RISKGATE: a national online knowledge bank for coal industry risk management

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The Sustainable Minerals Institute

Leading **RISK**, **HEALTH**, and **SAFETY MANAGEMENT** for the Minerals Industry

Capabilities:
- Risk management
- human factors engineering
- occupational health and safety management
- emergency preparedness
- incident investigation
- Mining+Health

**RESEARCH, EDUCATION & CONSULTATION**

- Safety & Health
- Mineral Processing
- Mining & Geology
- Coal Seam Gas
- Environment
- Water Management
- Social Responsibility

**COLLABORATION & PROJECT MANAGEMENT**
Outline

• Genesis of RISKGATE
• RISKGATE – introductory video
• RISKGATE topics and structure
• RISKGATE case studies
• RISKGATE – STATURE video
• RISKGATE beyond Australian coal chain
Knowledge management through knowledge sharing in the Australian coal industry
Australian coal mining safety performance

Key Aspects to Australian Mining OHS Legislations

- **Risk Management**
  - Major Hazards Management Plans

- **Duty of Care**
  - Employer
  - Employee

- **Stakeholder Involvement**
  - Workplace plays an inherent role in implementing OHS management

The diagram illustrates the number of fatalities and incidents from 1991 to 2013, highlighting specific incidents such as 'inrush (14/11/96 NSW 4f)' and 'spon com (7/8/94 QLD 11f)'.
Why RISKGATE?

• The mining workforce is transient, and highly mobile and aging.

• Continuous improvement:
  • The coal mining industry is making a step change in risk management by focusing on control effectiveness using bow-tie methods.

• Known and Unknowns
Analysis of Collisions-related Events as a Percentage of Total Incidents, FY 2001 to 2012
Queensland, Australia

Note: Collision-related Events include:
- Loss of control/unplanned movement
- Vehicle
- Mobile plant
What we already know.....

• ... it is rare to find that [a] hazard was new or unknown. Far more often, the knowledge of hazards and their controls resides somewhere in the organization or the industry, but for some reason has not filtered through to the people who need it, or has not been applied at the right time. (deMeulles, 2002; 65)

Shrinking the unknown knowns
Industry requirement

• In order to achieve an effective level of risk assessment and management, there must be knowledge-sharing capabilities and a culture for sharing experiences at both an organisational and an industry level.
The importance of knowledge
From: Threadgold (2014) The journey continues: Sixty years of sharing incident information in the geophysical industry.
SPE International Conference on Health, Safety, and Environment. Long Beach California, USA: Society of Petroleum Engineers.

"The author believes that the key driver for this change has been the willingness of companies and key individuals to share accident information across the industry sector. This enables the entire sector, not just the companies involved, to learn from an accident and also utilize the shared information to develop industry guidance documents."

"Nor does there appear to be any other significant alternative explanation for the improvement in relative safety."

SPE 168305
The Journey Continues: Sixty Years of Sharing Incident Information in the Geophysical Industry
Ian M. Threadgold, SPE, Threadgold Safety Management

Abstract

For more than sixty years the geophysical industry has been taking a journey towards greater safety and security for its workforce. In the early 1950’s, a worker in the geophysical sector of the petroleum industry was five times more at risk of injury than workers in other sectors of the same industry. Today a worker in the geophysical sector is at par with other oil and gas industry workers in terms of their safety.
What is RISKGATE?

- Prompts, not procedures. The discussion is important!
- Online ‘Body of Knowledge’.
- Built by the mining industry.
- Developed by UQ and UNSW. Managed by ACARP.
- Based on Bow-tie Analysis.
- Comprehensive (approaching 20,000 controls).
- Easy to use.
- Can be used with other RM tools such as WRAC.
Mining companies involved in building RISKGATE

- RIO TINTO
- Anglo American
- Peabody Energy
- Centennial Coal
- Natural Resources Environment
- adani
- GUJARAT NRE
- BMA
- Glencore Xstrata
- Caledon Resources
- Austar Coal Mine
- Bandanna Energy
Mining company days to build a BOK

- Adani
- Anglo American
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- Bandanna Energy
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- Caledon
- Centennial Coal
- Glencore Xstrata
- Gujarat NRE
- Peabody Energy
- Rio Tinto

Case Studies
Workshop days to build a BOK

- 473 mining
- 286 related
- 328 project

Case Studies
- 1087
Introductory video

Coal, Energy and Sustainability Conference
November 27-28 2014   Cape Town RSA
Making knowledge accessible

Easy to use, available anywhere 24/7

• Design
• Useability
• Navigation
• Outputs

“bringing the industry into the room”

“putting the knowledge of oldtimers into the minds of new staff”
The RISKGATE Process

**Identify the gap or area to be addressed (ACARP)**

**Recruit experts and appoint a Topic Leader (MISHC)**

**User suggestions, alterations, inclusions, omissions**

**Workshop Process**

Define the Topic and Initiating Events

Define the Causes and Consequences

Define the Preventive and Mitigating Controls

**Internal / Expert Review**

**Legal Review**

**Usability Testing**
User Friendly Bowties and Controls
Fires Topic

Relates to the unwanted or unexpected combination of a fuel source and an ignition source that results in fire causing personnel injury, fatality and/or equipment damage.

Model:
- Fuel source
- Ignition source

Initiating Events:
- Fire on mobile plant and field equipment
- Fire on fixed plant and infrastructure
- Fire on natural environment
- Fire on stockpile or spoil heap

Not Included:
- Spontaneous combustion in areas other than stockpile or spoil heap (see RISKGATE Explosions Topic)
- Methane gas in the underground environment (see RISKGATE Explosions Topic)
- Chemicals (see RISKGATE Occupational Hygiene Topic, 2013)
Isolation Topic

Relates to the loss of control of relevant energy due to failure to achieve effective isolation.

| Model:                      | • Life cycle management of the asset Design & Procurement, Installation & Commissioning, Operation & Maintenance, Modification, Decommissioning, Disposal
|                            | • Isolation process Identification, Operation, Verification, Securing

| Initiating Events:         | • Loss of control of electrical energy
|                            | • Loss of control of hydraulic energy
|                            | • Loss of control of pneumatic energy
|                            | • Loss of control of mechanical energy
|                            | • Loss of control of radiating energy

| Not Included:              | • Loss of control of energies in other RISKGATE topics (e.g. rock fall in RISKGATE Strata)
Tyres Topic

Relates to the use of off the road (earthmover), industrial and other types of tyres, rims and wheels.

<table>
<thead>
<tr>
<th>Model:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Tyre and rim management lifecycle:</td>
</tr>
<tr>
<td>Selection, procurement, transport, fitting</td>
</tr>
<tr>
<td>(installation and removal), maintenance,</td>
</tr>
<tr>
<td>operation, storage and disposal</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Initiating Events:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Loss of control of tyre/rim assemblies</td>
</tr>
<tr>
<td>during handling, storage and disposal</td>
</tr>
<tr>
<td>• Loss of control of equipment, tools and</td>
</tr>
<tr>
<td>vehicle stability</td>
</tr>
<tr>
<td>• Loss of control of tyre/rim assemblies</td>
</tr>
<tr>
<td>while in operation</td>
</tr>
<tr>
<td>• Loss of control of tyre/rim assemblies</td>
</tr>
<tr>
<td>during fitting and maintenance (install</td>
</tr>
<tr>
<td>and remove)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Not Included:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Chemicals (see RISKGATE Occupational</td>
</tr>
<tr>
<td>Hygiene Topic, 2013)</td>
</tr>
<tr>
<td>• Underground fires (See RISKGATE Fires</td>
</tr>
<tr>
<td>and Explosions Topics)</td>
</tr>
</tbody>
</table>
## Strata Control

Relates to the management and prevention of failures due to loss of strata control in the underground mine environment

### Model:
- Design
- Operation

### Initiating Events:
- Loss of control at
  - longwall face
  - outbye roadways
  - development roadway and face
  - shafts
  - goaf edge in pillar extraction
  - stress relief mining systems
- Loss of
  - pillar system instability
  - control of caving

### Not Included:
- Spontaneous combustion, methane, gases (see RISKGATE Explosions Topic)
- Outburst, inrush, coal bursts and bumps
### Tailings dam

Relates to the management of risks associated with tailings dams: catastrophic failure, seepage, spillage, contamination

<table>
<thead>
<tr>
<th>Model:</th>
<th>Design</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Construction</td>
</tr>
<tr>
<td></td>
<td>Operations</td>
</tr>
<tr>
<td></td>
<td>Post-closure</td>
</tr>
</tbody>
</table>

| Initiating Events: | Release of tailings and/or water due to failure of the tailings storage facility wall |
|                   | Release of tailings and/or water via surface run-off |
|                   | Release of water via seepage into the foundation or through the tailings storage facility wall |
|                   | Release of tailings and/or water via failure of the delivery systems |
|                   | Release of airborne particles from tailings surface |

| Not Included:     | Hazardous dust |
|                   | Acid mine drainage, spontaneous combustion |
In practice......
Operational status

- First eleven: ACARP launch 12/2012
- Eighteen completed
- Password access automated and available to all ACARP member companies
- MISHC developing training materials and workshops
  - Videos
  - User guides
  - Case studies
Integration in company operations

Stages

- Reference / body of knowledge
- Consideration in corporate practice
- Integration into operating systems
Revising Anglo American’s global isolation standard

RISKGATE Case Studies I

Coal, Energy and Sustainability Conference
November 27-28 2014  Cape Town RSA
Revising Anglo American’s global isolation standard

- Anglo American has used RISKGATE to assist in revising its global isolation standard.
Process

- Excel spread sheet - RISKGATE isolation BoK.
- Anglo American (Johannesburg) correlated RG data against the global standard,
  - Suggest RISKGATE controls that could improve the standard
- Review of standard
  - Normal Anglo American’s approach
  - Input from the business units.
Using RISKGATE to revise the isolation standard generated constructive discussion around cultural issues
- Mark Spinks, Principal Electrical Engineer, Metallurgical Coal business unit, Anglo American
Some controls faced implementation barriers in other countries.
- Did not ignore these opportunities, but included them.
In countries where there were cultural barriers, the controls would be goals that required a period of transition before full implementation was expected.
• At that time, RISKGATE data was not able to be directly exported into MS Excel – the software used in the review process – so Anglo American commissioned the RISKGATE team to develop an interface, which is now available to all RISKGATE users.
Choose your output format

- Output to screen
- Save as PDF file
- Save as Microsoft Excel XML
- Save as Stature XML

Disclaimer

- RISKGATE is a free service. RISKGATE does not purport to be a guideline or code of practice but rather is a reference source and may not necessarily be current.
- RISKGATE is not intended to be and should not be relied upon as legal or technical advice.
- RISKGATE is a database of information from various sources, including the host providers, that may be of some assistance to its users. RISKGATE does not give any guarantee, undertaking or warranty that the information provided is comprehensive and covers every case/incident/safety alert/bulletin potentially relevant in the mining industry. Users should consult other sources of information and not rely on RISKGATE as the only source of information.
- RISKGATE does not invite reliance upon, nor accept responsibility for, the information it provides. RISKGATE makes every effort to provide a high quality service. However, neither RISKGATE nor the host providers nor the providers of data on RISKGATE, give any guarantees, undertakings or warranties concerning the accuracy, completeness or up-to-date nature of the information provided. Users should confirm information from another source if it is of sufficient importance for them to do so.
- Hypertext links on RISKGATE are inserted by RISKGATE, not by the data providers.
- RISKGATE is operated by the Minerals Industry Safety and Health Centre at the University of Queensland.

I agree  I disagree
Interfacing with Stature risk management software

RISKGATE Case Studies II

Coal, Energy and Sustainability Conference
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Vertical integration of risk management in the coal supply chain

Coal, Energy and Sustainability Conference
November 27-28 2014  Cape Town RSA

www.riskgate.org
Risk management in the Energy Chain
RISKGATE: estimated relevance to related industries in the coal supply chain
Opportunities beyond Australian coal

Coal, Energy and Sustainability Conference
November 27-28 2014   Cape Town RSA

www.riskgate.org
Now and Future

ACARP member companies:
- RISKGATE BoK: 18 completed modules
- Training and implementation tools

Future
- Other coal mining regions
  - ALPHA Foundation USA (US UG – 3 topics)
  - South Africa, India, China
- Other mining domains (hard rock, aggregates)
- Other high risk industries (e.g. tunnelling)
Acknowledgements

• ACARP, 9 coal companies, ~10 suppliers, 2 regulators
• 100+ industry experts, 20+ affiliated experts
• RISKGATE Management Group:
  – John Hempenstall, Dave Mellows, Tony Egan
  – David Cliff, Jim Joy, Tilman Rasche
• RISKGATE Topic Leaders
  – David Cliff, Mark Spinks, Gul Kizil, Tilman Rasche
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  – Peter Bergin, Jim Galvin, David Williams
• RISKGATE team:
  – Jill Harris, Barbara Whittaker, Darren Sprott, Carol Bond, Shirley Shi, Jirui Li

• CONTACTS: www.RISKGATE.org, p.kirsch@uq.edu.au 0488 797 977
NATIONAL COAL FATALITY OUTCOMES:
Australia, United States, India, China, South Africa
### Comparative coal mining fatalities (2006 to 2010)

<table>
<thead>
<tr>
<th>Country</th>
<th>Total number of fatalities</th>
<th>Total coal production (per million metric tonne)</th>
<th>Total number of hours worked (per million hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>9</td>
<td>2487.6</td>
<td>437.2</td>
</tr>
<tr>
<td>China</td>
<td>4712</td>
<td>13556.5</td>
<td>N/A</td>
</tr>
<tr>
<td>India</td>
<td>519</td>
<td>2578.3</td>
<td>4840.4</td>
</tr>
<tr>
<td>South Africa</td>
<td>85</td>
<td>1252.9</td>
<td>694.1</td>
</tr>
<tr>
<td>US</td>
<td>177</td>
<td>5119</td>
<td>832.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
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<th>Total number of fatalities</th>
<th>Total coal production (per million metric tonne)</th>
<th>Total number of hours worked (per million hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi</td>
<td>Aus of India</td>
<td>2% same</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td>Aus of India</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Aus of US</td>
<td>5% 50%</td>
<td>50%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>country</th>
<th>comparison</th>
<th>±</th>
<th>♦</th>
<th>♣</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aus of SA</td>
<td>10%</td>
<td>x2</td>
<td>65%</td>
<td></td>
</tr>
</tbody>
</table>
Australian mine OHS governance is:

- Risk-based
- Duty of care
- High worker representation

Regular mine work features:
- 24-7 (shift work)
- 12 hour shifts
- Roster schedules/patterns

Site specific fatigue management plans, that prove the risk of worker fatigue is sufficiently managed

Australian coal mines the safest in the world:

Coal mining fatal injury frequency rates (per million hours worked) for Australia, India, South Africa & US (2006-2010)
Fatal injury frequency rates (hours worked)

Surface & Underground

- **US**
- **South Africa**
- **India**
- **Australia**

High safety performance of Australia

Country | FIFR (hrs) 5yr average | FIFR (hrs) 5yr average
---|---|---
Australia | 0.02 | 0.03
India | 0.11 | 0.11
South Africa | 0.13 | 0.21
US | 0.21 | 0.27

Upper Big Branch explosion 29 died

Environmental (geotech) Organisational Technical Legislative Societal

Similar safety outcomes Underground mining more dangerous

Underground only

Surface only
## Hazards causing fatalities

### Top three hazards causing coal mining fatalities (2006-2010)

<table>
<thead>
<tr>
<th>Country</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td><strong>Collisions</strong> 3</td>
<td><strong>Isolation - mechanical</strong> 2</td>
<td><strong>Strata</strong> 1, <strong>Tyres</strong> 1, <strong>Isolation</strong> 1, <strong>Hydraulic</strong> 1, <strong>Slips/trips/falls</strong> 1</td>
</tr>
<tr>
<td>China</td>
<td><strong>Explosions</strong> 1619</td>
<td><strong>Inrush</strong> 715</td>
<td><strong>Strata</strong> 616</td>
</tr>
<tr>
<td>India</td>
<td><strong>Collisions</strong> 170</td>
<td><strong>Strata</strong> 120</td>
<td><strong>Isolation - mechanical</strong> 70</td>
</tr>
<tr>
<td>South Africa</td>
<td><strong>Collisions</strong> 30</td>
<td><strong>Strata</strong> 22</td>
<td><strong>Isolation - mechanical</strong> 16</td>
</tr>
<tr>
<td>US</td>
<td><strong>Explosions</strong> 49</td>
<td><strong>Collisions</strong> 46</td>
<td><strong>Strata</strong> 26</td>
</tr>
</tbody>
</table>

- Australia had only 1 death as a result of a major hazard, but they cause many deaths in other countries
- Collisions may not cause multiple deaths, but it does cause many deaths
Fatalities, Coal vs Metal, Australia, FY 1990-2014
Acknowlegdements

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