SAFETY CASE ON A PAGE

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Introduction

'Safety Case on a Page' (SCOAP) has been developed by the Atomic Weapons Establishment (AWE) to enhance front-line operator awareness and understanding of the significant process hazards and safety controls present in their workplace. There has been significant demand from facility teams for SCOAPs to be produced for their areas, as they simplify the complex and analytical nature of safety cases. It is also receiving significant interest from regulators and other operators.

SCOAP is presented as a facility-specific or process-specific poster displayed in the workplace. It provides operators with a visual and accessible summary of the main information from the safety case, eg. engineered and procedural safety controls. Development of a SCOAP with facility staff engages the workforce and encourages them to consider how their day-to-day actions directly affect safety. SCOAPs should be put together by personnel who understand the structure and contents of the safety case, but with input from operators who are knowledgeable on the plant operations.

It is important to note that the SCOAP does not replace any element of the safety case, existing safety instructions or training, nor does it present the full safety case, but it simplifies key information from the safety case in a visual format to focus attention on major process hazards.

Purpose of Safety Case on a Page

Safety cases can be complex documents that are not easy to use. The main outputs from a safety case are presented in a Safe Operating Envelope (SOE) document including the key procedures and engineered systems that support safe operations. However, the SOEs can still be sizeable documents for large facilities and cover many different processes.

By increasing the awareness of the information presented within the safety case at the operational level, it is anticipated that this will encourage operational staff to think more carefully about how their actions directly affect the safety of their plant by:

- Improved hazard and control awareness and understanding in workforce;
- Improved engagement with / of workforce and management;
- Improved safety behaviours.

In addition to its primary function of promoting front-line operational safety awareness, SCOAPs can also be used to convey key safety case information to a range of stakeholders and for a range of other purposes, such as:

- Maintainers undertaking work on process plant or safety related equipment;
- Designers undertaking modifications to process plant or safety related equipment;
- Visitors or new starters receiving plant familiarisation tours;
- Committees (e.g. Nuclear Safety Committee) requiring an 'Executive Summary' view of a safety case;
- Regulators requiring plant and safety case familiarisation.

Background to Development of the SCOAP

The content and layout of the SCOAP format was developed and piloted in conjunction with a front-line operations team, to ensure it was appropriate for the intended audience. It uses visual representations to effectively communicate relevant high level safety case information, including:

- Bow-tie diagrams to illustrate fault sequence progression from initiating event to consequence, along with the engineered and procedural safety controls;
- Photographs and/or diagrams to illustrate key safety related items of plant, along with a description of their safety function;
- References to source documentation, eg. the Safety Case and Safe Operating Envelope.

Various types of diagram are used by safety assessors across diverse hazardous industries (e.g. nuclear, oil and gas, chemical) to model fault sequence progression for the purpose of hazard assessment and to visually illustrate fault sequences within safety cases. For the purposes of SCOAP, the 'bow-tie' style diagram has been chosen, drawing upon leading research into workforce understanding of hazard management and their role within it [HSE, 2008]. The report recommends the use of bow-ties to

present the major hazards of the facility in such a way as to facilitate workforce understanding of hazard management and their role in it.

In addition, the bow-tie style diagram was chosen as the most appropriate form of illustration through consultation with principal stakeholders (i.e. the bow-tie diagram was judged by front-line workers and other facility personnel to provide the most easy to understand and, hence, user friendly presentational format).

In addition, SCOAP also implements a number of key lessons learned identified from major accident investigations, such as:

- Presenting safety case information in a form that is SHAPED: 'Succinct, Home-grown, Accessible, Proportionate, Easy to understand and Document-lite (SHAPED)' [Haddon-Cave, 2009].
- Focusing attention on the major process hazards and controls, to supplement the consideration of occupational safety [National Commission, 2011].

Applicability to Different Facilities and Hazards

The SCOAP process has been applied to all facilities that are covered by a safety justification, i.e. a Safety Case for nuclear facilities or a Safety Basis for non-nuclear facilities.

They address all applicable hazards, e.g. nuclear (criticality), radiological (ionising and non-ionising radiation), explosives, chemotoxic, industrial/conventional, environmental, etc.

The process for producing a SCOAP is based on the utilisation of information contained in a safety case. The SCOAP is aimed principally at operational facilities, and thus is based on the operational safety case. However, the concept could be applied at any stage of a facility's lifecycle (e.g. based on the safety documents for concept / detail design, modifications or decommissioning). SCOAP may be produced for a facility as a whole, or for each different process area of a facility, and is displayed locally within the facility (i.e. on the wall).

Structure of a SCOAP

The template for Safety Case on a Page is shown in Figure 1. The format and layout of the template (i.e. the shapes, colours, degree of information, etc.) has been adopted for all SCOAPs to ensure consistency across AWE's facilities.

It is in a format that summarises the following information from the safety case required to operate a facility safety, in a style that is easily accessible:

- Main hazards and fault sequences;
- Main engineered equipment necessary for safe operation;
- Key safety actions necessary for safe operation;
- Signposts safety case implementation documents.

The terminology used must be suitable for the audience. It is therefore important that information extracted from the safety case documentation is not 'cut and pasted', but is reviewed for its suitability for the SCOAP.

A SCOAP consists of four main elements (shown in Figure 1), as follows.

a) Bow-Tie Diagram Area - Illustrates the key initiating events (i.e. what can go wrong) and the subsequent hazardous events and potential consequences, along with key preventative / mitigating safety controls.

The bow-tie diagram presents high level (summary) information on the main fault sequences associated with the process, as given in the safety case for the facility.

For each of the selected faults, this will include:

- *What can go wrong?*

  The initiating event of the fault sequence (or threat to the process).

- *What safety controls PREVENT the hazardous event from occurring?*

  The main engineered and/or procedural safety measures that prevent the fault from progressing from the initiating event to a hazardous event, as stated in the safety case (Fault/Protection Schedule, Hazard Analysis).

- *Hazardous Event*

  A statement of the fault in simple terms, which would occur if the preventative safeguards have failed (e.g. loss of containment, criticality), i.e. the point at which control is lost.

- *What safety controls MITIGATE the hazardous event?*

  The main engineered and/or procedural safety measures that reduce the potential worst case (i.e. unmitigated) consequences of the fault to a tolerable level, as stated in the safety case (Fault/Protection Schedule, Hazard Analysis).

- *Consequence*

  The potential unmitigated effect of the fault, should preventative and mitigative safety measures fail, as stated in the safety case (dose assessments, assessments of health impacts). Consequences are expressed in terms of harm to people (workers or members of the public) or the environment, and can be radiological, chemotoxic or conventional in nature.

b) Pictorial Area - Illustrates key safety controls on the plant and their associated safety functions.

To avoid the reproduction of significant amounts of process/plant description included within the safety case, each SCOAP incorporates a pictorial area that includes some form of visual aid to assist the user of the SCOAP in understanding the physical scope of the main process plant or equipment covered.

The content of the pictorial area could take various forms and, in most cases, will be in the form of a photograph. Alternative forms could be 3D layouts, building plans, etc.

The pictorial area consists of two main elements, as follows:

- *Central Overview Illustration;*

  This element shows the main process plant or equipment with which the faults identified in the bow-tie diagram are associated. The overview illustration shows the system level view of the subject process plant or equipment, not the component level view.

- *'Pop-out' Illustrations;*

  The pop-out illustrations around the central picture draw out the main safety related controls (engineered or procedural) that are identified in the bow-tie diagram.

The aim is to provide detailed views of safety related controls, such that any user of the SCOAP can physically locate the SSCs important to safety. Each pop-out illustration is accompanied by a statement of the safety function(s) provided by the controls highlighted.

c) Information Area - Presents the key Facility Safety Case information and associated references.

In order to highlight key safety related information from the safety case within the SCOAP, the bow-tie diagram and pictorial area are accompanied by a small summary information area, which may include the following:

- The title of the facility and process area covered by the SCOAP;
- A summary of the main hazards (e.g. radiation, explosives, etc), with relevant hazard symbols, as defined under the applicable regulations, e.g. COSHH, CHIP, etc;
- A list of all (or key) associated Operating Instructions;
- A list of all associated Operating Rules;
- A list of all requirements for direct supervision by a Duly Authorised Person (DAP);
- A reference to the Safe Operating Envelope section of the safety case.

d) Key & Configuration Control Area - Identifies the Facility Safety Case issue on which the SCOAP is based, along with signed ownership of SCOAP by process supervisor.

This area includes a document issue box recording the SCOAP issue and facility safety case issue on which the SCOAP is based. The SCOAP should then be configuration controlled against any changes to the plant or the safety case, and reviewed on a regular basis to ensure it remains current.

The document issue box includes the signature of the 'Process Owner/Lead' to highlight ownership of the document by the key stakeholder. It should be re-issued if there is a new Process Owner/Lead, to promote ownership and understanding of the content.

Adjacent to the document issue box, a key for the identification of engineered and procedural safety controls is provided.

Specific Benefits of Implementation of SCOAPs across AWE

Over one hundred different SCOAPs have been produced across both nuclear and non-nuclear facilities at AWE and rolled out to the workforce. Feedback has illustrated number of specific benefits seen.

It has improved engagement with the workforce:

- Facility personnel have actively wanted to produce SCOAPs and most work undertaken has been as a result of "pull" from the facilities.
- The concept of SCOAP is easy to understand and apply, with many facilities producing their own with minimal assistance from the central safety team.
- The range of personnel involved has encompassed: operators, supervisors, facility managers, assurance managers, safety case managers and facility engineers.

It has also made people think about how the safety case is constructed:

- The clarity of safety documents - whether it is easy to follow through from hazards to controls in a logical way (ie. traceability).
- The structure of the safety argument and safety measures.
- It illustrates the depth of the safety argument (ie. number of controls).
- Whether there is consistent use of terminology (eg. fault scenario, equipment names).

There has been an enhanced awareness and understanding of engineered and procedural systems:

- Operators may know there is a system there, but not fully appreciate its safety function as it would only operate following a fault.
- Operators may know a particular step in a procedure had to be done, but hadn't appreciate what the hazard would be of not doing it.
- In one or two cases, it identified equipment not included in the safety case, but known support safety.
- Instances of mitigation identified in the safety case, that probably would not be used in that particular fault scenario.

Summary of General Benefits of Implementation of SCOAPs

To summarise, the benefits of the SCOAP process and posters go a long way to achieve the aim to present the major hazards of the facility in such a way as to facilitate workforce understanding of hazard management and their role in it, by:

- Providing a visual and accessible summary of the safety case output.
- Promoting a wider understanding of the main process hazards and controls.
- Making operators more aware of the safety significance of their day-to-day actions.
- Enabling greater operator involvement in safety discussions.
- They can be used as an effective training and awareness tool.
- Presenting safety case information in a form that is SHAPED. (Lesson learned from Nimrod accident investigation).
- **S**uccinct - **H**ome-grown - **A**ccessible - **P**roportionate - **E**asy to understand - **D**ocument-lite
- Focusing attention on the major process hazards to supplement consideration of conventional safety. (Lesson learned from Deepwater Horizon accident investigation).

References

[HSE, 2008] HSE Research Report RR637 – Optimising Hazard Management by Workforce Engagement and Supervision, 2008.

[Haddon-Cave, 2009] The Nimrod Review Report, Charles Haddon-Cave, October 2009.

[National Commission, 2011] Deepwater – The Gulf Oil Disaster and the Future of Offshore Drilling, National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling, November 2011.

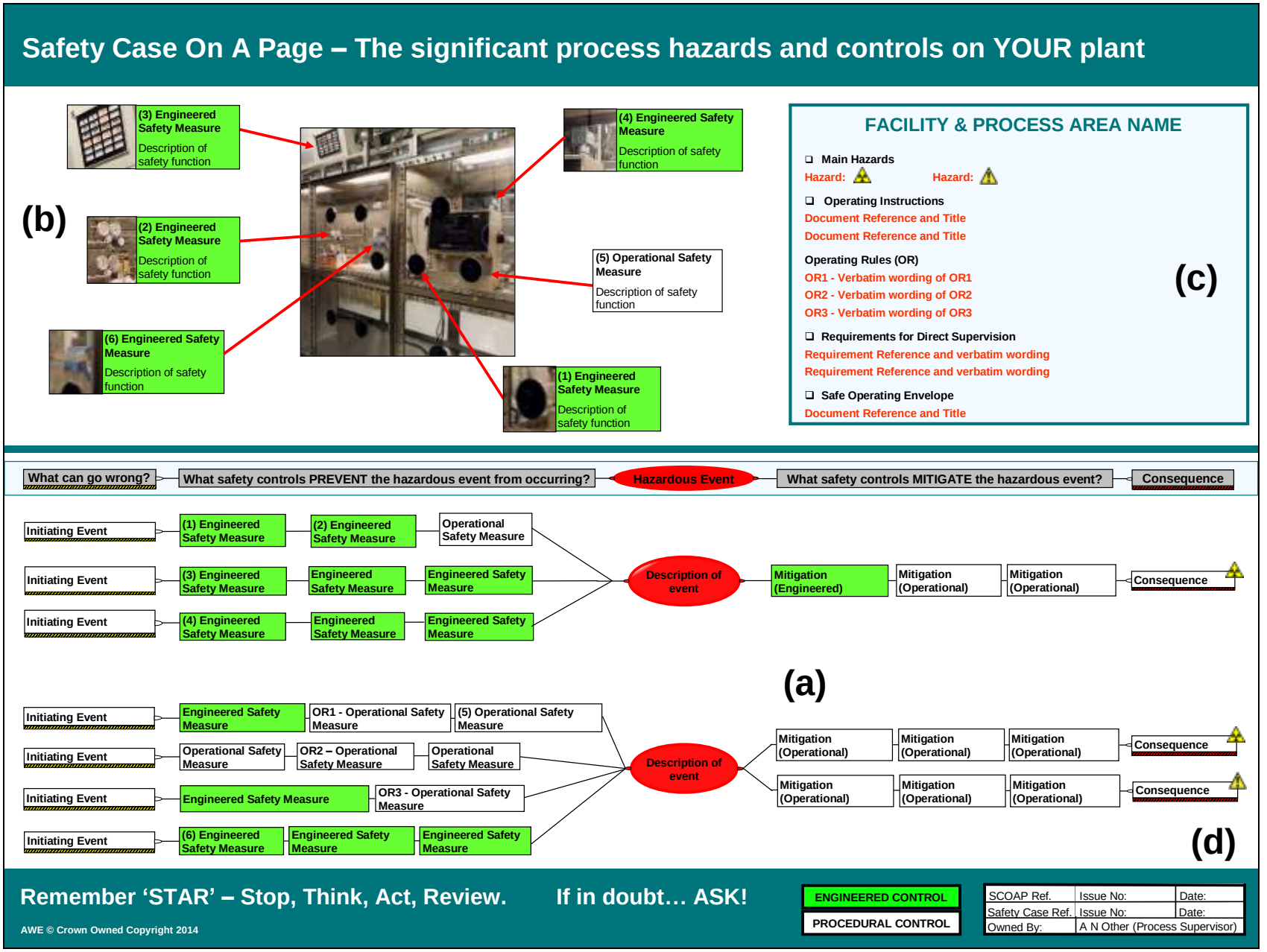

Figure 1: Template for Safety Case on a Page