



## Provincial Battery Electric Vehicle

## Root Cause Analysis Workshop Results

A focused approach to improving workplace health and safety

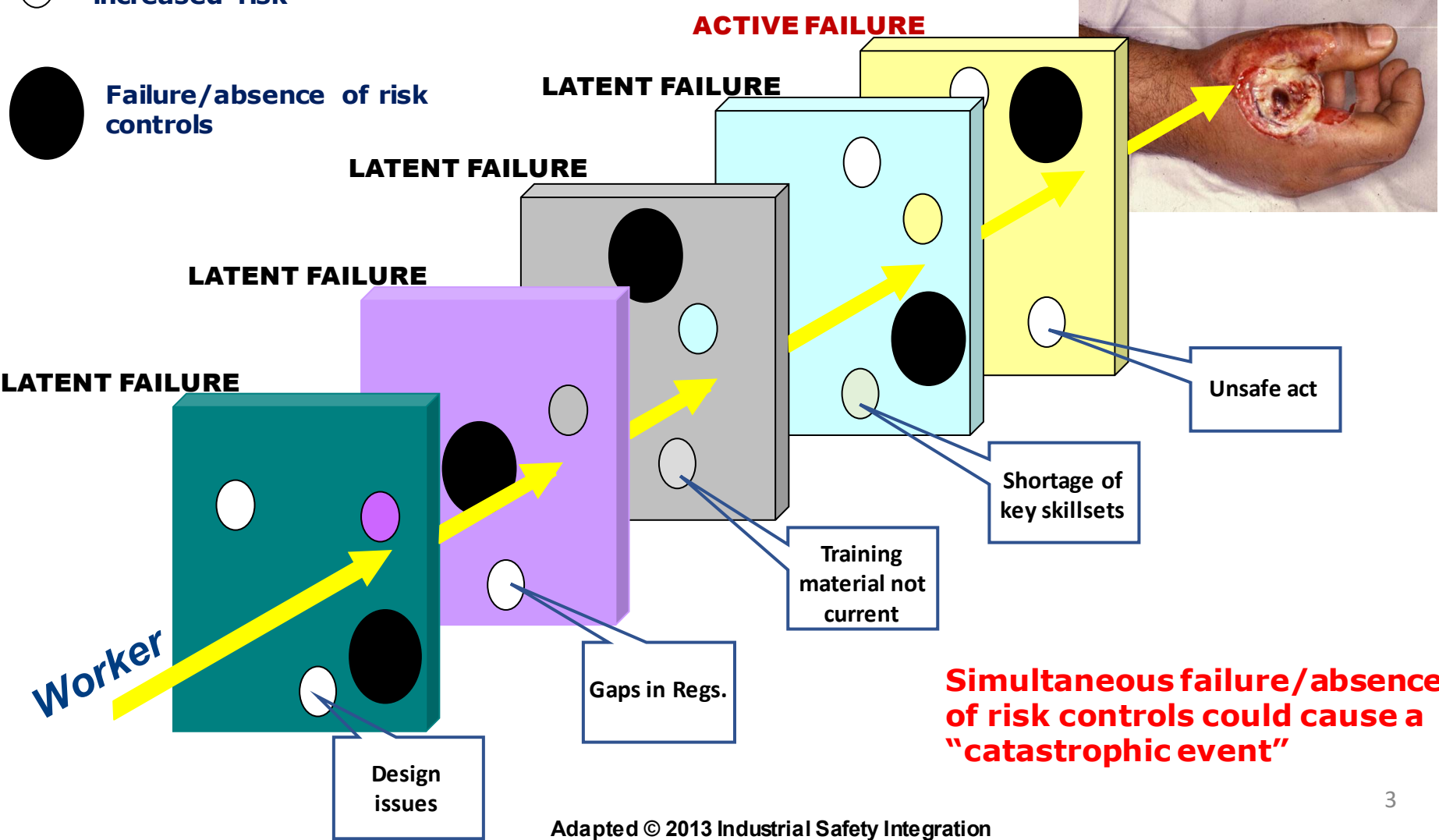
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# Risk Assessment Project

○ Examples that could lead to increased risk

● Failure/absence of risk controls



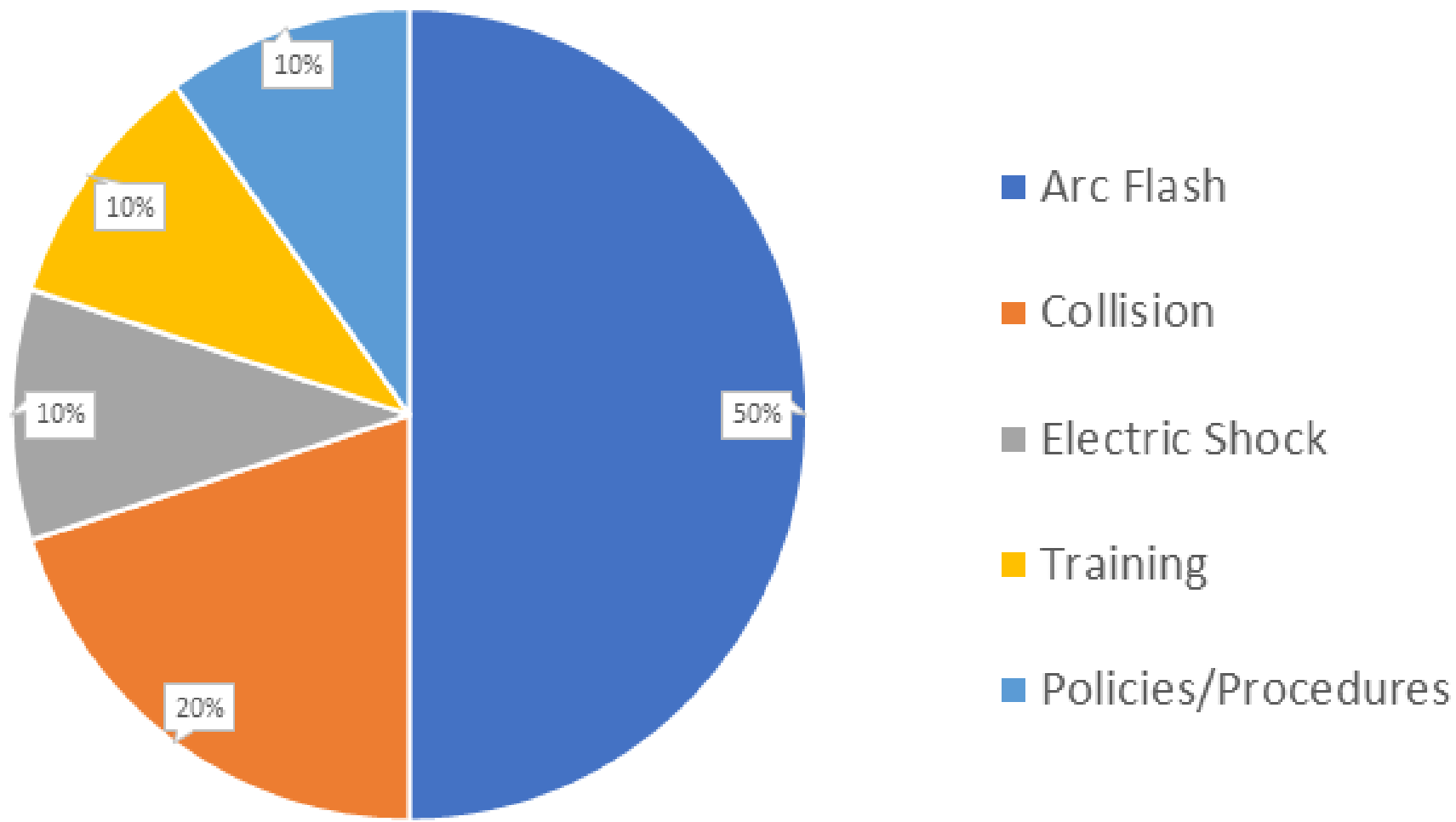
**Simultaneous failure/absence of risk controls could cause a "catastrophic event"**

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Rank	Category	Event (Situation/Condition) that could result in Injury or Illness OR <b>What could keep you up at night?</b>
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

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

# Top 10 BEV Risks



Analyses of the top 10 risks and their undesired outcomes have identified the following overall risk ranking based on the following risk categories:

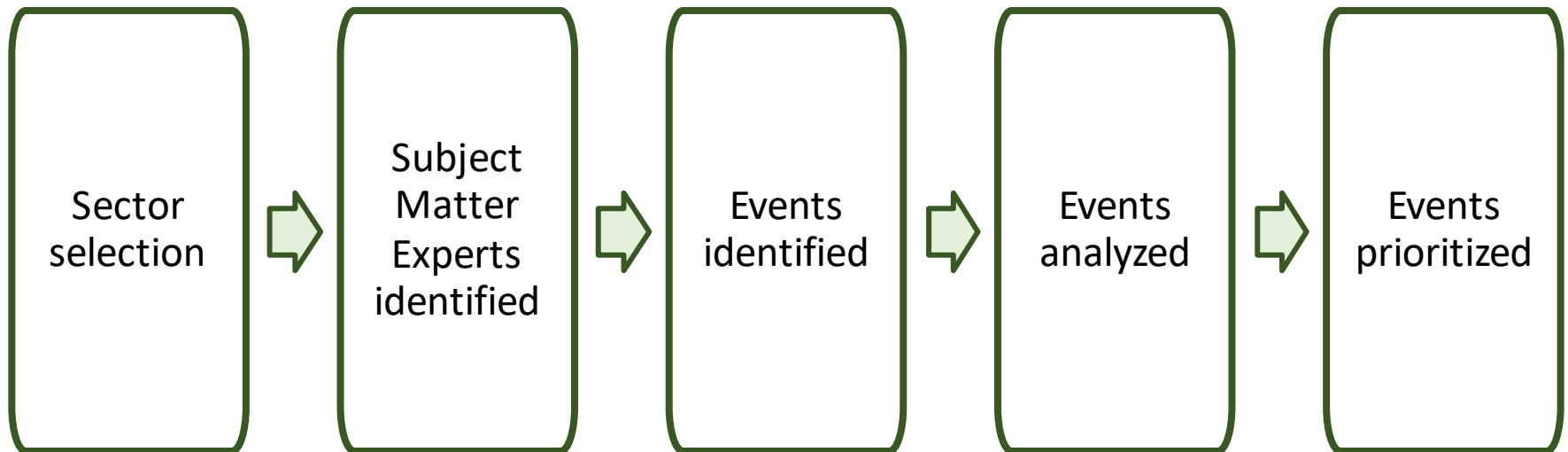
Risk Rank	Risk Category	Contributing Factor	Result
1	Arc Flash	Improper live troubleshooting Improper/unclear work delineation; worker assumes authorized to perform work on traditional work experience Inadequate specifications, standards, regulations – provincial Inadequate management of change process 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





# 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 MLTSD/HSA
- 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**

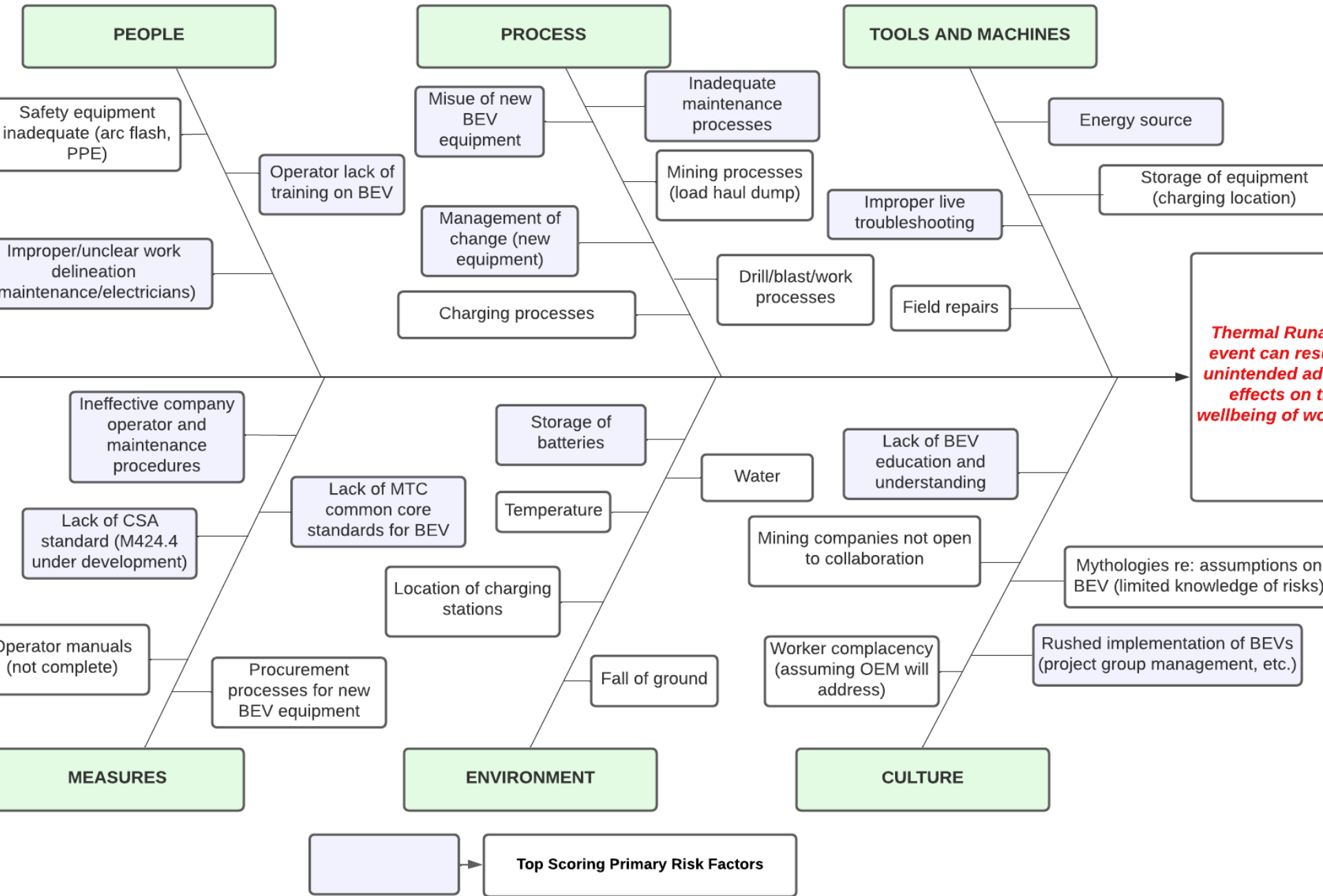
**Employer Representation**

## WORKSHOP PARTICIPANTS

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

*WSN: Workplace Safety North*

*MLTSD: Ministry of Labour, Training, and Skills Development*



# 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/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 (M424.4 under development)
  - Lack of modular training program Common Core standard for BEVs

# Appendix A

## Workshop Contacts

- For additional information or questions, please contact:

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Questions?

