Current Status & The Future of Critical Control Management in the Australian Resource Industry

Minerals Industry Safety & Health Centre
Sustainable Minerals Institute
Brett Garland
Summary

Most of the large resource companies are implementing the Critical Control Management processes consistent with ICMM (The International Council on Mining and Metals) approach

• BHP
• Anglo American
• Rio Tinto
• Glencore
• Peabody
• Sandvik
• Hanson Construction Materials
• Additionally – Oil and Gas, Construction and Regulators
Safety Innovation Lifecycle

Impact on safety performance

Introduction

Growth

Maturity

Reinvigoration

Decline

Time
9 Steps where **Success** & **Challenges** are happening
Planning the process

Different starting points
Improving verification and reporting
Identifying controls and selecting correct critical controls
Assigning accountabilities

Factors affecting rate of progress
Resources applied
MUEs selected
Effort getting content correct vs effort getting system working and effective

Currently
✓ Full cycle needed to have CCM embedded – need good content and system
✓ Some are reviewing content and some are designing system
Planning the process

Regions or companies are doing bow-tie and selecting the controls

Challenges

- Embedding the understanding
- Getting buy-in at front line
- Producing controls and verification that match site specific risks

Each site does bow-tie and feed up to corporate

- Struggles to produce good consistent quality for
  - Bowties
  - Control Selection and Specification
  - Verification materials
Selecting Material Unwanted Events MUEs

ICMM definition

An unwanted event where the potential or real consequence exceeds a threshold defined by the company as warranting the highest level of attention

Key Actions

Understand major hazards and identify potential MUEs.

Apply selection criteria to MUEs with a focus on the consequences – maximum reasonable consequences.

Identify design opportunities to address the hazard, reducing the potential consequences and eliminating the MUE from the CCM process.

Describe the identified MUE, including the relevant hazard, mechanism of release and nature of the consequences.

<table>
<thead>
<tr>
<th>Examples of Mining and Metals MUEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aviation</td>
</tr>
<tr>
<td>Underground ground control</td>
</tr>
<tr>
<td>Underground fire/explosion</td>
</tr>
<tr>
<td>Heavy mining equipment</td>
</tr>
<tr>
<td>Dropped objects</td>
</tr>
<tr>
<td>Pressurized systems</td>
</tr>
<tr>
<td>Confined spaces</td>
</tr>
<tr>
<td>Inrush/inundations</td>
</tr>
<tr>
<td>Explosives</td>
</tr>
<tr>
<td>Highwall stability</td>
</tr>
<tr>
<td>Flammable gas</td>
</tr>
<tr>
<td>Light vehicles</td>
</tr>
<tr>
<td>Work at height</td>
</tr>
<tr>
<td>Electricity</td>
</tr>
<tr>
<td>Hazardous materials</td>
</tr>
</tbody>
</table>
Climbing Mount Everest
(hint: don’t try 1:20 chance of dying)
Understand the MUE

When do climbers die?
Most foreigners die descending from the summit, while most Sherpas die preparing the route for them.
How do climbers die?

Falls kill the most foreigners on Everest, while most Sherpas have been killed by avalanches.

Deadliest altitudes

Foreigners are most likely to die at altitudes above 8000m, while the deadliest altitudes for Sherpas are between 5300m and 5800m.
Selecting MUE challenges

• Criteria for MUE
  – Single fatality (eg Rio Tinto, Downer, Sandvik)
  – Multiple fatality (eg BHP, Glencore)
  – Variation between site and corporate requirements – need to do both?
  – Problems with health and well-being risks

• Documenting the scope
  – clarifies what is included and excluded
  – needs to be written down
  – checks work covers all locations, equipment, people, activities, scenarios
  – highlights overlapping elements
Indicative Graph of Safety Performance

Total number of coal mine deaths in China 2005-2018

- Total number of coal mine deaths
Using Bowties

Bowtie challenges

• Different levels of bowties – high level corporate to site specific
• Guidance does vary
• Right content and correct level of detail

Good hazard control bowties for “front-line” workers or Corporate tool?

− Have I got the right hazard – the inherent risk source that has the potential to cause harm
− Have I identified all the threats – the mechanisms that can release the hazard
− Is the knot the initial point where control is lost?
− Have I identified both primary and secondary fatalities
− Are the controls action or object that of itself directly arrests the event or consequence? Are they it specifiable, measurable and auditable?
− Have I got sufficient controls to adequately address all threats and consequence over an entire event sequence?
− Is the bowtie understandable, precise, concise, and comprehensive?
Bow tie representation of risk and control

Risk management strategies = Assuring effective control over time

Monitoring, maintaining and improving controls

CONTROL ASSURANCE MANAGEMENT SYSTEM (CAMS)

- Operations activities
- Maintenance activities
- Engineering activities
- Management activities
Control sorting exercise

Start

Is it, of itself a physical object, technological system, and/or human action?

Yes

No

Does it, of itself, directly prevent an unwanted event or mitigate an unwanted outcome?

Yes

No

Is the required performance specifiable, measurable, and auditable?

Yes

No

A CONTROL

Support Activity

Verification Activity

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Start

No

Yes

Is it activity that maximises health/minimises erosion of the control?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it an in-field check that control is implemented?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?

No

Yes

Is it activity that determines if control is healthy/functioning as required?
Critical Controls ??

What is a critical control

How do we select it

Some using ICMM filter – others have modified it

Rule of thumb eg

4 – 6 critical controls per bow-tie

1 critical control per threat line
Inadequate critical control performance

Define
• Adequate vs inadequate
• Required response

Identify
• Monitoring
• Verification
• Incident investigation

Challenge - Deciphering issues of control ineffectiveness

• Improving inherent control activity
• Improving control support to better address erosion factors
• Benefits and limitations of analysis
Failure of controls
In other words:

How do you know the control is operating as designed?
How can you assess this?

How do you know the control is effective?
How can you assess this?

What can prevent the control from being effective?
Can you measure this deviation?
Performance requirements

• Objective performance requirements
• Triggers for stopping or changing operations
• Verification and reporting requirements

Done with varying degrees of rigour! If not done well

• Varying understanding of what is an effective control eg vehicle separation distance, stopping/yielding at intersections
• Clear triggers or people will not stop.

“Stop” trigger – stop when it isn’t safe
“Go” trigger – only proceed when you have verified it is safe to do so
Verification and reporting challenges

CCRM – check objects (relatively easy) and actions (not so easy)

Leading practice is focusing on:

• Right people:
  – doing the verifications in a timely manner
  – understanding the fundamentals of CCRM
  – understanding the control being verified so they can do a quality job

• Discussions that seek to understand:
  – when the control action and monitoring processes work well
  – when they don’t
  – what might be required to further enhance the performance of the control
Site Specific Implementation – Front-line challenges

- Fundamentals are understood as to why CCRM is being done so it doesn’t become a tick and flick process
- Where appropriate it replaces or complements rather than duplicates current work. Most of what comes out of CCRM is already buried within existing plans, procedures, inspections, processes etc.
- This part of the program is appropriately measured and reported
- Checklists
- Focus on supervisors
- Re-structuring of safety conversations
Summary

- Reach the front-line people – bring people with you and provide top-down support

- Leverage technology for data acquisition and analysis

- Multiple layers of assurance and verification

- CCRM is a tool – retain focus on culture and systems

- Be patient
Thank you

Brett Garland - Director
Minerals Industry Safety and Health Centre
Sustainable Minerals Institute
b.garland@uq.edu.au
+61 7 3346 4037
+61 418 199 067