Process Safety in the Mining Industry – Rio Tinto Aluminium’s experience

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France Tremblay
Mireille Busque
Presentation Overview

1. Safety Share
2. Introduction to Rio Tinto and ERM
3. Process safety risk within the mining business
4. Rio Tinto Process Safety Requirements
5. Rio Tinto Aluminium Process Safety Experience
Gramercy, Louisiana, USA, July 5th 1999

- Power Failure / pumps stop
- Power house still delivering steam
- Pressure relief had been blocked
- Overflow piping is restricted with excessive scaling
- Digestor overpressurise – Explosion

Explosion destroys part of the plant
Injuring 29 workers
Rio Tinto Operations

Key
- Mines and mining projects
- Smelters, refineries, power facilities and processing plants remote from mine

Aluminium
Copper & Diamonds
Energy & Minerals
Iron Ore

North America
South America
Europe
Africa
Asia
Australasia
Rio Tinto’s Safety Strategy

Improving safety performance: A balanced approach

Fatality elimination
- Leverage SPIs
- Embed critical controls
- Human performance

Catastrophic event prevention
- Aviation
- Underground
- Process safety
- Geotech
- HSEC in design

Reducing injuries
- Contractor safety
- Hazard and risk awareness
- Severity focus
- Workplace conditions

Everyone goes home safe and healthy every day

Leadership and culture
Critical risks and controls
Systems and technology
Learning and communication
ERM Worldwide Locations

**NORTH AMERICA**
Over 80 offices in the US and Canada
2300+ professionals

**EUROPE, MIDDLE EAST AND AFRICA (EMEA)**
Over 35 offices in 20 countries
1200 + professionals

**LATIN AMERICA AND THE CARIBBEAN (LAC)**
Over 10 offices in 8 countries
400+ professionals

**ASIA PACIFIC**
Over 30 offices in 13 countries
900+ professionals

Presence in 40 countries ~ 160 offices.
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Mining Industry Hazards

- Mines
- Smelters
- Refineries
Rio Tinto Process Safety Hazards

- Molten Metal
- \( \text{H}_2\text{S} \)
- \( \text{NH}_3 \)
- \( \text{CO} \)
- Petroleum Products
Aluminium Production Steps

Bauxite
Al₂O₃

Alumina
Al(OH)₃

Aluminium
Al
Rio Tinto Aluminium

Rio Tinto Aluminium Atlantic Region:
1 Refinery / 9 Smelters / 6 Hydro Dams
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Process Safety – Group level Governance & Organisational Structure

The Group level governance include:
• Executive Sponsor (Risk Custodian)
• Process Safety Directorate
• Process Safety Working Group
Process Safety Directorate

AGENDA

Deliver the Process Safety Vision

Execute Deep Dive Recommendations

Continue on the journey to implement the Process Safety

Bring closure to the findings of the Occupied Buildings program

Process Safety Working Group
PSM through… HSEQ MS

- Process safety risk analysis
- Design and start-up processes
- Risk registers and reporting

Leadership and culture

- Workforce capability

- Process safety information
- Procedures and safe work practices
- Asset integrity
- Protection Systems

Emergency planning and response capability

MOC

Contractor management

Process safety incident reporting – tier 1-2-3

Process safety incident reporting – tier 4
Rio Tinto Process Safety model

Defining the Requirements

Standard
- The structure of the Standard aligns to the four component model, with corresponding elements.
- Each section (component) starts with the intent for each component and then defines the requirements for corresponding elements.

Group Procedures
- One for each component of the model.
- They describe the intent for each element of process safety and the additional requirements to that of the standard.

1. Commitment to process safety – Process safety governance, roles and capability
2. Understanding hazards and risks – Process safety hazard identification and risk analysis
3. Systems to manage risk – Process safety operational control and management
4. Learning from experience - Process safety monitoring and improvement
The D6 standard

Standard – Defines the minimum requirements

Contents – elements:

Governance, roles and capability
- Org resources, accountabilities & responsibilities
- Training, competency and awareness

Hazard identification and risk analysis
- Process safety information
- Hazard identification
- Inherent safety and plant layout
- Process hazard analysis

Operational control and management
- Pre start-up safety review
- Operating procedures
- Process safety critical controls
- Asset integrity
- Design, installation and fabrication
- Management of change

Monitoring and improvement
- Measuring and monitoring
- Performance assessment and auditing
Scope

The standard applies where the following process hazards exist:

a) Chemical and physical explosion
b) Fires involving process material
c) Loss of containment
d) Engulfment or physical impact
e) Third-party exposure

Operations most impacted by this standard are:

• Alumina refining
• Aluminium smelters
• Carbon plants
• Iron and titanium dioxide processing
• Copper processing
• Uranium processing
• Borate refining

• All other sites will now have to identify any in-scope process safety risk activities and implement the standard
Strategy for implementation

Implementation of the standard will be achieved by a combination of individual business plans for certain elements and a defined set of Group milestones where all sites follow a common plan for a number of agreed elements critical to process safety implementation.

Defined by Group
- Organisation resources, accountabilities and responsibilities
- Hazard identification
- Process hazard analysis
- Asset integrity
- Measuring and monitoring
- Occupied buildings*

Defined by business
- Develop own implementation plan to close gaps
- Set own targets for progress of each element with respect to PSM criteria
- All other elements, eg. Process Safety Information; Operating procedures; MOC, etc

The process safety implementation plan is governed by the PSD

* Central project
Assurance plan - 3 stage approach

**2016**
Field checks by Process Safety Working Group members

**2017**
Field checks
For monitoring progress to plans with focus on implementation assistance, knowledge sharing, improvement and guidance

**2018**
Field checks
Through 2020 for conformance to requirements based on individual site implementation plans

**2021**
Business conformance audits
Auditing for assurance to the Board
Program to be designed on the experience of the 2017 / 2018 program

Process safety implementation is governed and monitored by the Process Safety Directorate
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Rio Tinto Aluminium Process Safety Committee

Group PS Lead

PS Advisor for Atlantic Region
  Site PS Champion
  Site PS Champion

PS Advisor for Pacific Region
  Site PS Champion
  Site PS Champion
Rio Tinto Aluminium – PSM Deep Dive

Approach

- Team
- Boundary setting
- Kick Off

- Risk Register
- Bowtie
- Critical Control
- Improvement Requirements

- Develop action plan
- Review Operating strategies
- Review maintenance plan
- Identify training requirements
- ATO & PSI

- CCMP
- Training
- KPI integrated to lean board

- Risk Register update
- Verification audit
Rio Tinto Aluminium – PHA Replication Process

- Progress report on implementation
- Critical Control Monitoring Plans
- Audits
- Site level reviews

Identification and prioritization of the PS hazards

PLAN

Initial PHA

DO

• Conduct a PHRA at an initial site
• Selection of the critical controls and potential improvement in control strategy
• Definition of monitoring plan for the critical controls and potential improvements

PSM Deep Dive

ADJUST

Management

• Conduct a Gap Assessment based on initial PHRA results
• Implementation of corrective actions to fill the gaps
• Implement critical control monitoring plans/
Learning from experience

Incident Reporting tools have been adapted to include PS

• Each incident is reviewed for ranking
  − Tier approach for the actual loss
  − MRO (Maximum Reasonable Outcome)

• Same reporting and investigation requirements as for HSE

• All PS incident are reported at Business Level and Group Level
  − Critical Control solicitation are reported.
## Benefits and challenges

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<th>Benefits</th>
<th>Challenges</th>
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<td>• Better understanding of the risk</td>
<td>• Training and personnel movement</td>
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<td>• Standardization of control strategies</td>
<td>• Maintain focus</td>
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<td>• Holistic review of a specific Hazard</td>
<td>• Amount of effort required to fix some to the issues revealed by the assessment</td>
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<td>• Over all Risk Reduction</td>
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Questions ?