Provincial Battery Electric Vehicle Root Cause Analysis Workshop Results

A focused approach to improving workplace health and safety

November 9, 2022

1 888 730 7821 (Toll free Ontario)
workplacesafetynorth.ca

Welcome to the webinar:
Provincial Battery Electric Vehicle Root Cause Analysis Workshop Results

- Thank you for joining us!
- We will be getting started at **1:30 pm ET**
- Please use the **Q&A** at the bottom of your screen for speaker questions and we will answer them at the end of the webinar.
- Please use the **chatbox** for commentary or technical questions.
- A link to the webinar recording, a copy of the presentation slides, and reference material will be emailed to registrants within a few days.

Webinar host

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About Workplace Safety North

- Workplace Safety North (WSN) is one of four sector-based health and safety associations in Ontario, and the only one headquartered in the north.
- WSN provides province-wide, government-approved workplace health and safety services for mining and forest products sectors, as well as for businesses and communities across northern Ontario.
- With health and safety specialists located across the province, WSN and its legacy organizations have been helping make Ontario workplaces safer for more than 100 years.
- For more information, visit workplacesafetynorth.ca.

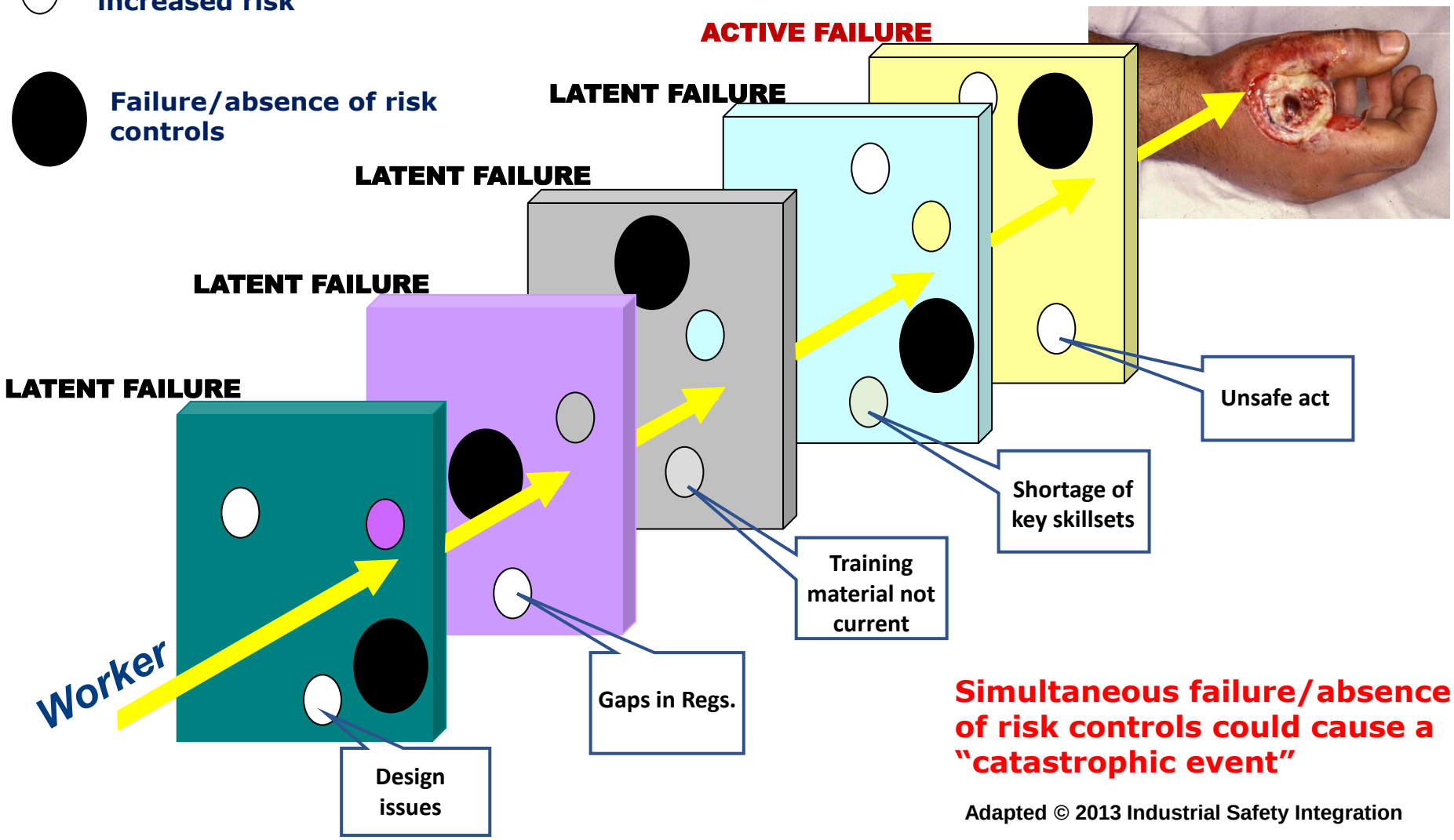
Agenda

- Risk Assessment Project: The Subject of Inquiry
- Background: Revisiting the 2021 Risk Assessment Workshop Results
- Root Cause: Risk Breakdown and Analysis
- Root Cause Analysis, Contributing Factors and Results
- Root Cause Analysis: Risk Statement
- Workshop: A Bipartite and Collective Process
- Workshop Participants: Industry, Research and System Partners
- “Fishbone” Diagram: 28 Identified Causal Factors
- Top 10 Primary Causal Factors: List of Controls
- Next Steps: What Should we Focus on Immediately?
- Questions

Risk Assessment Project

Examples that could lead to increased risk

Failure/absence of risk controls

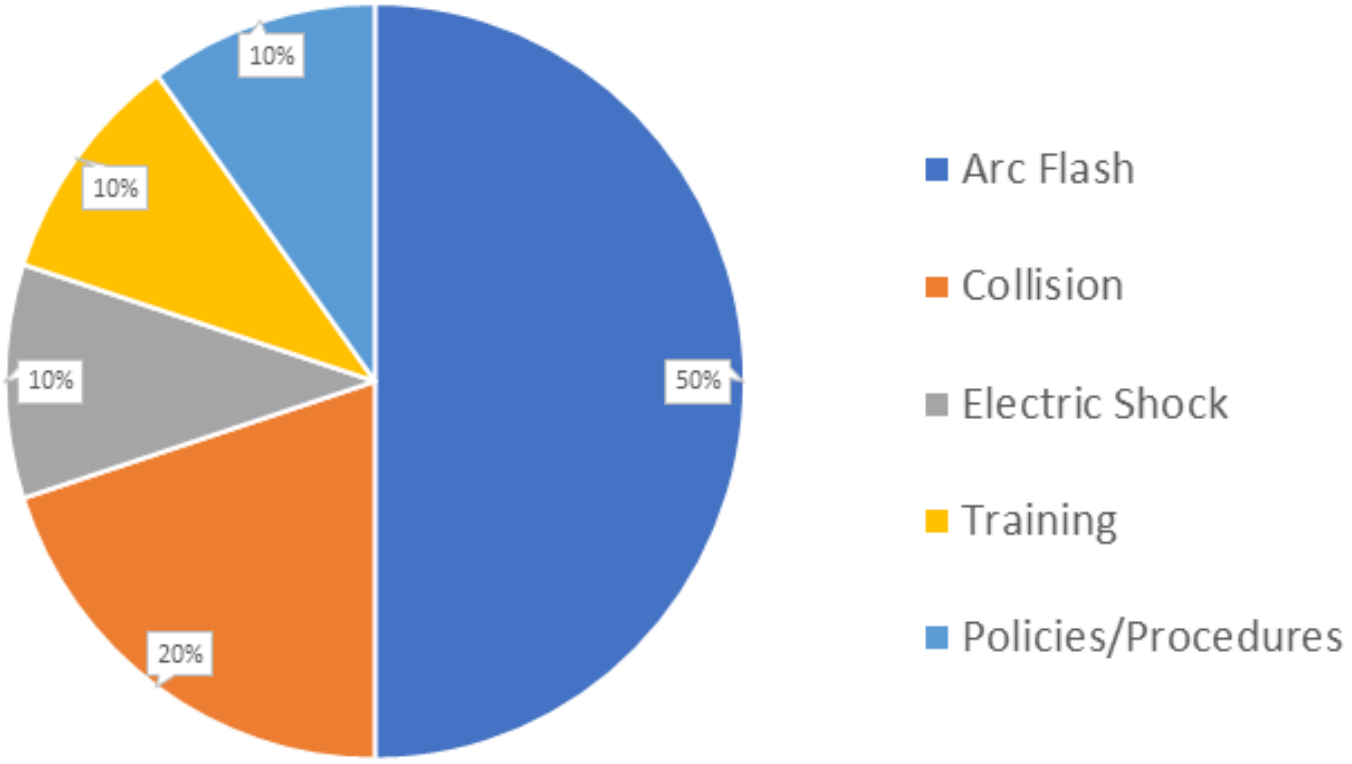


Simultaneous failure/absence of risk controls could cause a "catastrophic event"

BEV Risk Assessment: Top 10 risk categories based on highest risk within that category

Rank	Category	Event (Situation/Condition) that could result in Injury or Illness OR What could keep you up at night?
1	Collision	Personnel struck by battery electric equipment
2	Training	Lack of training for maintenance employees
3	Arc Flash	Loss of control of a particular Li-Ion based battery chemical energy source; exposing personnel to: Thermal runaway (fire), Arc Flash, Electric shock potentials (Improper live troubleshooting)
4	Arc Flash	Loss of control of a particular Li-Ion based battery chemical energy source; exposing personnel to: Thermal runaway (fire), Arc Flash, Electric shock potentials (Improper/unclear work delineation (worker assumes authorized to perform work on traditional work experience)
5	Policies/ procedures	There are no standardized industry regulations with regards to BEV charge stations and charge locations
6	Arc Flash	Loss of control of a particular Li-Ion based battery chemical energy source; exposing personnel to: Thermal runaway (fire), Arc Flash, Electric shock potentials (Inadequate specifications, standards, regulations - provincial)
7	Arc Flash	Loss of control of a particular Li-Ion based battery chemical energy source; exposing personnel to: Thermal runaway (fire), Arc Flash, Electric shock potentials (Inadequate management of change process)
8	Electric shock	Loss of control of a particular Li-Ion based battery chemical energy source; exposing personnel to: Electric shock
9	Arc Flash	Loss of control of a particular Li-Ion based battery chemical energy source; exposing personnel to: Thermal runaway (fire), Arc Flash, Electric shock potentials (Field repairs)
10	Collision	Inability to identify presence of an oncoming vehicle while traveling in a ramp system or around corners

Top 10 BEV Risks



Analysis of Top 10 Risks

Risks and undesired outcomes have identified the following overall risk ranking based on the following risk categories:

Risk Rank	Risk Category	Contributing Factor	Result
1	Arc Flash	Improper live troubleshooting Improper/unclear work delineation; worker assumes authorized to perform work on traditional work experience Inadequate specifications, standards, regulations – provincial Inadequate management of change process In field Repairs	Thermal Runaway
2	Collision	Lower sound or operational presences	Collision with people or other equipment
3	Training	Lack of training for maintenance and operational workers	Injury to worker Damage to Equipment Loss of process
4	Policies and Procedures	No standardized industry regulations with regards to BEV charge stations and charge locations	Inadequate management of change process
5	Electric Shock	Loss of control of a particular Li-Ion based battery chemical energy source	Exposure to electric shock

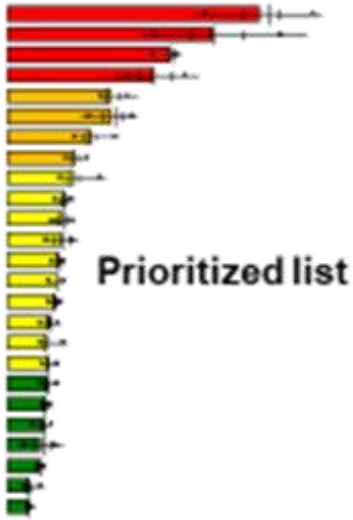
Root Cause Analysis: Risk Statement

Based on the results of the Battery Electric Vehicle Risk Assessment and further analysis, the Root Cause Analysis working group confirmed and developed the following risk statement using the **"Fishbone"** approach addressing Arc Flash or Thermal Runaway:

"Thermal Runaway event can result in unintended adverse effects on the wellbeing of workers."

Workshop: A Tripartite and Collective Process

Sector Selection ⇨ SMEs Identified ⇨ Events Identified ⇨ Events Analyzed ⇨ Events Prioritized



Workshop: A Tripartite and Collective Process

Workshop process was open, transparent, and collaborative:

- Ensured any perspective or viewpoint was heard
- Each response received was respected and not freely edited
- Final list shared with participants before the workshop
- Final workshop results reviewed/validated by industry participants

Finding acceptable solutions that all members can support:

- Only industry experts ranked the risks, not ministry or health and safety associations
- Process was NOT about consensus, although the results demonstrate a significant degree of convergence

Root Cause Analysis Workshop: Participants

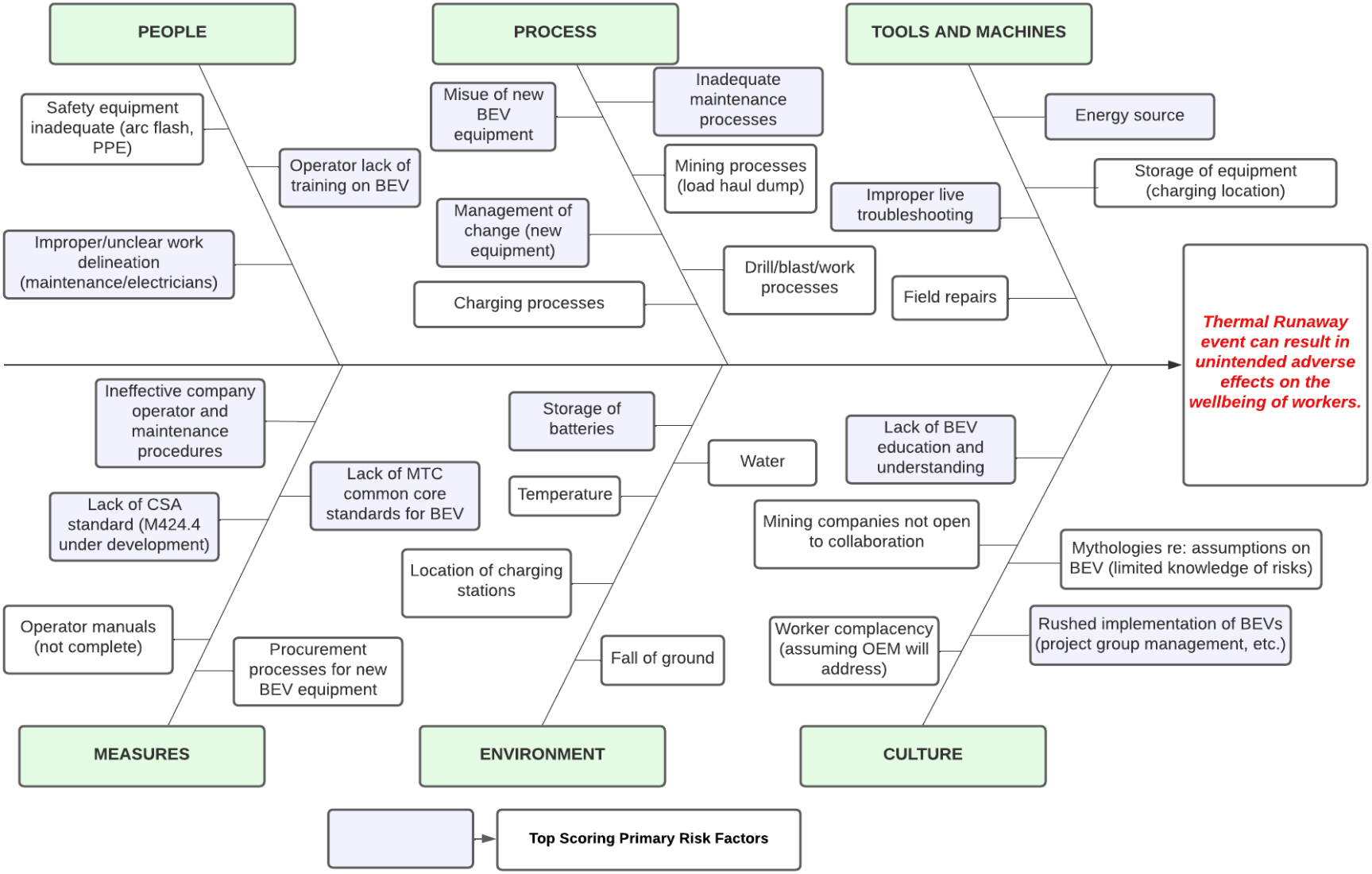
SUBJECT MATTER EXPERTS		
#	**Name**	**Company/Representative**
1	Craig Allair	Vale (U.S.W., Local 6500)
2	Richard Genesse	Impala - Lac Des Iles (U.S.W. Local 9422)
3	Daniel Gareau	Glencore (UNIFOR Local 598)
4	Matthew Curtis	Newmont
5	Raphael Tiangco	Vale
6	Steven Holmik	Glencore

Worker Representation

Employer Representation

WORKSHOP PARTICIPANTS		
#	**Name**	**Company/Representative**
7	Derek Budge	Mining Legislative Review Committee
8	Malcolm Mills	Mining Legislative Review Committee
9	Bob Barclay	MLITSD: Senior Manager, Mining (observer)
10	Scott Secord	MLITSD: Inspector (observer)
11	Tom Welton	WSN: Facilitator
12	Tiana Larocque	WSN: Tech Support
13	Tricia Valentim	WSN: Tech Support

WSN: *Workplace Safety North*
MLITSD*: Ministry of Labour, Immigration, Training, and Skills Development*


PEOPLE
PROCESS
TOOLS AND MACHINES
Safety equipment inadequate (arc flash, PPE)
Operator lack of training on BEV
Improper/unclear work delineation (maintenance/electricians)
Misue of new BEV equipment
Inadequate maintenance processes
Mining processes (load haul dump)
Management of change (new equipment)
Drill/blast/work processes
Charging processes
Energy source
Storage of equipment (charging location)
Improper live troubleshooting
Field repairs
Thermal Runaway event can result in unintended adverse effects on the wellbeing of workers.
Ineffective company operator and maintenance procedures
Lack of MTC common core standards for BEV
Lack of CSA standard (M424.4 under development)
Operator manuals (not complete)
Procurement processes for new BEV equipment
Storage of batteries
Water
Temperature
Location of charging stations
Fall of ground
Lack of BEV education and understanding
Mining companies not open to collaboration
Mythologies re: assumptions on BEV (limited knowledge of risks)
Worker complacency (assuming OEM will address)
Rushed implementation of BEVs (project group management, etc.)
MEASURES
ENVIRONMENT
CULTURE
Top Scoring Primary Risk Factors

Top Primary Causal Factors

- Inadequate maintenance processes
- Current lack of CSA standard for BEVs
- Ineffective management of change on new equipment
- Energy sources creating potential for electric shock
- Ineffective company operator and maintenance procedures
- Improper live troubleshooting on issues with BEV machines
- Operator lack of training on BEVs
- Lack of education and understanding of BEV safe use
- Misuse of new BEV equipment
- Rushed implementation of BEV use
- Lack of common core training standards for BEV use
- Improper or unclear work delineation for electricians and maintenance personnel
- Inadequate battery storage

List of Solutions and Controls for the Top Primary Root Causes

Notes:

- Scope of this exercise does not include assessment of listed controls.
- List provides information on specific controls and/or activities that support a control.
- Control performance should be **specified**, **observable**, **measurable** and **auditable.**

Next Steps: What should we focus on immediately?

Based on a scan of controls identified for the Top Primary Causal Factors, it would be beneficial, as a start, to focus right away on the following common systemic weaknesses:

- Current lack of a CSA standard for BEVs (CSA M424.4:22 Self-propelled, electrically driven, non-rail-bound mobile machines for use in non-gassy underground mines under development)
- Lack of modular training program Common Core standard for BEVs

Thank you for attending today's webinar and helping make workplaces safer.

Questions?

Workshop Contact

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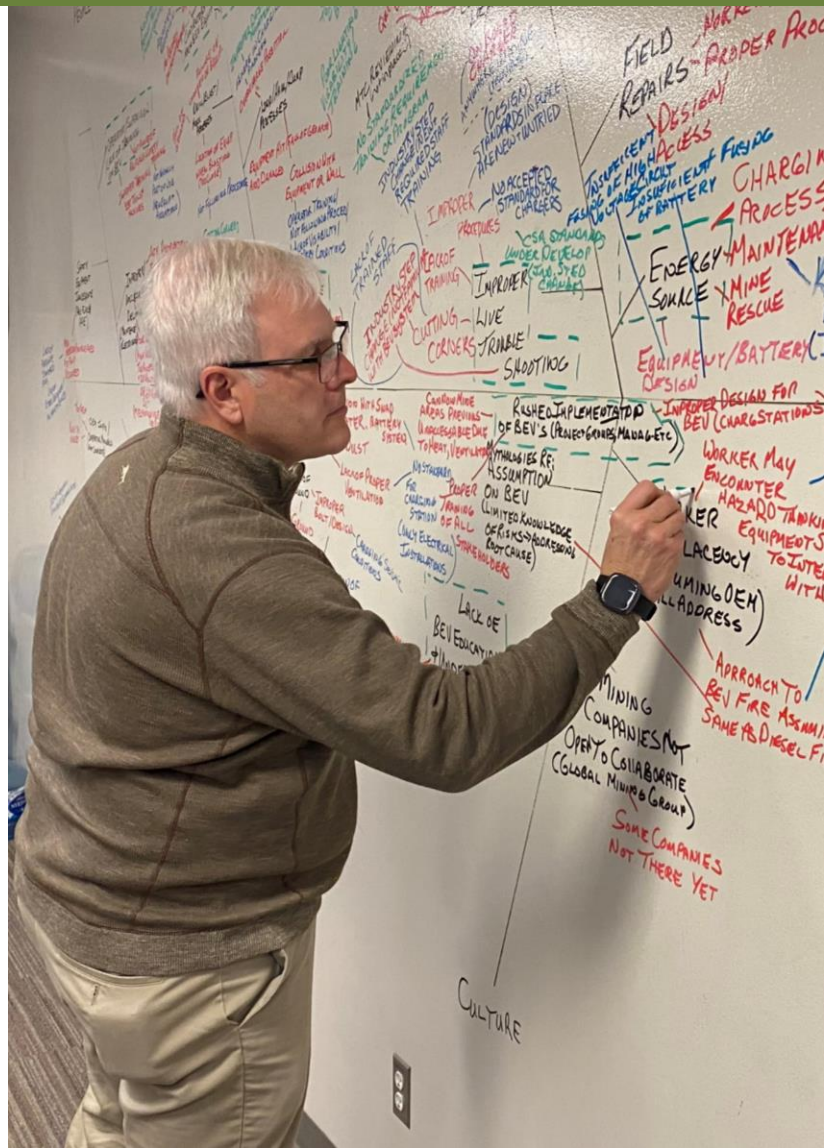

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