Bowties in process safety auditing
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Process Safety Auditing

Auditing is a vital part of a PSM program

- Demonstrate compliance with company expectations and processes
- Ensure suitable safeguarding measures in place
- Identify deficiencies in compliance or safeguarding measures.
- Needs to be systematic and independent.
- Must be relevant to the site hazards
Different types of audit

Compliance-centred
- Regulatory
- Corporate
- Management systems

Hazard-centred
- Focussed on particular hazards
- Safeguards necessary to control hazards
Audit protocol

But developing an audit protocol can be problematic

■ Process safety hazards may vary from site to site or from time to time

■ Consequences of accident may vary and therefore different safeguards required

One size does not fit all for a varied portfolio of assets

■ Audit must consider safeguards important to prevent or mitigate site-specific process safety hazardous events
Using Bowties in Process Safety Auditing

So how can you:

■ Identify process safety measures relevant to particular sites?
■ Account for local concerns and vulnerabilities?
■ Leave a legacy of increased process safety awareness
Some bowtie concepts

Various distinct causes of the top event

The scenario which represents losing control of the hazard

Measures to prevent a top event due to a particular threat

Measures to mitigate the consequences of a top event

Conditions which could cause barrier to fail

A physical situation with a potential for harm

Realistic worst-case outcomes of the top event

PREVENTION

MITIGATION

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Safety Cases

Bowtie diagrams have many different uses:
Deep understanding of barrier operation

Bowtie diagrams have many different uses:

- Part of design process
  - Understand hazards
  - Identify Safety Critical Elements
  - Identify Safety Critical Tasks
  - Capture actions and recommendations
  - ALARP demonstration
Communicating hazard management

Bowtie diagrams have many different uses:

- Senior Leaders
  - High-level overview
  - Conversation-starter for site visits
  - Context for process safety KPI

- Workforce
  - Hazard overview
  - Operational risk assessment
  - Permit risk assessment
Bowtie use in various industries

"Bowtie is one of many barrier risk models available to assist the identification and management of risk and it is this particular model we have found (and are still finding) useful."

“We are improving our risk management process through the objective centred ‘bow tie’ approach.”

ERM is also using bowties with clients in:
- Food production
- Manufacturing
- Road transport
- Upstream O&G
- Downstream O&G
- Chemicals
Bowties provide all information necessary to develop a focussed audit protocol
Using bowties ...

For each barrier on a bowtie ...

- H.1.08 Gasoline in storage tank
- Loss of containment
  - Does it actually exist?
  - Is it in good order?
  - Is it appropriate for the hazard
  - Is the responsible person competent?
  - Is there evidence of a maintenance program?
Typical application

Techniques typically applied to:
- Large organisations with many sites having similar hazards
- Single sites with a range of hazards
- Sites which are at an early stage of process safety maturity

May have generic bowties for large organisations
- Generic bowties must be made local – what’s different here?

May need to develop bowties where none exist
- Hazard Identification
- Develop bowties for a couple of hazards

Developing bowties in a workshop is the first part of the audit!
- Gaps or deficiencies often become apparent without even looking at the site.
Typical application

HAZID and bowtie workshop

- Provides insight to audit team to identify areas to investigate further
- Takes site team on a journey of discovery, rather than just presenting findings
- Bowtie is useful for site to use in training and for raising process safety awareness

Audit process split between

- Process safety safeguards
  - equipment and tasks
- Management systems
  - eg MoC, PTW
Audit output

Findings around:

- Control strategy
  - Have you got the right controls?

- Overall control effectiveness
  - Do the controls actually work?
  - Do people know what they have to do to make controls effectiveness?

- Management systems
  - Do these support the effectiveness of controls?

Greater understanding of process safety hazards and the measures necessary to manage them effectively
Typical Site Audit – 4-5 days

- **Orientation**
  - Meeting Site tour
  - Site intro

- **HAZID**
  - Top events
  - Causes
  - Consequences

- **Bowties**
  - Preventative measures
  - Mitigation measures

- **Audit**
  - Inspect safeguards (includes barriers and controls)
  - Audit management systems

2.5 days

2 days
Advantages of method

**Focussed:**
On those systems, tasks and equipment of direct importance to managing process

**Flexible:**
To allow the auditor to follow areas of particular concern at each site

**Educative:**
Allows sites to understand why findings are important and the potential outcomes of weaknesses
Application of method

ERM engaged in major programme with manufacturing organisation

- Sites on all continents
- Variety of hazards
- Differing levels of maturity

Successful program delivering

- Understanding of process safety issues across portfolio
- Increased process safety awareness across sites
Available guidance on bowties
Questions