

Ministry of Labour, Training and skills Development
Ground Control Root-Cause Analysis

- Companion Document to Analysis Findings -

November 22nd, 2019 – Final Draft

Background and Introduction:

The final report for the Mining Health, Safety and Prevention Review (i.e. the M.H.S.P.R.) that took place throughout 2014 and in the first quarter of 2015 was completed in late March of 2015. The final report includes eighteen recommendations. Recommendation No. 1.1 reads as follows:

- **1.1 The Ministry of Labour supported by all relevant health and safety system partners and subject matter experts, to undertake a Mining Sector risk assessment with employers and labour every three years.**

In response to M.H.S.P.R. Recommendation 1.1, the Ministry of Labour (i.e. the M.O.L.), in consultation with the Mining Legislative Review Committee (i.e. the M.L.R.C.), decided that the next sector level risk assessments should strive to define the controls that need to be put into place to effectively manage the highest risk health and safety hazards in the sector, rather than consist of exercises devoted to risk-ranking common hazards in the Mining Sector. Therefore, the M.O.L., with support from the M.L.R.C., elected to conduct a series of root-cause analysis sessions that would identify potential controls for specific risks from predominant health and safety hazard themes that were identified through a risk assessment that was conducted as part of the M.H.S.P.R. Specific hypothetical unwanted events from each of the following three health and safety hazard themes were chosen as the focal points for these root-cause analyses:

- ground control;
- mobile equipment;
- water management.

For each the three root-cause analyses conducted, the key objectives were to:

- identify the causal factors (i.e. including the primary, secondary, tertiary, and in some case quaternary) that could contribute to the occurrence of the hypothetical unwanted event in question;
- define potential controls (i.e. or activities that could enable controls) corresponding to the primary causal factors identified.

Process Adopted:

For each of the three root-cause analyses conducted, the process involved the following steps:

- A root-cause analysis team was established consisting of relevant peer-recognized subject-matter experts. For the Ground Control Root-Cause Analysis, the team consisted of three members representing employer stakeholders and three members representing labour stakeholders. All six members had extensive expertise in ground control and were selected and appointed by the M.L.R.C. The team member composition also reflected the various sub-sectors in the Ontario Mining Sector, including members from base metal, gold and industrial mineral mining operations.
- The hypothetical unwanted event, or risk statement to be explored through root-cause analysis, was defined by the team.
- A “fish-bone” diagram was constructed by the team that identified potential causal factors (i.e. including primary, secondary, tertiary, and in some cases, quaternary causal factors) for the unwanted event in question using a generic “fish-bone” diagram template. The template used for the Ground Control Root-Cause Analysis consisted of six fish bones, or categories (i.e. people, processes, tools and machines, measures, environment and culture).
- Potential controls (i.e. or activities that could enable a control) corresponding to all of the primary causal factors identified in the fish-bone diagram were identified.
- The root-cause analysis findings were reviewed and validated by the team.

The Unwanted Event Examined:

The hypothetical unwanted event explored through the Ground Control Root-Cause Analysis was as follows:

- **A rockburst occurs in an underground mine at a location where workers are normally present.**

The root-cause analysis team selected this unwanted event primarily because rockbursting is currently deemed to constitute the highest risk health and safety hazard in underground mining in Ontario.

Dates Conducted:

The Ground Control Root-Cause Analysis was conducted on the following dates:

- October 18 and 19, 2017;
- December 6 and 7, 2017.

A final team meeting was held on March 9th, 2018 to review and validate the root-cause analysis findings.

Summary of Findings:

The Ground Control Root-Cause Analysis rendered:

- 159 potential causal factors which could contribute to the hypothetical unwanted event in question;
- over three hundred potential controls (i.e. or activities that could enable a control).

The breakdown of the causal factors identified, according to causal factor level, is shown below in Table No. 1.

Table No. 1 - Number of Potential Causal Factors

Number of Primary Causal Factors	Number of Secondary Causal Factors	Number of Tertiary Causal Factors	Number of Quaternary Causal Factors
40	79	37	3

Potential Applications:

The findings from the Ground Control Root-Cause Analysis have a number of potential useful applications. Some of these are as follows:

- Mine operators in Ontario are now required to prepare and maintain formal workplace risk assessments (i.e. as required by Sections 5.1, 5.2 and 5.3 of Regulation 854). Mines that are seismically active could rely on the findings from this sector level root-cause analysis to assist with the preparation of their own site-specific risk assessments and to recognise gaps in controls that they have already specified.
- Health and safety associations serving the Ontario Mining Sector who are responsible for providing assistance to seismically active mines could rely on these findings towards developing training materials, and best practices, for managing seismicity and rockbursting.
- The opportunity exists for seismically active mines to derive meaningful leading health and safety metrics from the lists of controls rendered by the root-cause analysis.
- Coroners' juries at inquests into fatalities resulting from rockbursts could rely on these findings for the purposes of developing inquest recommendations.
- The Ground Control Sub-Committee of the M.L.R.C. could rely on these findings when developing proposed amendments to Regulation 854, or guidance materials pertaining to rockbursting and seismicity.