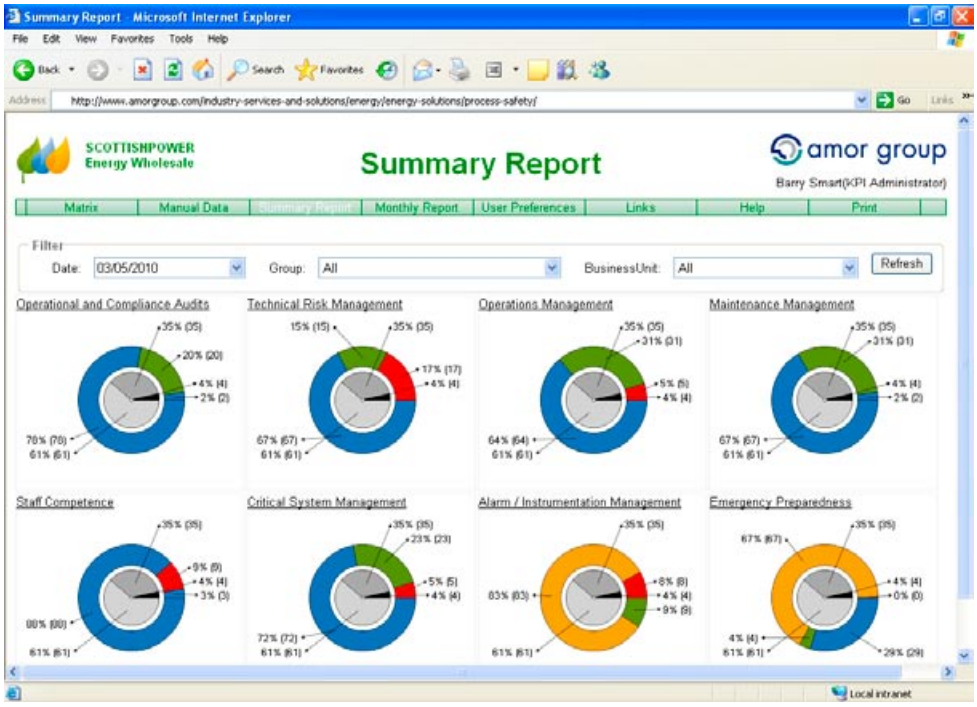
- 20% reduction in operations and maintenance costs;
- 22% increase in plant availability; and
- 25% reduction in plant forced outage rates.

For the first time, senior management has visibility of core operational processes. This has increased confidence and assurance from Board to plant level which has resulted in improved cooperation between leadership and workforce and the drive to deliver a 'high reliability organisation'.

Improved performance and transparency of key processes has led to a significant reduction in insurance premiums which in turn affects the bottom line of the business.

What next?

Further enhancements are planned including a weighted KPI process, which allows a risk-based approach to reporting to KPIs, along with a new dashboard, which integrates leading and lagging KPIs to improve the visibility of performance. The new dashboard shows leading indicators as a doughnut on the outside and lagging indicators as a pie on the inside, as a means of visualising the 'Swiss cheese' model that is at the heart of its Process Safety Management System. This integrated approach to combining leading and lagging indicator performance enables Scottish Power to calibrate its Process Safety Management System by questioning areas where leading and lagging performance is out of sync.



Further information

Developing process safety indicators: A step-by-step guide for chemical and major hazard industries HSG254 HSE Books 2006 ISBN 978 0 7176 6180 0 www.hse.gov.uk/pubns/books/hsg254.htm

PAS 55-1:2008 *Asset management. Specification for the optimised management of physical assets* British Standards Institution

Plant ageing: Management of equipment containing hazardous fluids or pressure RR509 HSE 2006 www.hse.gov.uk/research/rrhtm/index.htm

The Report: The BP U.S. Refineries Independent Safety Review Panel 2007 ('the Baker Report')

Process safety performance indicators for the refining and petrochemical industries API RP 754 American Petroleum Institute

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