emesrt.org

*Safety by Design*

CELEBRATING 20 YEARS

2005 - 2025

EMESRT

Earth Moving Equipment Safety Round Table

# 2025 ACTIVITY REPORT

# Glossary of Terms

| | |
|---|---|
| ACARP | The Australian Coal Industry's Research Program |
| BI | Business Inputs |
| DP | Design Philosophy |
| EAG | EMESRT Advisory Group |
| EMESRT | Earth Moving Equipment Safety Round Table |
| FDSS | Fire Detection and Suppression System |
| ICMM | International Council on Mining and Metals |
| ICSV | Innovation for Cleaner Safer Vehicles |
| ISO | International Standards Organisation |
| OEM | Original Equipment Manufacturer |
| OTR | Off the Road |
| PR | Performance Requirement |
| TWG | Technical Working Group |
| VI | Vehicle Interaction |

EMESRT
Earth Moving Equipment Safety Round Table

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CELEBRATING 20 YEARS
2005 - 2025

# INTRODUCTION

EMESRT is pleased to present the 2025 Activity Report, marking 20 years of ongoing commitment to 'safety by design' in the mining industry.

Formalised in 2006, EMESRT is a global initiative involving major mining companies and remains the 'common voice' of the mining industry. EMESRT engages with key mining industry Original Equipment Manufacturers (OEM's) to advance the design of equipment and processes to improve safe operability and maintainability beyond Standards.

EMESRT is a respected high-influence global organisation that delivers industry-level understanding of complex health and safety problems. Its effectiveness rests on trusted relationships with OEM's and third parties. This trust is vital to sustain EMESRT's relevance and ability to influence the design outcomes.

EMESRT interacts by genuine two-way engagement with all stakeholders. Throughout its history, EMESRT, a mining company membership-based entity, has focussed on health and safety problems of significant consequence to the people in the mining industry

EMESRT's genuine two-way engagement delivers an industry-level understanding of complex health and safety problems. This collaborative effort ensures that a wide range of perspectives are considered when developing equipment design improvements.

The success of EMESRT is based on trusted relationships, open and honest dialogue, and a practical industry-level approach that:

- Defines the landscape of the problem
- Identifies stakeholders who can influence design changes
- Stimulate stakeholders to work on industry level improvements through collaboration.

This 2025 Activity Report provides a summary of EMESRT's activities, achievements, and project progress for the 2025 calendar year. It covers the four key industry projects, broader industry engagement, resources developed for industry use, and other information of relevance to stakeholders.

The EMESRT Advisory Group trusts that this report is both pertinent and useful to readers, and reflects on 20 years of collaboration while looking ahead to the challenges and opportunities that remain.

> "Today around the world, no Mining company, OEM or Tech co. discussion on Vehicle Interaction occurs without using the common language and principles of EMESRT. EMESRT continues to unite industry. Looking forward to the future.

Michael Murphy
ICMM Co Chair Vehicle Interaction

# About EMESRT

***Working with industry since 2006***

EMESRT is a global 'safety by design' initiative established in 2006 by mining companies to fill the functional performance expectations gap between earth moving equipment users and equipment designers.

## VISION

A mining industry free of fatalities, injuries and occupational illnesses associated with operating and maintaining earth moving equipment.

## MISSION

Accelerate development and adoption of leading practice designs to minimise the risk of health and safety through a process of Original Equipment Manufacturer (OEM), contractor and user engagement.

## KEY PRINCIPLES

- Design beyond standards
- Balancing engineering and behaviour (human factors)
- Recognising the value of task-based design review
- Appreciate that the OEM does its best with the end user involve d
- Open genuine two-way engagement is key


## ACKNOWLEDGEMENT

The individual contributions of member company representatives, technical working group (TWG) members, and other individuals of the wider EMESRT community, including mine operators, original equipment manufacturers, third-party equipment suppliers, researchers, industry associations, and others, are acknowledged and much appreciated by the EMESRT Advisory Group (EAG).


As part of the EMESRT success story, their participation in meetings, seminars, webinars, and other events since 2006 has directly aided in the realisation of the EMESRT mission.

## 2025 MEMBERS

**TIER 1**

Agnico Eagle
Alcoa
Anglo American
AngloGold Ashanti
BHP
Glencore
Kiewit
New Hope Group
Rio Tinto
Teck Resources
Vale
Whitehaven Coal

**TIER 2**

Coronado
Kinross
South32
Tronox

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## ACTIVITIES SCOPE

EMESRT seeks to foster candid dialogue, transparent industry-level collaboration, open sharing of non-commercial information, and active stakeholder engagement.

The EMESRT Advisory Group (EAG) is aware of managing anti-trust issues and clearly communicates EMESRT's scope in all workshops and other industry forums. This process has been in place since OEM engagement work commenced in 2006.

In scope; EMESRT will:

- Focus on the design of earth moving equipment in surface and underground mines
- Provide aligned design expectations based on hazards
- Involve interested mining companies in the industry
- Share openly with all interested OEM's and other third-party suppliers
- Listen, consider and value OEM and third-party supplier contributions
- Provide information on leading practice to OEM's and third-party suppliers
- Share leading practice to assist mining equipment users in achieving health, safety and environmental compliance goals

Out of scope; EMESRT will not:

- Discuss commercial issues or anything of an anti-trust nature
- Provide approval for OEM or third-party designs
- Share OEM confidential information with other OEM's or third-party suppliers
- Impose adoption of solutions on member company sites

## ANNUAL WORK PLAN

The EAG meets annually to discuss the progress of current projects, review and amend the strategic plan, and document future focus areas.

The work plan process includes:

- Reviewing the progress of current industry projects (including outstanding activities and the potential end date)
- Identifying prevalent industry issues that members are highlighting
- Structuring responses that are within EMESRT's stated scope of operation
- Appointing project lead(s)
- Confirming the strategy and plans
- Setting timelines and allocating resources
- Allocating budget(s)
- Determining the following year's membership fees based on the identified work plan and allocated budget

The EAG establishes a Technical Working Group (TWG) for each project. Each TWG includes multiple member representatives, OEM's, third-party suppliers, industry experts and others with relevant expertise. The EAG and TWG's meet regularly to discuss the progress of each industry project.

# ADVISORY GROUP

***Each EAG brings a wealth of knowledge, diversity of thinking and experience to the table.***

The EAG plays a crucial role in guiding EMESRT initiatives and ensuring the continuous improvement of leading practices in the mining industry.

The EAG comprises one representative from each Tier One member company.

An EAG member can lead multiple EMESRT industry projects. As a project lead, the member representative provides strategic direction for all technical working group activities, ensuring consistency in messaging to OEM's and third-party manufacturers and suppliers.

The EAG provides valuable insights and experiences that enhance the effectiveness of EMESRT's program of activities.

## OBJECTIVES OF THE EAG

The EAG has several primary objectives. These include:

- Development and implementation of EMESRTs strategic work plans and initiatives:
  - Identifying, rigorously defining, and documenting the problem landscape to be addressed from the perspective of mining equipment users and agreeing on appropriate actions to stimulate industry activity to address the problem
  - Promoting collaboration among key industry stakeholders to address equipment safety challenges
  - Preparing a draft industry improvement project scope and project plans

- Building project communities through subject-focused technical working groups.
- Sharing knowledge and experiences to facilitate continuous improvements through stakeholder education on the problem.

> ***"Since joining EMESRT three years ago, it has given me the opportunity to contribute and be part of change in the industry, ensuring workers can go home safely to their families."***
>
> *Corey Packham, Whitehaven Coal*

## KEY RESPONSIBILITIES OF THE EAG

The EAG contributes to EMESRT's vision and purpose by fulfilling a range of responsibilities.

These include:

1. Participating in EAG monthly meetings to discuss membership, activity funding, current industry focus area project progress, stakeholder engagement opportunities, and industry emerging issue.
2. Participating in the EAG strategic planning annual workshop
3. Providing input on the development of industry resource material.
4. Collaborating with other industry organisations to promote leading practices in equipment design
5. Offering guidance on the communication strategies employed by EMESRT to raise awareness

## BENEFITS OF BEING AN EAG MEMBER

Being a part of the advisory group offers numerous benefits to EMESRT members. These include:

- Access to a network of industry experts and professionals which provide:
  - Opportunities for collaboration and knowledge sharing
  - Exposure to the latest safety innovations and technologies
  - Exposure to global safety trends and leading practices
- Early involvement in developing industry resource materials
- Ability to influence earth-moving equipment design improvements by direct collaboration with OEM's
- Influence in the development of industry standards through EMESRT Liaison status with International Standards Organisation (ISO) committees

# STRATEGIC PLANNING WORKSHOP


Image (Left to Right): Corey Packham (Whitehaven Coal) Newcastle, Kostas Apostolidis (BHP) Adelaide, Peter Hasler (Alcoa) Perth, Mark Geerssen (ex-Rio Tinto) Brisbane, Eve McDonald (EMESRT) Brisbane, Tony Egan (Glencore) Newcastle, Holly Kissner (EMESRT) Brisbane, Richard Ganza (Rio Tinto) Brisbane.

**Online**
Greg Henshall
(AngloGold Ashanti)
Colorado

**Apologies**
Daenan Fairburn, Kiewit, Texas
Damien Bilsborow, Agnico Eagle, Melbourne
Kent Flaherty, New Hope Group, Newcastle
Roberto Martinez, Teck, Santiago

## STRATEGIC PLANNING WORKSHOP

From 11–13 November 2025, the EMESRT Advisory Group convened in Brisbane, Australia, for its annual strategic planning workshop.

The three-day workshop provided an opportunity to reflect on EMESRT's achievements to date and to confirm priority industry focus areas for 2026 and beyond.

Through structured discussion and collaboration, the Advisory Group reviewed progress across current projects, considered emerging risks and challenges, and aligned on where EMESRT can continue to add the greatest industry value.

Following the workshop, detailed activity planning will progress for the confirmed focus-area projects. This will include identifying key actions, clarifying roles and responsibilities, and updating project plans to reflect agreed scope, timelines, and resource requirements.

Further detail on EMESRT's current industry focus areas, achievements, and planned future work is outlined in the following sections of this report.

# WORKSHOP SUMMARY

The EMESRT Advisory Group Strategic Planning Workshop provided three days of focused discussion, and confirmed where EMESRT should concentrate its efforts to deliver the most impact, moving beyond strategy definition toward practical adoption and capability uplift. These outcomes position EMESRT to continue accelerating the development and adoption of leading practice designs across the global mining industry.

### 1. Clear confirmation of priority focus areas for the next 2–3 years

The Advisory Group reaffirmed that the four existing projects, Vehicle Interaction, Fire Management, Tyre and Rim Management, and Exposure to Live Work, remain the highest industry priorities. No new projects will commence in 2026, allowing EMESRT to concentrate resources on completing, embedding, and scaling impact across these areas.

### 2. Shift from framework development to capability uplift and industry adoption

Across all projects, the group agreed the next phase must focus on education, awareness, and consistent application. This includes development of learning modules, and clearer communication of EMESRT resources materials so industry can better apply them in procurement, design and operational decision making.

### 3. Stronger emphasis on human factors and task-based design

The workshop reinforced that safety outcomes require balancing engineering controls with human behaviour, decision-making, and error-tolerance. There was strong consensus that OEM engagement must increasingly consider serviceability, cognitive load, and task-based design reviews to reduce reliance on procedural controls alone.

### 4. Agreement to develop consistent, industry-wide data and validation approaches

Progressing common taxonomies, the operational effectiveness baseline validation process, resources particularly for Fire Management and Exposure to Live Work, was identified as a priority. The advisory group supported pilot trials of the operational effectiveness baseline validation process at member sites in 2026

### 5. Governance, leadership continuity, and momentum strengthened

The Advisory Group confirmed governance arrangements, budget direction for 2026, and leadership succession planning. There was agreement to increase Advisory Group strategic reviews frequency to twice yearly to maintain momentum.

# MEMBERSHIP

EMESRT continued to strengthen its global representation in 2025, welcoming Agnico Eagle as a Tier 1 member and Kinross Gold Corporation as a Tier 2 member.

Our new members join existing Tier 1 members; Alcoa, Anglo American, AngloGold Ashanti, BHP, Glencore, Kiewit, New Hope Group, Rio Tinto, Teck Resources, Vale, and Whitehaven Coal. Tier 2 members include Coronado Global Resources, South32 and Tronox.

EMESRT member company representatives bring a wealth of knowledge, diversity of thinking, and experience to the table and collaborate closely with OEMs and equipment designers to influence improved health and safety outcomes.

Advisory group members actively promote the EMESRT engagement process at industry forums to a wide international audience and have introduced resource materials developed by EMESRT to help understand the hazards faced by operators and maintainers of earth-moving equipment.

Although EMESRT membership is limited to mining companies, EMESRT has a global community of individuals representing mining houses, original equipment manufacturers, third-party suppliers, researchers, and other companies that are part of the technical working groups.

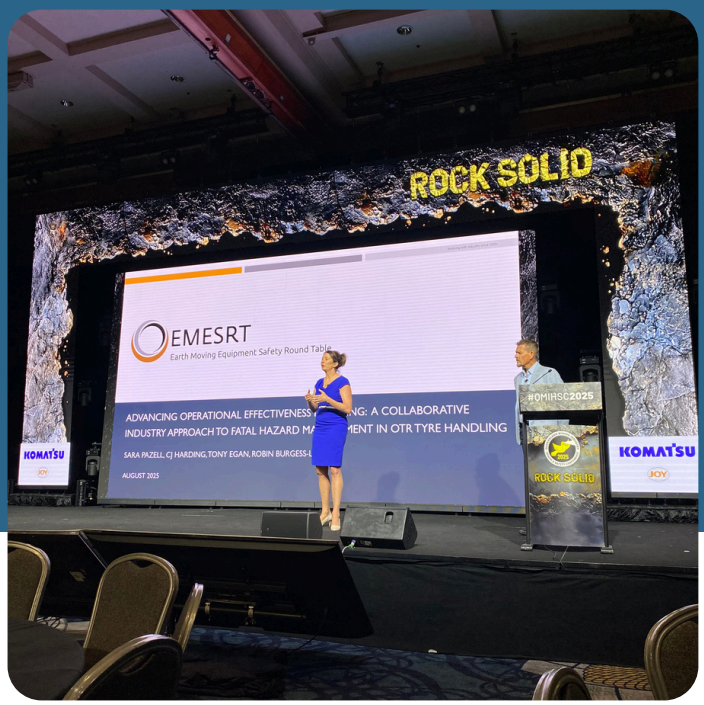
## TECHNICAL WORKING GROUPS

To achieve its vision and purpose, EMESRT has established working groups that collaborate on specific focus areas. These groups bring together industry experts, equipment manufacturers, mining companies, technology providers, end users, regulators, researchers, and others to share knowledge and experiences.

In 2025, working group activity continued to focus on EMESRT's four core priority areas: vehicle interaction, tyre management, exposure to live work and fire management.

Participation across EMESRT working groups continued to grow in 2025, strengthening the depth and diversity of technical expertise supporting EMESRT's work.

The EMESRT Advisory Group thanks all members and contributors for their ongoing commitment, collaboration and support. EMESRT looks forward to continuing this collective, industry driven approach in 2026.




# INDUSTRY ENGAGEMENT

Industry engagement is central to driving collaboration and influencing safer earth-moving equipment design.

EMESRT's collaborative model fosters trust, knowledge sharing, and continuous improvement by bringing together mining companies, OEMs, regulators, researchers, service providers, and end users to exchange leading practices and address shared safety challenges.

Through regularly hosted bi-monthly meetings, targeted workshops, and webinars, the global EMESRT community openly discusses safety issues, collectively defines problems, and identifies opportunities for design improvement.

This engagement also strengthens alignment across stakeholders and helps translate operational learnings into practical problem focused design improvements.

EMESRT also presented and participated in the following mining sector events:

## QUEENSLAND MINING INDUSTRY HEALTH AND SAFETY CONFERENCE GOLD COAST, AUSTRALIA

On 19 August 2025, EMESRT was pleased to contribute to the Queensland Mining Industry Health and Safety Conference on the Gold Coast, with a presentation by Dr Sara Pazell (ViVA Health at Work) and Clinton J. Harding (Thiess).

Their session, *"Advancing Operational Effectiveness in Mining: A Collaborative Industry Approach to Fatal Hazard Management in Off-the-Road Tyre Handling"*, highlighted the power of industry-wide collaboration in tackling complex industry challenges.

## ICMM ICSV LEADING SITES FORUM PERTH, AUSTRALIA

In June 2025, the International Council on Mining and Metals (ICMM), in collaboration with EMESRT, convened the fourth Leading Sites Forum in Perth, bringing together industry leading mining companies to better understand and utilise the EMESRT Vehicle Interaction Body of Knowledge resource materials.

The three-day forum focused on practical implementation of the Vehicle Interaction improvement journey, grounded in the EMESRT 9-Layers of Defence framework. 47 participants explored each defensive layer in depth, from site design and vehicle segregation through to operator advisory systems and machine intervention technologies, examining real-world experiences, challenges and success factors across leading operations.

The forum reinforced the importance of structured, collaborative layered problem risk management, and definition, coordinated deployment planning. It also reaffirmed EMESRT's role in supporting industry alignment and advancing practical methodologies that reduce the exposure to high-potential vehicle interaction incidents.


## IMARC EXPO SYDNEY, AUSTRALIA

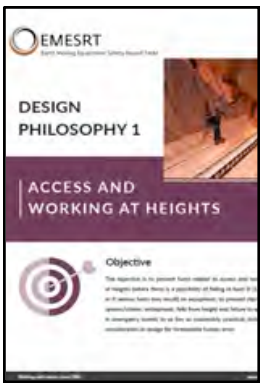
In October 2025, EMESRT presented a panel session at International Mining and Resources Conference (IMARC), Australia's largest mining and resources conference, titled "Exemplifying Collaborative Development of Technology Solutions to Reduce the Risk of Fatalities."

The session highlighted EMESRT's role in convening mining companies, OEM's and technology partners to address complex equipment safety challenges through structured collaboration. By showcasing practical examples of industry alignment and technology-driven risk reduction, EMESRT reinforced its position as a trusted, neutral forum advancing fatality prevention across the global mining sector.

# DESIGN PHILOSOPHIES: THE BACKBONE OF EMESRT

EMESRT published a unified set of Design Philosophies (DP's) for earth-moving equipment used in mining operations. The DP's provide an overall understanding of the material problems that create unwanted exposure for users, with an emphasis on human-centered design deficiencies.

These philosophies, listed below, are part of EMESRTs broader mission to accelerate the development and adoption of leading practice designs that minimise health and safety hazards in the mining industry.

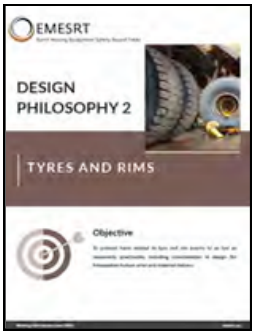



## DP-1: ACCESS AND WORKING AT HEIGHTS

The objective is to prevent harm related to access and working at heights (where there is a possibility of falling at least 6' (1.8 m) or if serious harm may result) on equipment; to prevent slip/trips, sprains/strains, entrapment, falls from height and failure to egress in emergency events to as low as reasonably practical, including consideration in design for foreseeable human error. For example, injury during access to equipment and its routine service and inspection points, work platforms and operator workstations due to poor location of service and inspection points, etc.

## DP-2: TYRES AND RIMS

The objective is to prevent harm related to tyre and rim events to as low as reasonably practicable, including consideration in design for foreseeable human error and material failures. For example, harm due to uncontrolled release of pressure from the tyre and rim assembly during operation and maintenance, etc.





## DP-3: EXPOSURE TO HARMFUL ENERGIES

The objective is to prevent harm related to exposure to moving machine parts, failure of hydraulic equipment or systems, or other energy sources, such as compressed gases, heat, electricity, electromagnetic fields and gravity to as low as reasonably practical, including consideration in design for foreseeable human error. For example, harm from exposure to energies such as heat, electricity, radiation, compressed air, high pressure fluids (including hydraulic fluids) and falling objects, etc.


## DP-4: FIRE

The objective is to prevent harm related to equipment fires to as low as reasonably practical, including consideration in design for foreseeable human error. For example, harm from fire arising from damage (including heating, melting and chaffing) to electrical cables and components, hydraulic hoses and fuel lines due to design inadequacies including poor location, inadequate separation of fuel and ignition sources, and flaws in clamping or restraints, etc.

## DP-5: MACHINE OPERATION AND CONTROL


The objective is to prevent harm, during machine operation and control, to as low as reasonably practical, including consideration in design for foreseeable human error. For example, musculoskeletal injury or illness due to workstation design (including seat and seatbelt design, openings and cab height) that promotes biomechanically compromised postures for the 5th percentile female to 95th percentile male body dimensions, etc.


## DP-6: HEALTH IMPACTING FACTORS

The objective is to prevent harm from exposure to health impacting factors to as low as reasonably practical, including consideration in design for foreseeable human error. For example, harm from exposure to health hazards such as extreme temperatures, excessive vibration and noise levels, particulates, gases and vapours within the operating workspace; and musculoskeletal factors due to poor ergonomic design of equipment and controls, etc.

## DP-7: MANUAL TASKS


The objective is to prevent harm due to manual tasks during installation, maintenance and operations of equipment, to as low as reasonably practical, including consideration in design for foreseeable human error and anthropometric range. For example, musculoskeletal injury from exposure to risk factors such as forceful exertion, awkward or static posture, repetition or prolonged duration, and hand-arm and/or whole-body vibration due to manual tasks associated with installing, operating and maintaining the equipment, etc.


## DP-8: CONFINED SPACES AND RESTRICTED WORK AREAS

The objective is to prevent harm to people working in confined spaces and restricted work areas to as low as reasonably practical, including consideration in design for foreseeable human error. For example, asphyxiation from irrespirable atmosphere due to lack of adequate ventilation, etc.

# INDUSTRY LEVEL PROJECTS

EMESRT adopts a structured approach to project establishment and management. It rigorously defines and documents each project, prepares an industry landscape, identifies key stakeholders, builds project communities, coordinates resources, and articulates project deliverables.

Each project is led by an EMESRT advisory group member who provides strategic project oversight and coordinates the technical working group activities on a voluntary basis.

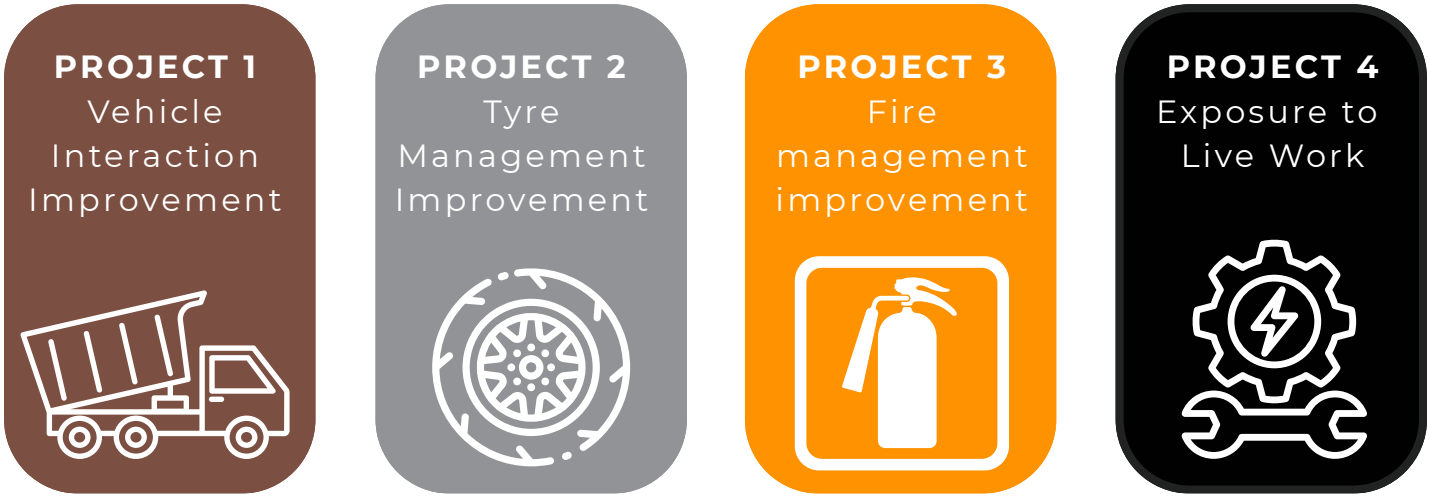
The project lead is responsible for achieving specified outcomes and leading the strategic direction of the technical working group.

EMESRT applies a formal project management methodology to all projects and, utilising the control effectiveness approach, provides users with practical and usable results.

At the end of 2025, EMESRT was leading four active industry-level projects:

1. Vehicle interaction improvement
2. Tyre management improvement
3. Fire management improvement
4. Exposure to Live Work

The first three projects have established global technical working groups delivering on agreed project objectives, with Exposure to Live Work expected to deliver project outcomes in 2026.



# VEHICLE INTERACTION IMPROVEMENT

This industry project is led by Glencore representative Tony Egan.

**Project objective:** to improve the effectiveness and reliability of vehicle interaction controls in mining.

## INTRODUCTION

A major challenge in reducing fatalities in the mining industry is improving control systems to manage the operation of mobile equipment and the transportation of people and materials.

Vehicle interaction is consistently one of the leading causes of fatalities in mining globally.

## THIS INDUSTRY PROJECT

The EMESRT Vehicle Interaction Improvement Project aims to enhance the effectiveness and reliability of vehicle interaction controls in the mining industry. This project addresses the significant safety hazards associated with vehicle interactions, which are a major cause of fatalities and serious injuries in mining operations.

Key aspects of the project include:

- **Industry Collaboration:** Bringing together industry experts, equipment manufacturers, and other stakeholders to share knowledge and leading practices.
- **Technology Integration:** Implementing and integrating new technologies to improve vehicle interaction controls
- **Resource Development:** In collaboration with industry, develop informative and useful industry resource materials aimed at improving safety and operational efficiency in mining.
- **Continuous Improvement:** Focusing on ongoing improvements and updates to ensure the effectiveness of vehicle interaction controls.

The project leverages the collective expertise of industry stakeholders to develop solutions that enhance safety, asset integrity, efficiency, and productivity in mining operations.

The project builds on EMESRT's earlier work in developing Design Philosophy 5: Machine Operation and Control.

Updated in 2024, Design Philosophy 5 (DP- 5): Machine Operation and Control objective is to prevent harm, during machine operation and control, to as low as reasonably practical, including consideration in design for foreseeable human error. A full list of DP 5's intended design outcomes are available on the EMESRT website.

## PROJECT COMMUNITY

In 2025, there were three vehicle interaction projects that primarily focused on sector educational uplift:

1. Strengthening the 9 Layers of Defence Guide
2. 9 Layers of Defence Video Series
3. Technical Vehicle Interaction Safe State Integration & Change Management

Each project had global working group representation comprising:

- OEM's
- Mining equipment users
- Technology providers
- Industry experts
- Regulators
- Researchers
- And other interested parties

Working group member contributions and insights are invaluable, and EMESRT looks forward to continuing this important work in the 2026.

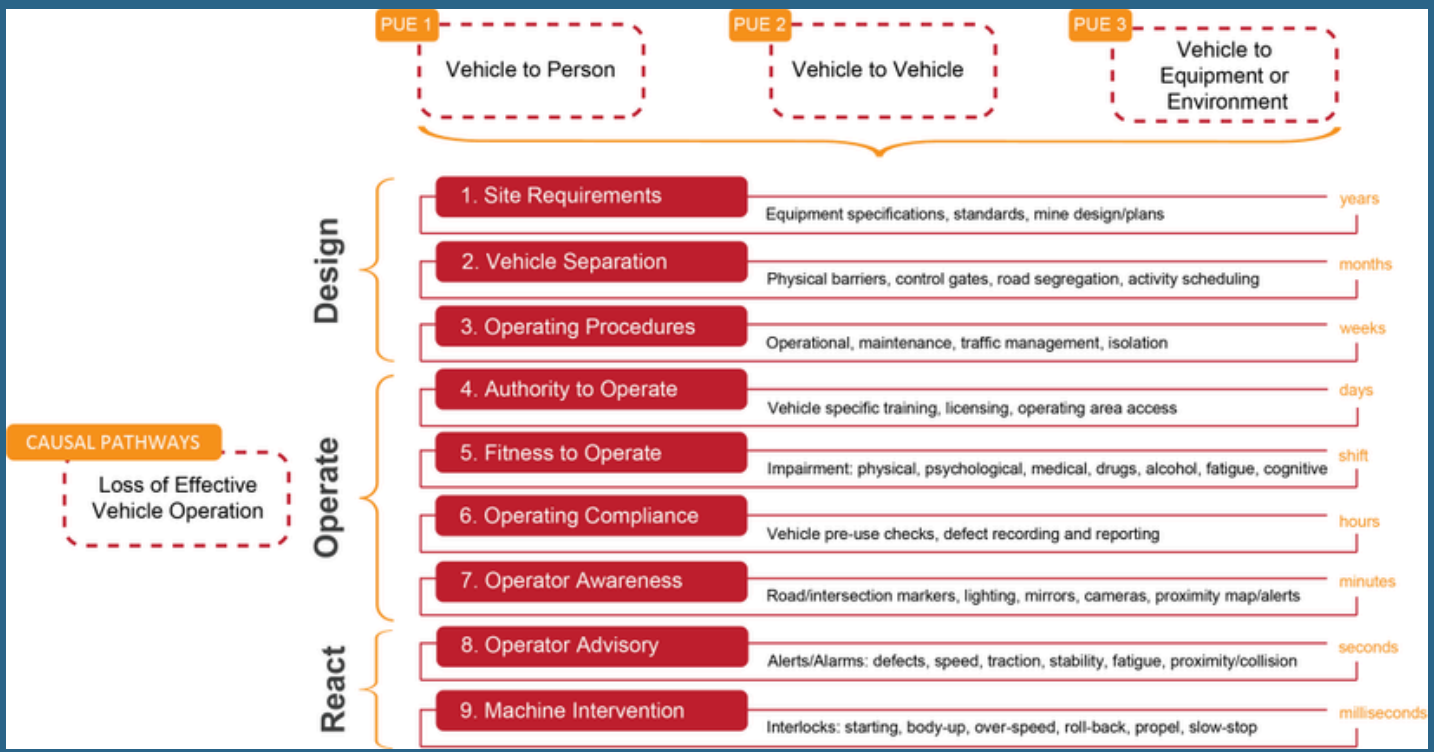
### Strengthening the 9-Layers of Defence

In 2025, the EMESRT Vehicle Interaction Working Group accelerated industry implementation of the 9-Layers of Defence framework, strengthening regulatory alignment, expanding practical tools, and deepening technical collaboration across mining operations globally.

The 9-Layers of Defence model was refined to improve clarity and global relevance, including updating terminology.

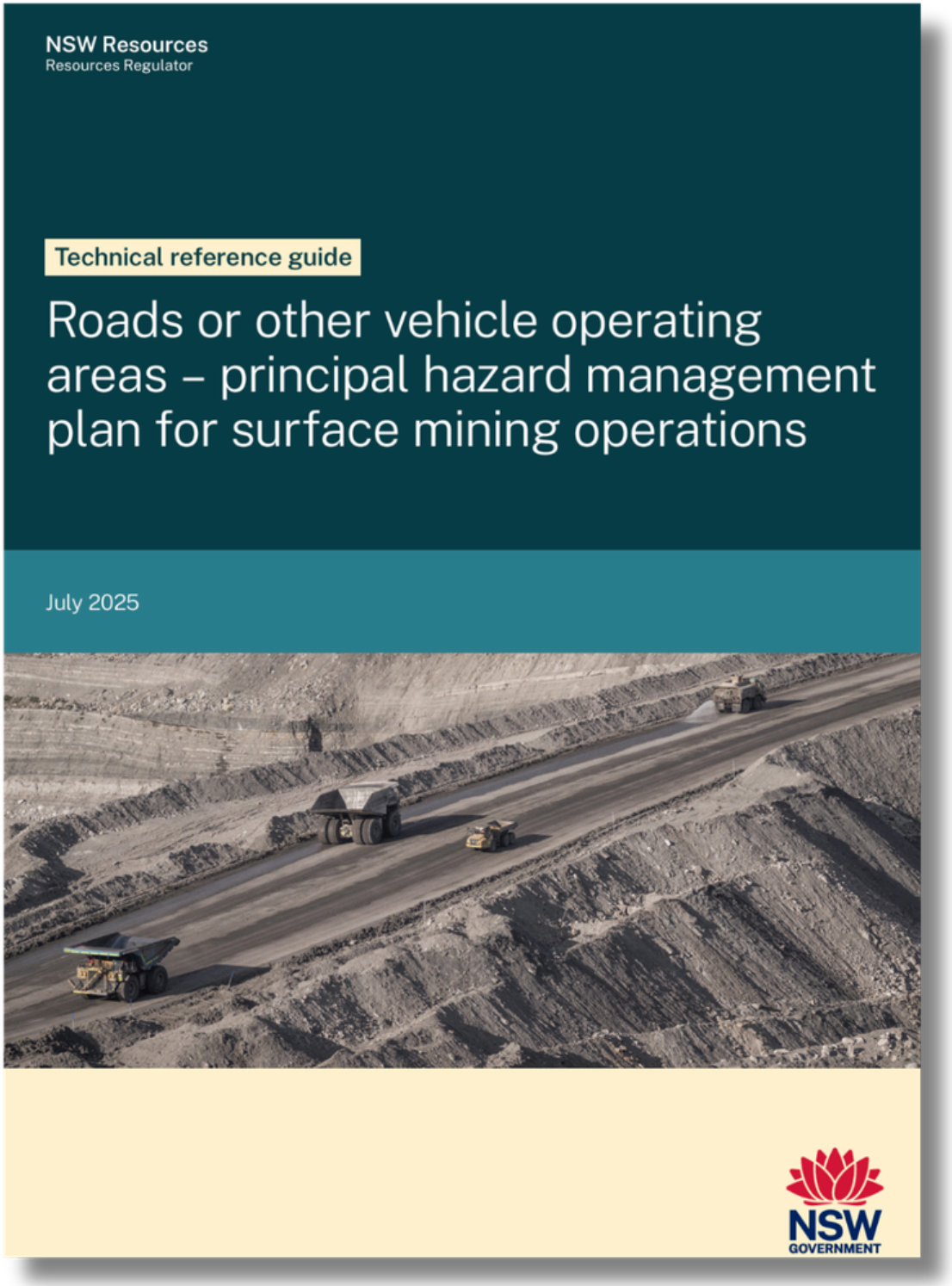
These updates were embedded across all EMESRT vehicle interaction resources, reinforcing the importance of foundational operational design before higher-level technology deployment.

## 9 LAYERS OF DEFENCE VEHICLE INTERACTION DIAGRAM



## REGULATORY ALIGNMENT

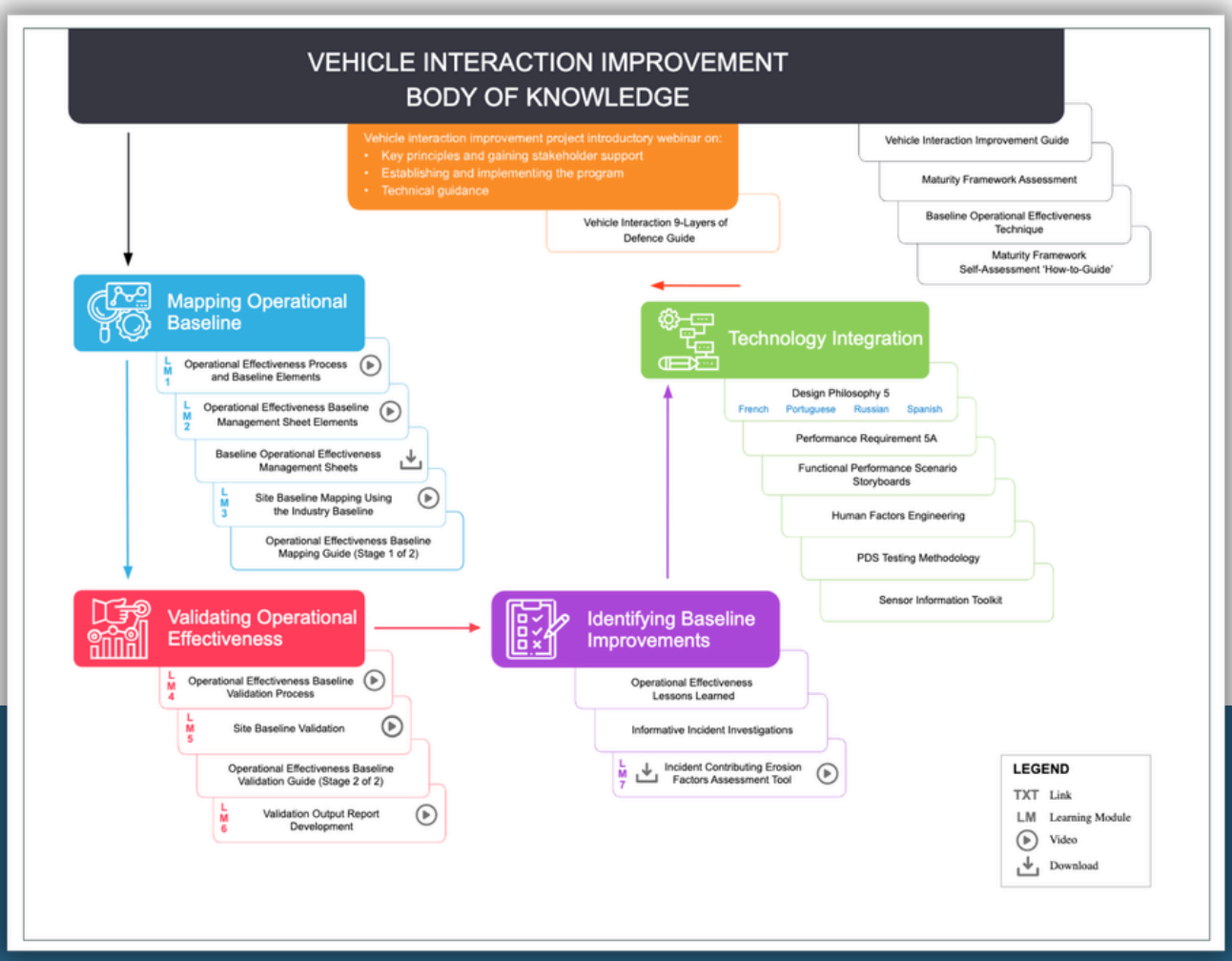
A significant milestone was the publication of the New South Wales Resources Regulator Technical Reference Guide (TRG), developed in consultation with EMESRT and aligned to the 9-Layers of Defence Guideline. This established a common language for managing vehicle interaction risks across operations of varying maturity, including quarries and smaller sites.



## NEW INDUSTRY RESOURCES: BODY OF KNOWLEDGE UPDATES

2025 saw continued progress made in strengthening the Vehicle Interaction Improvement Body of Knowledge (BoK) as a structured set of industry resources supporting mining operations to systematically understand, assess, and improve vehicle interaction controls. The BoK provides a practical improvement pathway, enabling sites to establish their control baseline, identify gaps, and guide technology integration in a structured and repeatable manner.

Key development focused on maturing complementary tools that support baseline definition, validation, and continuous improvement, including the 9 Layers of Defence approach, maturity and self-assessment resources, scenario storyboards, lessons-learned materials, and sensor and testing guidance. Together, these resources help create a shared understanding of vehicle interaction hazards and support more consistent implementation of improvements.



## OPERATIONAL EFFECTIVENESS VALIDATION TECHNIQUE: A CORE IMPROVEMENT ENABLER

A major advancement was the ongoing development and application of the Operational Effectiveness Validation technique.

The technique enable sites to:

- document control intent and expected performance
- capture how controls operate in practice verus design intent
- assess assurance and monitoring activities
- identify gaps between design intent and practical operational practice
- identify, prioritise and track targeted improvement actions

Beyond baseline mapping and validation, the process enables internal capability-building by allowing sites to undertake structured effectiveness reviews without heavy reliance on external resources.

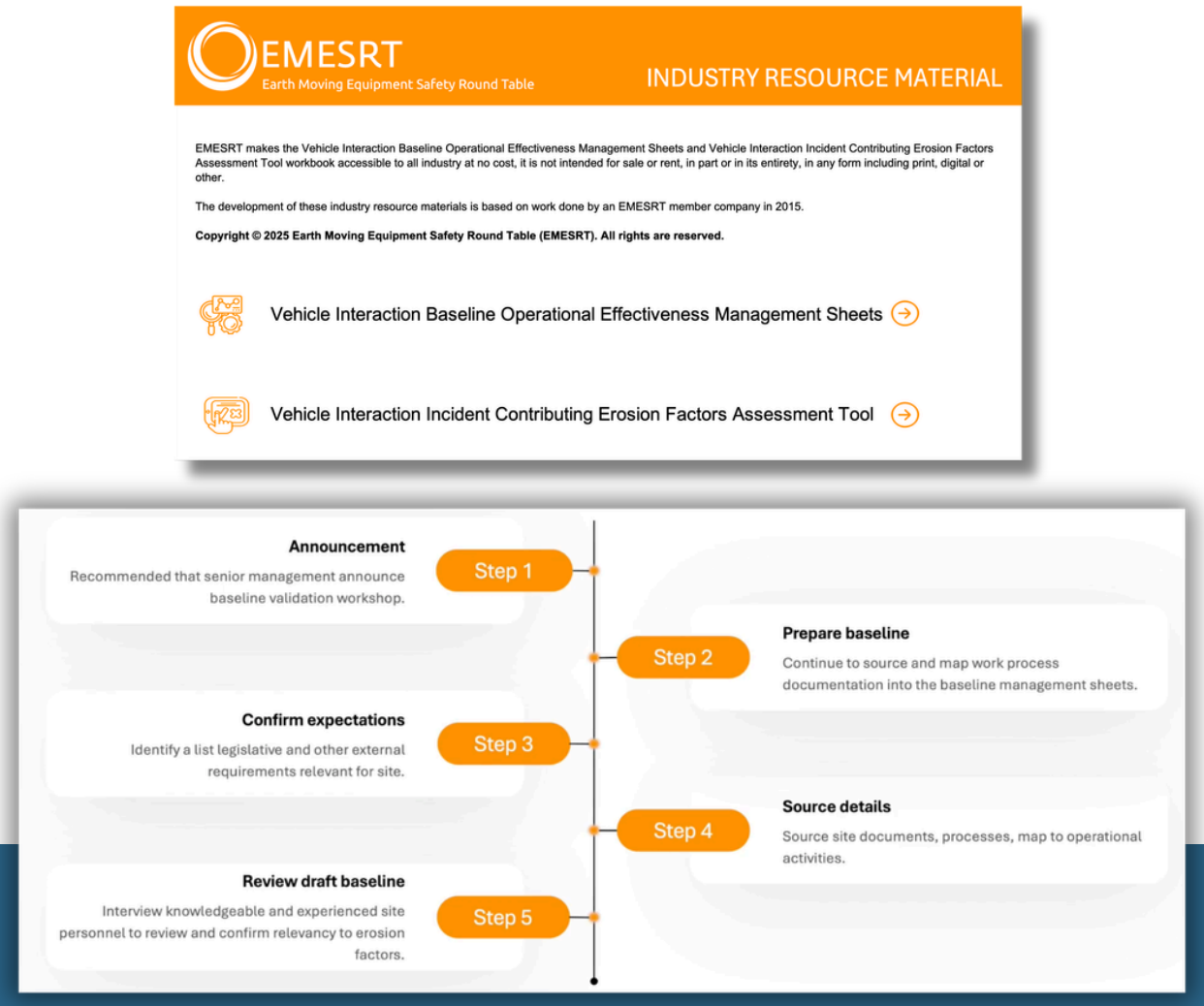



Image: Resources include videos and worksheets to help sites prepare for validation

## VEHICLE INTERACTION VIDEO SERIES

A key 2025 initiative was the development of the 9 Layers of Defence video series, initiated through Whitehaven Coal who agreed an enforceable undertaking with the NSW Resources Regulator. The series is intended to translate the conceptual 9 Layers framework into practical, site-relevant video learning resources that improve understanding of how layered controls work together to prevent vehicle interactions.

Significant progress was achieved during the year, including two face-to-face script development workshops that brought together operational, technical, and human factors perspectives to enable the content to reflect practical application challenges. Industry users personas were developed to base the scenarios in authentic operation contexts, helping demonstrate how different roles interact with controls and where breakdowns can occur. Draft scripts were completed across multiple defensive layers, and a dedicated steering group was established to provide governance, maintain technical accuracy, and ensure alignment with broader EMESRT resources.

Each video is designed as a concise 3–5 minute learning asset suitable for toolbox talks, pre-start discussions, and workforce refresher activities, supporting consistent communication of vehicle interaction risks and reinforcing the importance of maintaining control effectiveness across the defensive layers.

Video production is scheduled for the beginning of 2026 with a video release date of mid 2026.

**Image: Video Production Mock Up**

## TECHNICAL COLLABORATION WORKING GROUP

In 2025, ISO 21815 Parts 4 and 5 progressed toward publication, while future standards activity increasingly focused on automation and autonomy verification, including the application of human factors methodologies. EMESRT's existing Vehicle Interaction Working Group continued to provide a forum for addressing these evolving technical challenges and supporting industry alignment.

To enable deeper technical problem-solving, a user-only technical sub-group was established in 2025. This sub-group is focused on safe-state functionality and interoperability, and the practical integration of collision awareness technologies, reflecting industry demand for more detailed technical collaboration beyond high-levl guidance. The sub-group has also prioritised advancement and application of PR-5A, with particular emphasis on supporting consistent interpretation and implementation across operations. Broader industry engagement is anticipated to increase throughout 2026.

PR-5A remains a key enabler in the collision awareness technology integration process for Vehicle Interaction improvement. This resource provides clarity on the role of technology across Layers 7, 8, and 9 of the 9 Layers of Defence model, illustrating how these layers contribute to preventing unwanted vehicle interactions.

## DRAGLINE FUNCTIONAL PERFORMANCE SCENARIO STORYBOARDS

Industry collaboration continued on dragline functional performance scenario storyboards. A dedicated sub-group reviewed and refined seven core scenarios, with further workshop sessions planned to finalise functional performance parameters early 2026.

This work addresses persistent dragline-related interaction risks through practical visual guidance.


## ICMM EMESRT VEHICLE INTERACTION LEADING SITES FORUM PERTH, 24–26 JUNE 2025

The EMESRT and International Council on Mining and Metals (ICMM) Vehicle Interaction Leading Sites Program is a collaborative initiative aimed at improving vehicle interaction safety in the mining industry. The program is a joint effort between ICMM and EMESRT, under the Innovation for Cleaner Safer Vehicle (ICSV) initiative.

Mobile equipment accidents are the highest fatality category in ICMM member mining companies. Ongoing collaboration between mine operators, industry associations, researchers, OEM's and third-party technology providers continue to develop and refine resources that will assist sites to integrate technology while supporting the development of Capable Solutions for global market uptake.

In June 2025, ICMM in partnership with EMESRT and hosted by Gold Fields, convened the Vehicle Interaction (VI) Leading Sites Forum in Perth. The three-day forum brought together mining companies, OEMs, and industry leaders to accelerate practical implementation of the EMESRT 9-Layers of Defence framework.

### Day 1 – Foundations and Baseline Validation

The forum began with a deep dive into the 9-Layers of Defence model and its practical application through the Vehicle Interaction Baseline Operational Effectiveness validation process. Participants explored real-world examples across all layers, from site requirements and vehicle separation through to operator advisory and machine intervention. Breakout sessions focused on identifying operational drift and erosion factors, reinforcing the importance of strengthening foundational controls before relying on advanced technology.

### Day 2 – Implementation Challenges and Technology Integration

Day two addressed the practical realities of implementing vehicle interaction improvements. Discussions centred on sequencing improvement efforts, building organisational momentum, and determining where technology fits within a structured risk management approach. Case studies and technology readiness frameworks were presented, alongside facilitated discussions on supplier challenges and integration barriers. The forum reinforced that sustainable improvement requires alignment between operational discipline, human factors, and technology deployment.

### Day 3 – Industry Resources and Leveraging the Program

The final day focused on consolidating key learnings and reviewing available industry resources. Participants explored how to better leverage the Leading Sites Program, strengthen business cases, and identify priority actions upon returning to site. Company breakout sessions encouraged clear commitments to practical next steps.

### Overall Impact

The 2025 Leading Sites Forum reinforced industry alignment around a structured, layered approach to vehicle interaction risk management. It strengthened collaboration between mining companies, OEMs and regulators, highlighted the importance of baseline validation before technology escalation, and accelerated collective capability to reduce fatal and high-potential incidents across surface and underground operations.

# TYRE MANAGEMENT IMPROVEMENT

This industry project is led by EMESRT representatives from Glencore, Tony Egan and Whitehaven Coal, Corey Packham.

Project objective: to provide tyre and rim designers and users with structured information that enables the prevention of unwanted tyre and rim events and the mitigation of the consequences should an event occur.

## INTRODUCTION

Off-the-road tyre maintenance is crucial in mining operations as it enhances safety, efficiency, and cost-effectiveness. However, working with off-the-road tyres can be potentially dangerous due to their large size and mass with the uncontrolled release of stored energy resulting in serious, even fatal, consequences.

Industry statistics show that tyre fitters are the highest fatality occupational group in vehicle servicing within the mining industry.

## THIS INDUSTRY PROJECT

Formed in 2018, The EMESRT Tyre Management Improvement Project aims to enhance the safety and effectiveness of tyre and rim management in the mining industry. Established in response to significant incidents involving tyres and rims, this project focuses on providing structured information to designers and users to prevent and mitigate the consequences of tyre and rim events.

Key aspects of the project include:

- **Industry Collaboration:** Bringing together industry experts, equipment manufacturers, and other stakeholders to share knowledge and leading practices.
- **Resource Development:** Creating a comprehensive body of knowledge that includes guidelines, case studies, and technical resources to improve tyre and rim safety.
- **Control Effectiveness: Developing** frameworks and tools to assess and enhance the effectiveness of tyre and rim management practices.

The project builds on EMESRT's earlier work in developing Design Philosophy 2: Tyres and Rims.

Updated in 2024, Design Philosophy 2 (DP-2): Tyres and Rims, objective is to prevent harm related to tyre and rim events to as low as reasonably practical, including consideration in design for foreseeable human error, lead to adverse consequences from unwanted tyre and rim events.

DP-2 stipulates that the intended design outcome should include/consider the following:

- Physical size and weight of tyres
- Stored pressures
- Tyre and rim monitoring technology
- Tyre handling equipment and tools
- Gripping/Handling of structurally damaged tyres
- Handling of spare tyres from storage or transport carriers

DP-2 is a high-level overview of problems that can lead to adverse consequences from tyre and rim management events.

## PROJECT COMMUNITY

This project has global working group representation comprising:

- Mining equipment users
- Equipment manufacturers
- Tyre management specialists
- Industry experts
- Regulators
- Researchers
- And other interested parties

EMESRT hosts regular global tyre management improvement technical working group meetings, and workshops, both in person and online.

These meetings provide a forum for EMESRT to update the industry on the tyre and rim project progress, discuss industry challenges, and develop a common understanding of the problems at hand.

EMESRT thanks all the working group members for their continued contribution, commitment and support.

## ACARP RESEARCH PROJECT

Throughout 2025, the working group progressed ACARP Project C3007, examining the interaction between people, equipment, and process in OTR tyre handling operations.

Research activities included workshops, site validation, interviews, and process mapping to better understand organisational decision-making, work bay design, equipment selection, and technician engagement.

Findings highlighted fragmented decision pathways and reinforced the critical, often under-recognised role of tyre maintenance personnel in influencing operational safety and system performance.

## RESOURCE DEVELOPMENT AND TRANSLATION TO PRACTICE

A major transition during 2025 was the shift from research toward practical resource development. Work progressed on Performance Requirement 2 (PR-2): Tyre and Rim Management, aimed at distilling research insights into a structured and accessible industry guide aligned with other EMESRT focus areas.

Development also commenced on tyre-specific Baseline Operational Effectiveness Validation Management Sheets and an Incident Contributing Erosion Factors Assessment Tool, providing structured mechanisms to support baseline validation, operational assurance, and improved incident learning.

## BODY OF KNOWLEDGE

The tyre management improvement industry resources known as the Body of Knowledge (BoK) is hosted on the EMESRT website and provides users with an easy-to-use navigation aid, that also shows where each of the industry resource materials fits into the overarching tyre management improvement project.

The diagram navigational approach is based on a sequential improvement methodology and the key resources developed are linked to each of the resource materials.

# FIRE MANAGEMENT IMPROVEMENT

This industry project is led by EMESRT BHP representative, Chris Jensen

Project objective: to provide mobile equipment designers and users with structured information that enables the prevention of mobile equipment fires and the mitigat ion of the consequences should an event occur.

## INTRODUCTION

In the mining sector, mobile equipment fires, in both surface and underground mines, continue to represent a significant proportion of high-potential incidents.

Mobile equipment operators, maintenance staff, mine workers and others face an unacceptable risk from fire hazards. To lower the risk as much as is reasonably practicable, a step change in the management of fire hazards in mobile equipment and fixed plant is necessary.

## THIS INDUSTRY PROJECT

Formed in 2018, the EMESRT fire improvement management project aims to enhance the safety of mobile equipment in the mining industry by preventing and mitigating the consequence of equipment fires. The project focuses on several key areas:

1. Mobile Equipment Design: Improving the design to prevent fires, such as separating fuel from heat sources.
2. Maintenance Practices: Addressing issues with routine maintenance, including hot work.
3. Fire Detection and Suppression Systems: Enhancing the design, installation, and maintenace of these systems.
4. Operational Practice: Ensuring safe operation of equipment.
5. Emergency Response: Improving local and emergency response to fire incidents.

The project builds on EMESRT's earlier work in developing Design Philosophy 4: Fire.

Updated in 2024, Design Philosophy 4 (DP-4): Fire, objective is to prevent harm related to equipment fires to as low as reasonably practical, including consideration in design for foreseeable human error.
DP-4 highlights that the intended design outcome should include/consider the following:

- Elimination of ignition type of fuel sources
- Early fire detection and appropriate response initiation
- Protection of the operator should fire occur
- Automatic suppression of fire design
- Automatic engine shut-down and isolation of fuel sources, should fire occur
- Manual suppression of the fire should auto suppression be inadequate

DP-4 is a high-level overview of problems that can lead to adverse consequences from mobile equipment fire events.

## PROJECT COMMUNITY

This project has global industry working group members comprising:

- Mining equipment users
- Equipment manufacturers
- Fire detection and suppression system specialists
- Industry experts
- Regulators
- Researchers
- And other interested parties

EMESRT hosts regular global fire management improvement technical working group meetings, and workshops, both in person and online.

These meetings provide an avenue for EMESRT to update the industry on the fire project progress, discuss industry challenges, and develop a common understanding of the problems at hand.

EMESRT thanks all the working group members for their continued contribution, commitment and support.

Working group member contributions are invaluable, and EMESRT looks forward to continuing this important work in 2026.

## FIRE INCIDENT DATA ANALYSIS AND PROBLEM DEFINITION

A key focus throughout 2025 was strengthening industry understanding of mobile equipment fire exposure through analysis of historical incident data and shared operational learnings. Review of multi-year fire datasets reinforced the frequency of fire events and highlighted limitations in data quality, including gaps in causal detail, consistency, and completeness. These findings confirmed the need for a more structured approach to data capture to better support design improvements, operational decision-making, and industry learning.

## FIRE INCIDENT DATA CAPTURE TAXONOMY DEVELOPMENT

In response, significant progress was made toward development of an industry-aligned Fire Incident Data Capture Taxonomy.

Engagement with OEMs, regulators, and fire suppression specialists demonstrated strong support for a standardised dataset capable of supporting root cause analysis, identifying failure modes, and informing proactive design improvements.

The project progressed from concept and scope definition to establishment of a dedicated working group, development of draft taxonomy specifications, and refinement of problem and decision statements across user, designer, regulator, and suppression specialist stakeholder groups.

Subgroup activities during the year focused on aligning problem statements with required data fields, improving structure and usability of capture tools, and addressing opportunities to strengthen data quality through mandatory fields and structured input formats. The taxonomy is expected to progress to validation and testing phases in 2026.

## BODY OF KNOWLEDGE

Work commenced to expand the Fire Body of Knowledge, with plans to mirror the structured approach used in the Vehicle Interaction improvement program.

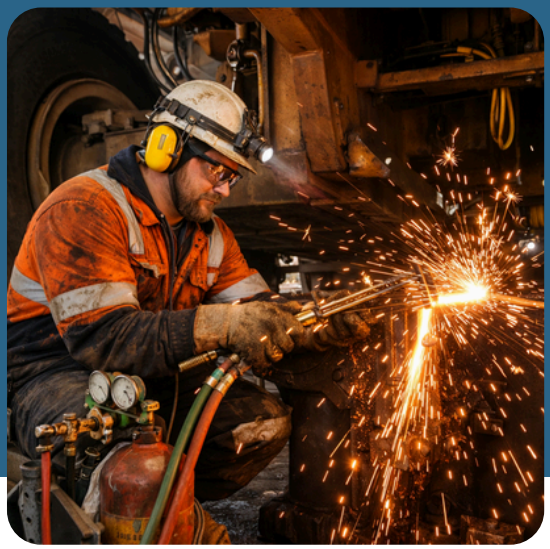
Proposed components include operational effectiveness baseline definition, validation and control improvement guidance.

Early scoping and collaboration activities were initiated to support development of these resources and prepare for pilot activities planned for 2026.

# EXPOSURE TO LIVE WORK

This industry project is led by EMESRT Alcoa representative, Peter Hasler and New Hope Group representative, Kent Flaherty

Project objective: to provide industry with a common approach to identifying and managing exposure to uncontrolled energy in situations where full isolation is not reasonably achievable.



## INTRODUCTION

Exposure to live work remains one of the most persistent and complex safety challenges in the mining industry due to the presence of uncontrolled energies associated with mobile equipment, maintenance activities, and operational systems. Unlike many hazards that can be fully engineered out, live work often occurs where complete energy isolation is impractical, creating exposure zones where workers may be at risk of serious injury or fatality. This makes live work not only a technical challenge, but a human-systems issue involving equipment design, task planning, operational pressures, and organisational decision-making.

In 2025, the EMESRT Advisory Group approved the Exposure to Live Work (ELW) project in response to a recognised gap between industry intent to eliminate live work and the continued reality of workers being exposed to hazardous energies during equipment maintenance, and fault-finding activities.

## THIS INDUSTRY PROJECT

The project addresses the lack of a consistent and practical approach for identifying and managing exposure to uncontrolled energy where full isolation is not reasonably achievable. Although many organisations are working toward eliminating live work, differences in definitions, identification methods, and control strategies have limited the effectiveness of these efforts. This has resulted in inconsistent recognition of exposure zones, uneven prioritisation of elimination opportunities, limited shared understanding of common exposure scenarios across equipment types, and a continued reliance on procedural controls rather than influencing design and system integration.

To address these challenges, the ELW project is developing a task-based methodology that enables industry to systematically identify live work exposure scenarios, understand the uncontrolled energies involved, document existing controls, and prioritise practical elimination or risk reduction strategies.

## PROJECT COMMUNITY

This project has garnered interest from the global industry with a wider working group to begin meeting in 2026.

In 2025, the primary focus was on gathering data from EMESRT member organisations to support analysis of current incidents and identify existing gaps and underlying challenges. Following completion of this research phase, the broader working group will commence engagement to progress the next stage of the project in 2026.

Working group member contributions are invaluable, and EMESRT looks forward to continuing this important work in 2026.

# CELEBRATING 20 YEARS OF EMESRT

## *From Vision to Reality*

*"...This forum provides the chance to work with industry competitors, seeking a common goal as the end result. Work by industry bodies such as EMESRT is important to help drive those improvements for the greater good."*
*Vince Atkinson*

*'It was a privilage to be part of EMESRT... a truly collaborative forum, represented by industry leaders with passion, perseverance and pride. Well done on 20 years of collaboration and partnering."*
*Stephen Eichstadt*

*"What has been achieved in a relatively short period of time for the Vehicle Interaction Improvement project thru strong industry collaboration & partnership between mining companies, OEM's, technology providers and research organizations has been truly remarkable..."*
*Craig Hoffmann*

2025 marked 20 yearsof EMESRT enabling collaboration and innovation to improve equipment design andoperational safety across the mining industry.

In November, we had the privilege of celebrating this achievement in Brisbane with EMESRT community members who could join us in person and some who attended online. It was a moment to reflect on how far we've come, from the early days of shared vision to the global impact EMESRT has today.

To everyone who has contributed over the years, industry partners, OEMs, site teams, and passionate individuals, thank you. Your voluntary commitment, expertise, and collaboration have made EMESRT what it is today.

This journey has always been about working together to make mining safer and more sustainable, and that spirit continues to drive us forward. What an amazing night to be able to reflect and celebrate together.

Here's to the next chapter of innovation and partnership. Together, we'll keep turning vision into reality.

*"Congratulations to EMESRT on 20 years of driving safety and innovation in mining! Your work has been instrumental in shaping best practices that keep our people and fleets safe every day..."*
*Gavin White*


*"...EMESRT was my foundation. It gave me clarity, structure, and a practical framework to turn intent into meaningful actions. But it became so much more than that, a network of dedicated, knowledgeable people who are always willing to share, support, and learn from one another. Because in safety, there is no competition. We are united by a single purpose: protecting lives."*
*Olga Sudnitsin*

*"EMESRT has stood as a testament to what the mining industry can achieve when it chooses collaboration over competition. A small group determined to improve equipment safety has grown into a global community shaping how equipment is designed and operated. . . I believe that the impact of better controlled hazards has contributed to countless workers going home safely, thanks to changes sparked by EMESRT's."*
*Pat Hurley*

CELEBRATING 20 YEARS
2005 - 2025

*From Vision to Reality*

# HOW EMESRT OPERATES

Whilst EMESRT is not a registered entity, it is committed to ensuring that its practices reflect good governance.

EMESRT aims to deliver practical outcomes at an industry level, with a work program that involves delivering specific projects. EMESRT's Advisory Group (EAG) members, who are senior managers in their respective organisations, make contributions based on their availability, experience and expertise.

Secretariat and financial management support is provided on a fee-for-service basis by a third-party provider.

Expert consultant support is sourced as required.

EMESRT membership is open to mining companies and the members provide the direct funding for EMESRT activities through an annual membership fee. The fee is set based on a 24-month rolling activity and project plan, which is reviewed annually.

Significant value is contributed from the in-kind involvement of all stakeholders in the many related project activities. This includes coordinating and connecting work already in progress by other organisations. Indirect funding is accessed via groups such as ACARP's coal industry research, university research, and other technical research and development conducted by other organisations.

## CONTINUITY AND RENEWAL

One of EMESRT's significant strengths is the continuity of its representatives from member organisations. A core group of company representatives were responsible for establishing EMESRT and have remained involved.

Each has made significant contributions to developing the reach and profile of EMESRT and supported the evolving operational processes that can deliver successful industry-level projects. Importantly, they have established and maintained good relationships with senior managers in OEM's and industry third-party supplier organisations.

One of the most important challenges facing EMESRT is capturing the core representatives' decades of effective work so EMESRT can continue beyond its original cohort of pioneers. Meeting this challenge has required formalising and updating EMESRT's operational processes as well as documenting the journey of current and past projects to provide insights into the activities that made a real difference in improving outcomes for users.

The effectiveness of EMESRT's approach for engaging with and influencing organisational decision-makers is reviewed at each EMESRT strategy and planning review meeting.

While EMESRT's role within the industry is well understood and highly regarded by senior OEM leaders and other industry supplier organisations, it has a lower profile in mining companies, including those that are members.

This uneven profile was reconfirmed during ongoing collaboration with the ICMM ICSV program in 2021, where senior OEM manager participants consistently and publicly endorsed EMESRT's successes and ongoing relevance.

This situation reflects EMESRT's underpinning philosophy of focusing on delivering useful outcomes. However, the EAG is working to increase EMESRT's profile and influence with all stakeholders, to increase capacity and support project outcomes.

Relevant stakeholders include research organisations internationally, regulators, industry associations and senior managers in operating mining companies (including EMESRT members).

More information about EMESRT is available on the website - emesrt.org.

# EMESRT MEMBERS FOR 2025

## Tier 1


## Tier 2

EMESRT

Earth Moving Equipment Safety Round Table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