



Developing a program for the communication of ground control information in surface and underground mines

1-888-730-7821 Toll-free Ontario
705-474-7233
workplacesafetynorth.ca



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2019 update of the reference document for developing program for the communication of ground control information in surface and underground mines.

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Safety North
690 McKeown Avenue, P.O Box 2050 Station Main
North Bay, Ontario P1B 9P1
Toll free: 1-888-730-7821 (Ontario)
Fax: 705-472-5800
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Alun Price Jones (Vice-Chair), Ryan Lyle	Cementation
Mike Yao	Vale Base Metals
Brad Simser	Glencore, Sudbury Integrated Nickel Operations
Richard Hong, Kelly Mayrand	Kirkland Lake Gold Corp., Macassa Mine Complex
Siavash Taghipoor, Dean Switzer	KGHM International Ltd., Sudbury Operations
Anneta Forsythe	Vale Ontario Operations
Grant Cory, Ray Wilkins	Goldcorp Inc., Red Lake Gold Mines
Jerry Ran	Kinross Gold Corp.
Amanda Conley	Barrick Gold Corp., Williams Mine
Gilles Guerin	Goldcorp Inc., Porcupine Gold Mines
Fred Davenport-Jones	Compass Minerals, Goderich Mine
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Tom d'Entremont	Goldcorp Inc., Musselwhite mine
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Travis Blake, Yuhang Xu	Alamos Gold Inc., Young Davidson Mine
Ali Jalbout (non-voting member)	Goldcorp Inc., Éléonore
Shan Lu, Michael Regan	Kirkland Lake Gold Corp., Holt/Holloway Mine Complex
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Chantale Doucet (Technical Advisor)	Mines Agnico-Eagle Division Goldex
John Hadjigeorgiou (Technical Advisor)	University of Toronto, Mining Department
Renée Royer (Technical Advisor)	CanmetMINING
Steve McKinnon (Technical Advisor)	Queen's University, The Robert M. Buchan Department of Mining
Mike Kat (Technical Advisor)	Ontario Ministry of Labour, Mining & Geomechanics

Foreword

Falls of ground and rockbursts are recognized as the main causes of underground injuries in Ontario's hard rock mines, and in many instances poor communication is identified as a contributing factor. This reference document is intended to assist Ontario mining operations in developing their internal programs for communication of ground control information. Factors that affect the nature and complexity of a communication program include the size of the mining operation, the severity of ground problems, and established communications protocols at the mine site.

This document was prepared by Workplace Safety North's (WSN's) Ground Control Technical Advisory Committee. WSN gratefully acknowledges the contributions of all members.

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1. Introduction

Ground instability such as falls of ground and rockbursts are hazards that workers can be exposed to and can cause injuries in Ontario's underground hard rock mines. Recognition of ground instability and communication of the observed ground control issues are factors that can contribute in preventing the hazards and protect workers from injuries.

Workplace Safety North (WSN) and WSN's Ground Control Technical Advisory Committee (GC TAC) is updating the original document titled "*Guidelines for communications of ground control information in underground mines*" which was first published by the committee in 2000.

Everyone who works in surface and underground mines must be aware of the company's established communication protocol for ground control issues and be mindful of the factors that affect the nature and complexity of a communication program. WSN recognizes that individual companies must develop health and safety policies and programs which apply to their workplaces and comply with appropriate legislation. The information contained in this material is distributed as a reference document only and is intended to assist Ontario mining operations in developing their internal policies and programs for communication of ground control information.

2. Discussion

Section 65 of Ontario's Regulations 854 (Mines and Mining Plants) reads as follows:

65. (1) An employer in an underground mine, in consultation with the joint health and safety committee, if any, for the mine, shall develop a written program to provide for the timely communication of information between workers and supervisors in the mine respecting ground stability, ground movement, falls of ground, ground monitoring equipment and emergencies.
- (2) The communications program shall set out,
- (a) means and procedures for communicating information;
 - (b) the kind of information to be communicated; and
 - (c) the actions to be taken by supervisors and workers with respect to information that is communicated to them.

Related regulations include Sections 21 and 72, which address the reporting and recording of rockbursts and falls of ground. Information on the recommended compliance with these regulations can be found in WSN's Technical Report titled "*Unusual Occurrence Report for Groundfall/Rockburst.*"

WSN's Ground Control Committee obtained and reviewed several existing communications programs from member companies; examples of typical communication programs are attached in **Appendix A** of this document. **Appendix B** shows an example of a ground control communications plan from an operating underground mine. Note that they differ in content and degree of specificity.

3. Type of information to be communicated

A *Ground Occurrence Report* may be completed whenever concern is expressed by the worker or supervisor in the heading on conditions considered dangerous or potentially dangerous. These conditions may include:

- Fall of ground or rockburst - Section 21 (5) of Regulation 854 requires that a notice in writing shall be given where: (a) A rockburst occurs causing damage to equipment or injury to personnel, or the displacement of more than five (5) tonnes of material; and (b) An uncontrolled fall of ground occurs causing damage to equipment or injury to personnel, or the displacement of more than fifty (50) tonnes of material. Falls of Ground and Rockbursts causing injury to workers must also be reported. Section 72 of the Regulation 854 specifies that all rockburst and fall of ground occurrences must be recorded.
- Steel jumping while installing ground support
- Ground noise (snapping) more than usual or noisy ground become quiet
- Offset drill holes
- Excessive scaling
- Bending of rock bolt plates
- Geological structures encountered while drilling (fault, bedding planes, dykes, voids)
- Unusual water inflows (leaks or drainage)
- Drummy ground
- Slabby ground
- Weight on timbers or squeeze blocks
- Floor heaving
- Fresh cracks on wall or back
- Hourglassing of pillars
- Oval shaped bore holes
- Monitoring data (Ground Movement Monitors, etc.)

4. Means and procedures for communicating information

All methods used for the communication of ground issues or substandard conditions should be described in the communication program. Failure to do so can result in information being known by few personnel and not communicated to all concerned.

Figures 1a, 1b and 1c show example flowcharts of the communication process for ground control information in underground mines, including reporting unusual ground condition/groundfall. **Figure 1a** is an example flowchart for a possible reporting sequence of unusual ground condition/groundfall, **Figure 1b** is an example flowchart for design through execution for ground control communication process of an operating mine, and **Figure 1c** is an example flowchart for return information and issue resolution for ground control communication process of an operating mine.

Figures 2a and 2b are examples of ground control communications flow processes in the event of a large seismic occurrence.

Example ground control report forms for recording events of groundfalls, changes in ground conditions or ground noise are shown in **Figure 3**. **Figures 3a and 3b** are an example of a simplified ground control form that can be completed by front-line supervisors in the event of changing ground conditions, **Figures 3c, 3d and 3e** are examples of ground control occurrence report and log entry forms from operating underground mines, and **Figure 3f** is an example of a ground control log entry form from an operating open pit mine. The reports are completed and forwarded to the appropriate personnel (general foreman, cross-shift, health & safety representative, engineering department, safety department, etc.).

Other methods may be used for informing personnel of ground conditions. Examples include: investigation reports; supervisor logbooks; telephones; radio; notice boards; Seismic Visualizer; reporting sheets (e.g. ITH, diamond drilling, other daily logs); engineering/geology letters; planning meetings; safety meetings; ground control audits; specific site investigations; basic training and refresher training in ground control; and company policies, etc.

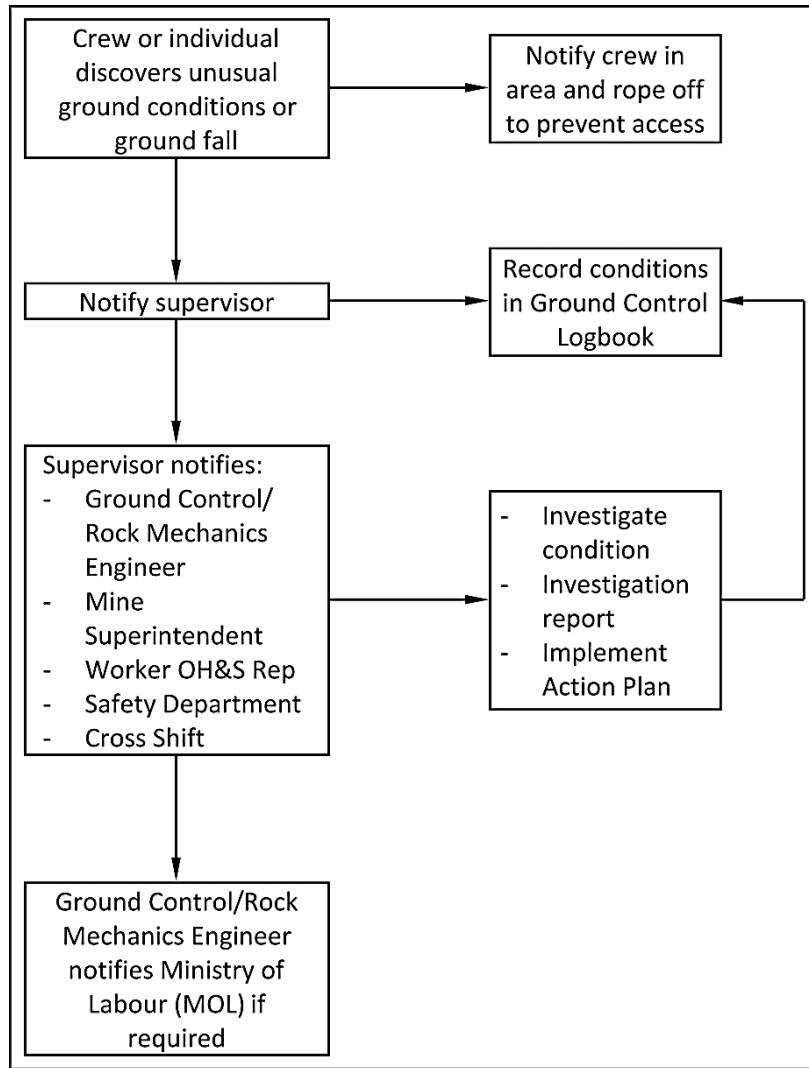


Figure 1a – Example of a possible reporting sequence for unusual ground condition/groundfall.

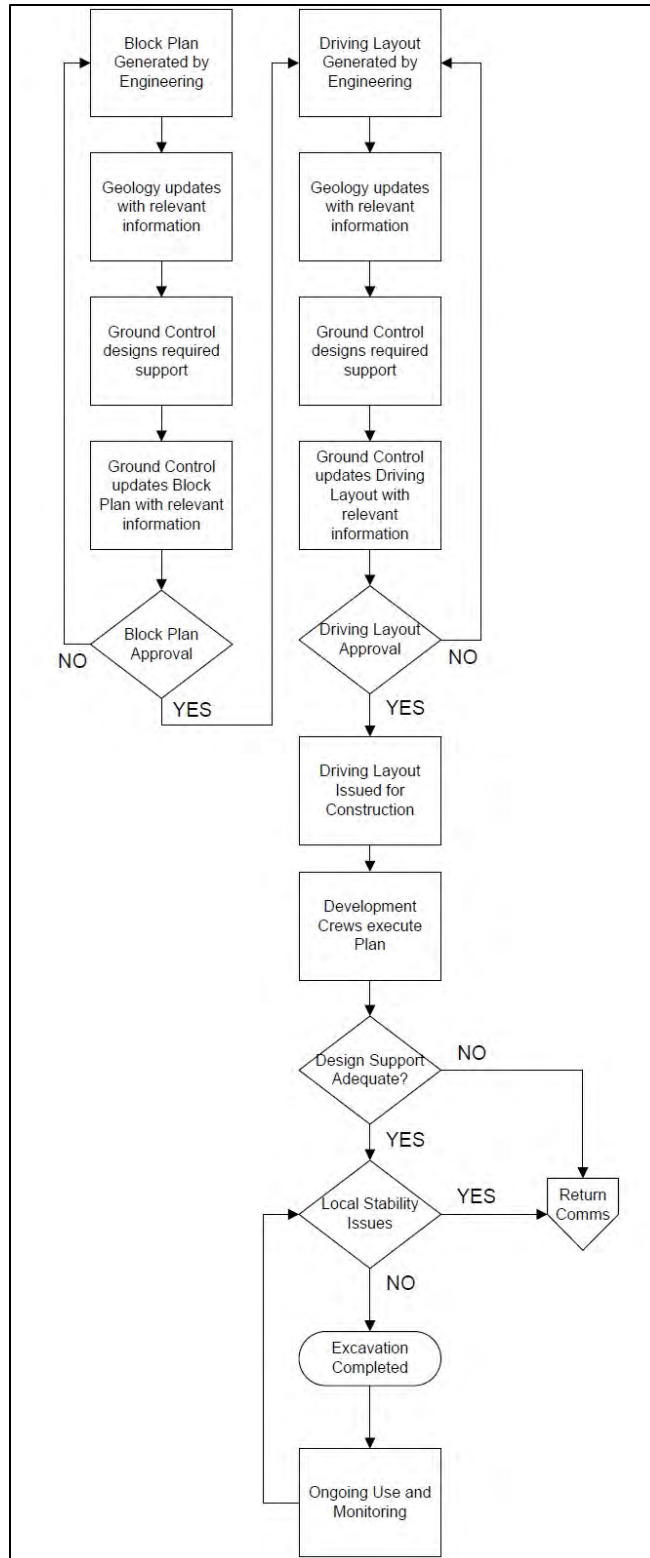


Figure 1b – Example for a design through execution of ground control communication process for an operating mine (source: Operating Mine and a member of the WSN’s Ground Control Committee).

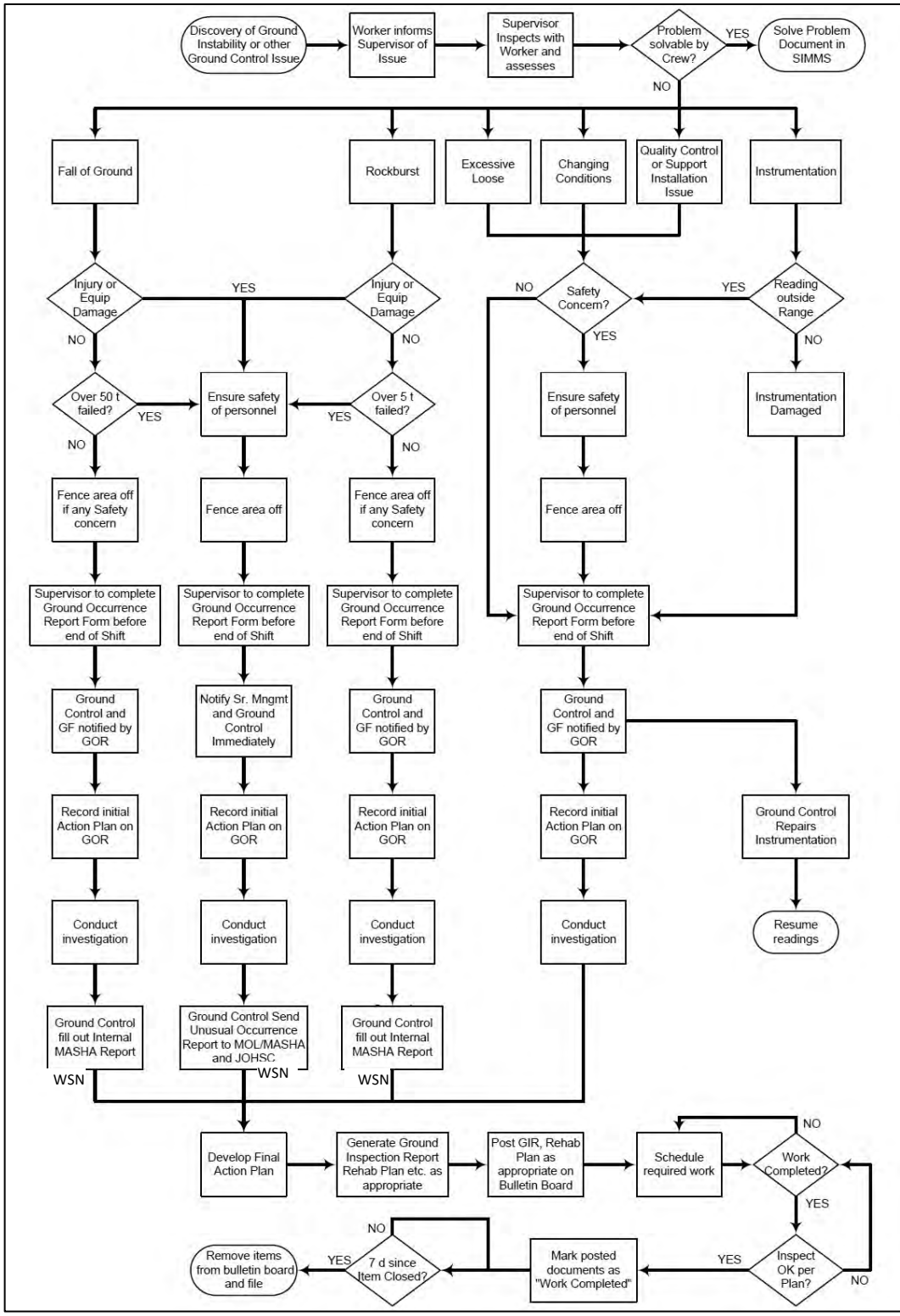


Figure 1c – Example for return information and issue resolution process of ground control communication for an operating mine (source: Operating Mine and member of the WSN’s GC Committee)

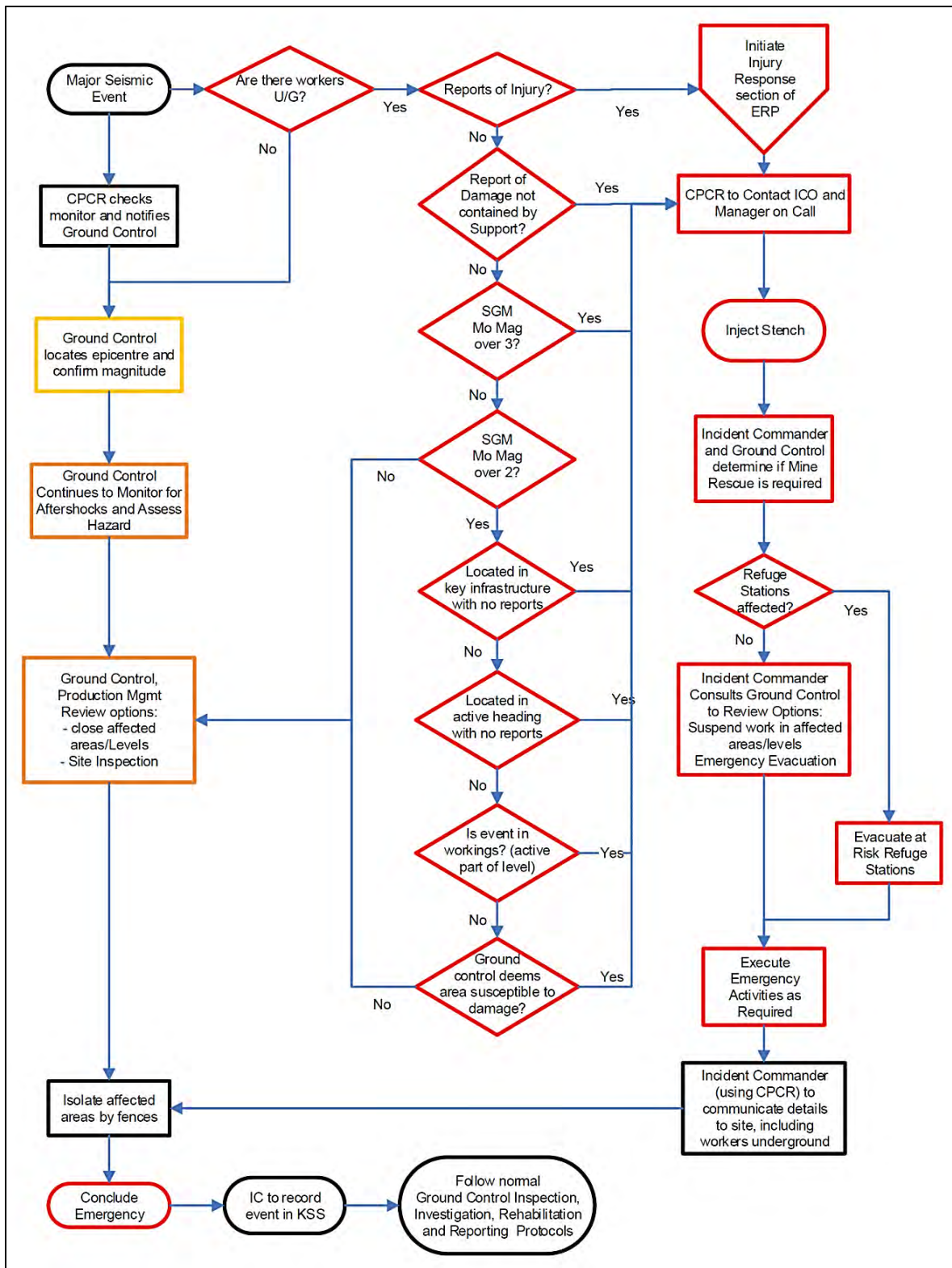


Figure 2a - Example of a ground control communication process in the event of a large seismic occurrence (source: Operating Mine and a member of the WSN’s Ground Control Committee)

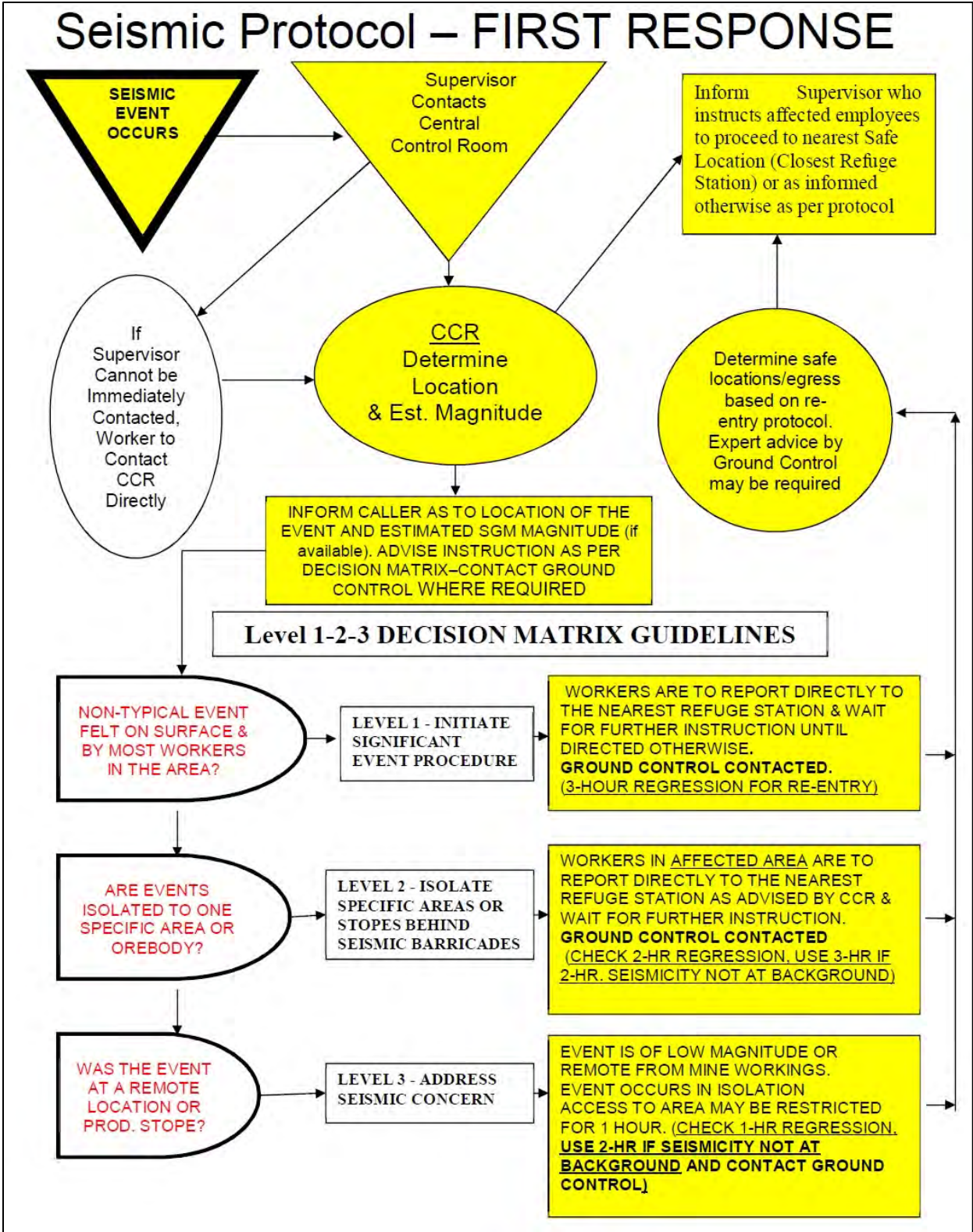


Figure 2b – Example of a seismic protocol in the event of a seismic event (source: Operating Mine and a member of the WSN’s Ground Control Committee)

Ground Occurrence Report

Date: _____	Time: _____	Reported by: _____
Level _____	Area _____	

Groundfall <input type="checkbox"/> Size _____ tons Evidence: Dust Cloud <input type="checkbox"/> Excessive dust on floor, back, wall <input type="checkbox"/> Sudden rush of air <input type="checkbox"/> Head <input type="checkbox"/> Injuries <input type="checkbox"/> Specify _____ Equipment Damage <input type="checkbox"/> Specify _____ Comments _____ _____

Ground Conditions Report <input type="checkbox"/> Excessive Loose in Screen <input type="checkbox"/> Failing bolt heads <input type="checkbox"/> Noticeable spalling/cracking of shotcrete <input type="checkbox"/> Ground support installation problems <input type="checkbox"/> Other <input type="checkbox"/> _____ Comments _____ _____
--

Ground Noise Report <input type="checkbox"/> Description of Ground Noise Heard (include: noise duration, magnitude), _____ _____ Evidence of Damage <input type="checkbox"/> Specify _____ _____

Action taken _____ _____ _____
--

Reviewed by	Title/Department	Reviewed by	Title/Department

Figure 3a – Example of a simplified example ground occurrence report

GROUND CONDITIONS REPORT (as per OHSA Regulation 65)

EVENT #: _____ /16 (next # in Ground Conditions log book)

FILL IN TOP SECTION AND HAND REPORT IN TO SHIFTER

Check Appropriate Situation

- Rockburst----->5 tonnes / equipment damage ____ (Report to M.O.L. per OHSA Reg. 21)
- Fall of ground----->50 tonnes / equipment damage ____ (Report to M.O.L. per OHSA Reg. 21)
- Ground support damage following Rockburst or Fall of Ground
- Ground Support System MULTIPLE Failure during Installation
- Ground working
- Bump
- Request for inspection
- Injury

NAME and EMPL. # _____ OCCUPATION _____

OTHER PERSONS INVOLVED _____

DATE / TIME of OCCURRENCE _____

LOCATION _____

LIST DAMAGE / INJURY and DESCRIBE CONDITIONS

SHIFTER SIGN-OFF _____ **DATE/TIME:** _____

GROUND CONTROL & MINE CAPTAIN RESPONSE:

PRELIMINARY ACTION / DATE / TIME / BY WHOM

(GROUND CONTROL DEPT. has to inspect area prior to any action being taken if a rockburst exceeds 5 tonnes OR a groundfall exceeds 50 tonnes OR a ground support system MULTIPLE failure occurs during installation.)

RECOMMENDATIONS / DATE / TIME / BY WHOM

GROUND CONTROL PERSONNEL: _____ **DATE/TIME:** _____

REMEDIAL MEASURES / DATE / TIME / BY WHOM

MINE CAPTAIN: _____ **DATE/TIME:** _____

FOLLOW-UP / COMMENTS / DATE / TIME / BY WHOM

Figure 3b - Example of a simplified example ground occurrence report

Ground Occurrence Report					
Please Print information CLEARLY. Please be SPECIFIC in all Locations and Descriptions. GOR No.					00001
Date	Time			AM	PM (For seismic events)
Shift	Days	Nights	Reported By	PR No.	
Level	Supervisor			(PRINT NAME)	
Location					
Area is currently active	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Injury	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Area Fenced Off	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Equip Damage	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Fall of Ground	Found <input type="checkbox"/>	Heard <input type="checkbox"/>	Seen <input type="checkbox"/>	Rush of Air <input type="checkbox"/>	Dust Cloud <input type="checkbox"/>
Ground Control to report to MOL if more than 50 tonnes of material failed, OR if Injury or Equipment Damage occurred					
Size	Tonnes		or	Cubic Meters (Circle One)	
Description	Wedge <input type="checkbox"/>	Slab <input type="checkbox"/>	Irregular <input type="checkbox"/>	Support Failed <input type="checkbox"/>	Past Support <input type="checkbox"/>
Material from	Drift <input type="checkbox"/>	Stope <input type="checkbox"/>	Raise <input type="checkbox"/>	Wall <input type="checkbox"/>	Back <input type="checkbox"/>
Work Activity	Dev/Rehab <input type="checkbox"/>	Drilling <input type="checkbox"/>	Blasting <input type="checkbox"/>	Filling <input type="checkbox"/>	None <input type="checkbox"/>
Comments					
Action Taken					
Ground Control Department to be contacted for all incidents of injury/equipment damage			Time contacted		
Seismic Event	Heard <input type="checkbox"/>	Felt <input type="checkbox"/>	Rock Ejected <input type="checkbox"/>	Dust Cloud <input type="checkbox"/>	
Ground Control to report to MOL if more than 5 tonnes of material displaced, OR if Injury or Equipment Damage occurred					
Size	Tonnes		or	Cubic Meters (Circle One)	
Description	Wedge <input type="checkbox"/>	Slab <input type="checkbox"/>	Irregular <input type="checkbox"/>	Small flakes <input type="checkbox"/>	
Material from	Back <input type="checkbox"/>	Wall <input type="checkbox"/>	Floor <input type="checkbox"/>	Closure <input type="checkbox"/>	Floor Heave <input type="checkbox"/>
Work Activity	Dev/Rehab <input type="checkbox"/>	Drilling <input type="checkbox"/>	Blasting <input type="checkbox"/>	Filling <input type="checkbox"/>	None <input type="checkbox"/>
Comments					
Action Taken					
CPCR contacted and Level Plan printed and posted on Ground Conditions Bulletin Board			<input type="checkbox"/> Yes	<input type="checkbox"/> No	
Ground Control Department to be contacted for all incidents of injury/equipment damage			Time contacted		
Other Reportable Ground Condition Changes					
New Cracks opening	<input type="checkbox"/>	Old Cracks opening	<input type="checkbox"/>	Loose peeling from wall/back	<input type="checkbox"/>
Crack Offset in Floor	<input type="checkbox"/>	Crack Offset in Back	<input type="checkbox"/>	Crack Offset in Wall	<input type="checkbox"/>
Excessive loose in screen	<input type="checkbox"/>	Screen torn or corroded	<input type="checkbox"/>	Rebar plates bent	<input type="checkbox"/>
Bolt heads/plates popping off	<input type="checkbox"/>	Cable bolts unbraiding	<input type="checkbox"/>	Cable bolts pulled out	<input type="checkbox"/>
Bent/damaged Amco Culvert	<input type="checkbox"/>	Crushed/deformed timber set	<input type="checkbox"/>	Bent/damaged steel sets	<input type="checkbox"/>
Increase in seismicity	<input type="checkbox"/>	Decrease in seismicity	<input type="checkbox"/>	Face/wall working/popping	<input type="checkbox"/>
Loss of water from floor	<input type="checkbox"/>	Loss of water from drill holes	<input type="checkbox"/>	Increased water from back	<input type="checkbox"/>
Out of Range Inst Reading	<input type="checkbox"/>	Reading	<input type="checkbox"/>	Damage to instrumentation	<input type="checkbox"/>
Ground Support Quality issue	<input type="checkbox"/>	Resin Quality issue	<input type="checkbox"/>	Cable bolt Quality Issue	<input type="checkbox"/>
Rebar/nut/plate Quality issue	<input type="checkbox"/>	Improper torque/spin	<input type="checkbox"/>	Resin set time issue	<input type="checkbox"/>
Ground Support Design issue	<input type="checkbox"/>	Inadequate length of support	<input type="checkbox"/>	Improper spacing of support	<input type="checkbox"/>
Comments					
Action Taken					
Supervisory Sign Off					
It is mandatory that all Supervisors read and initial this document					
Reporting Supervisor			Oncoming Supervisor(s)		
Senior Supervisory/Management Initials					
FOR GROUND CONTROL USE ONLY					
Ground Control			Date and Time		
Ground Control Response					
Results of Investigation					
Ground Inspection Rept			Inspection Report Number		
Ground Inspection Rept <input type="checkbox"/>		Rehab plan issued <input type="checkbox"/>		No Action Required <input type="checkbox"/>	
Comments					

Rev 2016/01/21

Figure 3c – Example of a standard ground occurrence reporting form for an operating mine (source: Operating Mine and a member of the WSN’s Ground Control Committee)

Ground Control Log Entry

DATE: _____ LEVEL: _____
 TIME: _____ am/pm LOCATION: _____
 Reported by: _____ Reported to: _____

PART I

Description: _____

Sketch (if applicable)

Classification (Circle any that apply):

A) Fall of ground B) Excessive loose C) Sign of high stress
 D) Damaged ground support E) Bent/stressed plates F) Support installation problems
 G) Shifting ground or holes H) Ground working/noise I) Adverse geological structures encountered
 J) Unexpected breakthrough K) Spalling/bowling pillars L) Unusual water in or out flows
 M) Monitoring instruments showing ground movement

PART II

Investigated by: _____ Date & Time: _____
 Observations and recommendation: _____

Entry Number

(O) GEOTECHNICAL2 Ground Control Log Book/GC Log Entry-2010.doc

Figure 3d – Example of a standard ground occurrence reporting form for an underground operating mine (source: Operating Mine and a member of the WSN’s Ground Control Committee)

FL 852 / Revised May 1998

GROUND CONDITIONS REPORT

(as per OSHA Regulation 65)

EVENT#: _____ (next # in Ground Conditions log book)

FILL IN TOP SECTION AND HAND REPORT IN TO CAPTAIN/SHIFTER/GROUND CONTROL

Check Appropriate Situation

- Rockburst _____ > 5 tonnes/equipment damage (Report to M.O.L. per OSHA Reg. 21)
- Fall of ground _____ >50 tonnes/equipment damage (Report to M.O.L. per OSHA Reg. 21)
- Ground support damage following Rockburst or Fall of Ground
- Ground Support System MULTIPLE Failure during Installation
- Ground working
- Bump
- Request for inspection
- Injury

NAME and EMPL. # _____ OCCUPATION _____

OTHER PERSONS INVOLVED _____

DATE/TIME of OCCURRENCE _____

LOCATION _____

LIST DAMAGE/INJURY and DESCRIBE CONDITIONS:

SUPERVISORY ACKNOWLEDGEMENT:

MINE CAPTAIN _____ SHIFT BOSS _____ GROUND CONTROL DEPT. _____

PRELIMINARY ACTION/DATE/TIME/BY WHOM

(GROUND CONTROL DEPT. has to inspect area prior to any action being taken , if a rockburst exceeds 5 tonnes OR a groundfall exceeds 50 tonnes OR a ground support system MULTIPLE failure occurs during installation.)

RECOMMENDATIONS/DATE/TIME/BY WHOM

ACTION TAKEN/DATE/TIME/BY WHOM

CAPTAIN _____ SHIFT BOSS _____

FOLLOW-UP/COMMENTS

Figure 3e – Example of a standard ground conditions report form for an operating underground mine (source: Operating Mine and a member of the WSN’s Ground Control Committee)

Ground Control Log Entry

Date: _____ Time: _____
 Location: _____ Reported by: _____
 Reported to: _____

Classification (Check all that apply)

Subsidence Crack Formation Ground Movement
 Fall of Ground Unusual Water Flow Excessive Loose
 Other: _____

Description

	Sketch

Equipment working in immediate area? NO YES Equip #: _____
 Person working in immediate area? NO YES # people: _____
 Dimensions: _____ Long _____ Wide

Investigation

Investigated by: _____ Date: _____

Ground Control: _____	Date: _____
Pit Supervisor: _____	Date: _____
D&E Supervisor: _____	Date: _____
General Foreperson: _____	Date: _____

Figure 3f - Example of a standard ground occurrence reporting form for an operating open pit mine (source: Operating Mine and a member of the WSN’s Ground Control Committee)

APPENDIX A

SAMPLE COMMUNICATION PROGRAM

Generic Ground Control Communication Program

The communication program set up at ***** Mine deals with problems associated with mining a rock mass with respect to the following items listed:

Section A	Ground Stability
Section B	Ground Movement
Section C	Falls of Ground
Section D	Ground Monitoring Equipment
Section E	Emergencies General Items

In addition, several other means exist to pass on information about ground conditions. These include report forms such as the foreman logbook, SAF-079 Investigation Report, ITH/LCD daily drill and ground condition report.

Section A - Ground Stability, and Section B - Ground Movement

Note - Mining layouts with major geologic conditions are issued by mines engineering and include specific instruction such as the Mine support standard to stabilize the ground. Mining layouts are issued to the Mine Foreman after the Mine Superintendent has signed them off.

- 1) In the event an **employee** encounters a ground condition (or any other condition), which the employee considers hazardous to himself or others, the employee will:
 - (a) Immediately correct the situation, if the employee can safely and efficiently complete the work required; and
 - (b) If the employee cannot correct the situation, then he/she must immediately secure the area so others will not be endangered. The Employee will then **notify his/her supervisor** of the condition.

- 2) The **supervisor** will investigate the reported situation and will:
 - (a) Take corrective action to remove or eliminate the hazardous condition;
 - (b) If the hazardous condition cannot be immediately corrected the supervisor will assure the area is secure so others will not be endangered; and
 - (c) Inform a senior supervisor (or designate), if the situation requires their advice.

- 3) The **senior supervisor** (or designate) may investigate the reported situation and will:

- (a) Ensure a plan of action to correct the situation is established, including the use of any Resource Personnel the senior supervisor (or designate) requires; and
 - (b) Ensure a written procedure to correct the situation is established if required. The foreman and the crew(s) involved will review the written procedure before any work commences.
- 4) The **supervisor** in charge of the reported situation will record in his logbook:
- (a) The situation and the corrective action taken;
 - (b) The present status of the situation;
 - (c) Assure that this information and all other pertinent information is passed on to the senior supervisor (or designate); and
 - (d) The on-coming supervisor reviews and signs off the previous shift logbook entry to acknowledge the information contained therein.
- 5) The **crew and the supervisor** will initiate a 079 Incident/Accident report. This report is to be circulated to all levels of local mine management, O.S.H.E. Co-Chairman and the Worker Representative.

Section C - Falls of Ground

When an employee encounters an unexpected fall of ground, the employee will immediately secure the area and **notify his/her supervisor, and will:**

- (a) The supervisor will investigate the area of concern and report to the senior supervisor (or designate);
- (b) The senior supervisor (or designate) will conduct an investigation using the ground control engineer or any other resource personnel the senior supervisor requires;
- (c) The supervisor for the area of concern will conduct an investigation with an O.S.H.E. member and report to the local mine management;
- (d) The crew or supervision will initiate a 079-Incident Report, which will be circulated to all levels of local mine management, O.S.H.E. co-chairman and worker representative; and
- (e) Mines engineering personnel will record the occurrence and report it to the MOL if required under the MOL regulations.

Section D - Ground Monitoring Equipment

The information gathered on ground movement by instrumentation or any other means of acquiring ground control information will be recorded and filed in the mines engineering office. Ground control (or designated) personnel review and analyze this information on a routine basis. This information is available to any employee who wishes to review it.

Section E - Any Emergency Situation Occurring

In the event of an emergency, the person(s) who first locate the emergency will immediately report the event to the operating shaft boss/shaft service leader. If this person is not available, the telephone will ring through to the plant protection officer or failing contact ring to number one first aid (manned 24 hours per day).

- (a) The report must include all pertinent information that is available, including the person's name and the phone number at which the person(s) can be reached.

The operating shaft boss/shaft service leader will contact the senior person on shift who will initiate the appropriate response.

If it is necessary to remove the employees from their work locations the Mine Fire Procedure will be initiated. This will allow the senior person on shift to:

- (a) Account for all personnel working;
(b) Inform all personnel of the emergency situation; and
(c) Issue any required directives to ensure the safety of all personnel at the plant.

General Items

- The 079-Investigation Report form is available for all personnel to report in writing on personnel injury, incident conditions, property damage, fires and other occurrences. The use of this form is encouraged through our safety program.
- Supervisors maintain logbooks from shift to shift which are used for recording unusual events, safety issues, and regular work performed. Reports involving adverse ground conditions are communicated to the ground control engineer/specialist.
- Telephones are available in strategic locations underground.
- Radio communications is available in portions of the underground operations and is being expanded in the active areas of the mine. Radios will become available to mine personnel as the system is expanded.
- LCD, ITH, Data Solo, diamond drillers, and bolting crews use sections of their various reports to inform their Supervisor if any unusual drill conditions are encountered & the location of the occurrence.
- Mines exploration personnel issue Ground Structure/Adverse Ground Notices for any areas of concern.
- The ground control engineer/specialist is used for consultation on specific areas of concern.
- Planning meetings are held with the crews, supervisor of the area, and mine planning engineers for respective areas.
- Safety department personnel distribute material to the supervisors from other mines dealing with unusual occurrences.
- Meetings are held with senior management where unusual occurrences are discussed.

Mine Superintendent _____ Date _____

O.S.H.E. Co-Chairman _____ Date _____

Injury / Incident / Condition Report No.

Mine or Plant: _____ Date Of Occurrence: Y ____ M ____ D ____ Time: _____

Workplace: _____ Workplace Supervisor: _____

Name of Originator: _____ Date: Y ____ M ____ D ____

Names of Others Involved: (If applicable)	Serial #	Occupation

What Happened? Describe to the best of your ability what occurred.

Why Did This Happen? In your opinion, what was the reason(s) why this occurred?
(See over for **Basic Cause Analysis Tool**)

What Can Be Done? What should / will be done to prevent this from happening again?

Approved:	Person Responsible:	Scheduled Completion Date:
Originator Informed of the Status of Investigation Within 14 Days:	Supervisor: _____ Originator: _____	Date: _____ Date: _____
Completion Verified:	Supervisor: _____ Originator: _____	Date: _____ Date: _____

Injury / Incident / Condition Report No.

Mine or Plant: _____ Date Of Occurrence: Y ____ M ____ D ____ Time: _____

Workplace: _____ Workplace Supervisor: _____

Name of Originator: _____ Date: Y ____ M ____ D ____

Names of Others Involved: (If applicable)	Serial #	Occupation

What Happened? Describe to the best of your ability what occurred.

Why Did This Happen? In your opinion, what was the reason(s) why this occurred?
(See over for **Basic Cause Analysis Tool**)

What Can Be Done? What should / will be done to prevent this from happening again?

Approved:	Person Responsible:	Scheduled Completion Date:
Originator Informed of the Status of Investigation Within 14 Days:	Supervisor: _____	Date: _____
	Originator: _____	Date: _____
Completion Verified:	Supervisor: _____	Date: _____
	Originator: _____	Date: _____

	APPROVED BY:	
	Mine Department	Date:
Ground Control Communications Program STANDARD MINING PROCEDURES	Engineering Department	Date:
	Safety Department	Date:
REVISION DATE:	JH&S Committee	Date:
REVISED BY:	Mine Manager	Date:

OBJECTIVE:

To ensure that a system is in place for informing u/g crews, engineering and supervision in an underground mine about:

- (i) possible hazards with respect to ground conditions;
- (ii) the proper procedure in the event of a ground control emergency.

To develop a written procedure which provides for the timely communication of information between u/g Crews, engineering and supervision in the mine regarding:

- (i) ground conditions;
- (ii) geologic structure;
- (iii) ground support/quality control;
- (iv) falls of ground;
- (v) emergencies pertaining to ground control; and
- (vi) ground monitoring equipment.

BACKGROUND:

The *Ground Control Communications Program* has been compiled for ***** Mine to address safety issues relevant to ground control and to comply with the following Regulations for Mines and Mining Plants of the Occupational Health and Safety Act:

- 65. (1) An employer in an underground mine, in consultation with the Joint Health and Safety Committee, if any, for the mine, shall develop a written program to provide for

the timely communication of information between workers and supervisors in the mine respecting ground stability, ground movement, falls of ground, ground monitoring equipment and emergencies.

- (2) The communications program shall set out,
 - (a) means and procedures for communicating information;
 - (b) the kind of information to be communicated; and
 - (c) the actions to be taken by supervisors and workers with respect to information that is communicated to them.

- 21. (5) In addition to the occurrences referred to in section 53 of the Act, a notice in writing shall be given where,
 - (e) a rockburst occurs causing damage to equipment or the displacement of more than five tonnes of material;
 - (f) an uncontrolled fall of ground occurs causing damage to equipment or the displacement of more than fifty tonnes of material;
- 72. A record of the occurrence of a rockburst or of an uncontrolled fall of ground at an underground mine shall be kept in writing setting out,
 - (a) the time, location and extent of the occurrence;
 - (b) injury, if any, caused to a worker thereby; and
 - (c) any other relevant information, including the records of any monitoring instruments or devices before the occurrence.

SCOPE:

These policies are to be followed by all company and contract personnel working at ***** Mine.

RESPONSIBILITY:

It is the responsibility of all levels of Company and Contractor personnel to ensure that the standards are met.

PROCEDURE:

BASIC TRAINING

The engineering department will give the common core skills program, Module U3514-Ground Control and Support as required by all front-line underground supervisors.

All underground employees will be issued the most current, written copy of the ground control procedures. The crew leaders will review these procedures with their crews periodically.

The training department and supervisors will train all new underground employees during orientation, common core training and periodic intervals to identify ground conditions, ground support systems, geological structures, instrumentation, proper installation and reporting procedures, etc.

Periodically, training will be given by qualified persons to u/g workers to improve their knowledge of ground control theory and practice.

The engineering, safety and mine department will develop guidelines and standards for ground control. These standards will be reviewed periodically to ensure that they are complete, correct and up-to-date. All departments will be responsible for inspection and compliance.

SAFETY MEETINGS

Front-line supervisors, engineering and the joint health and safety committee will give talks during safety meetings on necessary ground control concerns including potential problem areas and special support requirements. Routine discussions on related topics will be held at the workplace during the supervisor's site inspections.

U/G workers and supervisors will address any related concerns arising from safety meetings.

When a hazard has been identified, the supervisor or other party will note the problem in the *Ground Control Logbook* which describes the hazard and the necessary action(s). The front-line supervisor will then discuss the issue with each u/g worker who might be affected by the hazard.

Crew meetings are held as required with the u/g supervision, engineering and geology to discuss the driving layout prior to beginning work. Any known potential hazards are addressed at this meeting.

WEEKLY INSTRUCTIONS

A ground control representative is to be present at weekly progress meetings attended by the mine superintendent(s), crew leaders, planning engineer, mine geologist and safety department in order to discuss any ground condition concerns.

A ground control representative is to attend weekly crew safety meetings when necessary to discuss any ground control concerns.

The mine engineer will visit all active headings on a regular basis to identify any ground problem areas. A formal bi-monthly ground control report will be issued addressing any problems or potential problems during that period. Copies of the report will be sent to the

crew leaders, mine manager, mine superintendent, mine production coordinator, chief engineer, chief geologist, the safety department and bulletin board.

DAILY INSTRUCTIONS

Instrumentation:

A record of all ground movement instrumentation is kept by the mine engineer. All installed ground movement instrumentation is recorded in the *Ground Control Logbook* on a timely basis by the engineering and mine departments. The interval for reading of instrumentation is set by the amount of historical movement recorded and the rate of acceleration of the movement. In active headings, the instrumentation should be read at least once per day.

The mine engineer forwards copies of the results of the ground movement instrumentation to the mine department, mine superintendent, public notice board and engineering file.

The mine crew leader has the responsibility to barricade an area where ground movement instrumentation indicates a risk to the health and safety of an employee. The interpretation of all ground movement instrumentation is based on sound rock mechanics principles and the judgement of a competent person. As a rule of thumb, if movement of 1 mm or more occurs in a 24-hour period, the area should be shut down until the problem is rectified.

Structural Mapping:

Geology will map and provide engineering with drawings of any new structural features (including as much pertinent information as possible such as infilling, spacing, water, openness, etc.) as they are encountered. Geology will immediately notify the underground crew, mine department and engineering department if adverse structure is encountered.

The procedure for communicating information from structural mapping is as follows:

A potentially unstable structure is identified by geology or another party and is immediately communicated to the crew in the area if the condition is judged to be hazardous in the short term. If there is no crew in the area and the condition is judged to be hazardous in the short term, the potentially unstable area is barricaded, fenced or guarded, and posted with warning signs to prevent inadvertent access. All structural mapping is to be forwarded to the mine engineer, crew leaders, mine superintendent, underground crew and the geology file.

The mine engineer and crew leader will review the structural mapping and consult with geology to identify potentially unstable structural features. The mine engineer communicates with the crew leaders if potentially unstable structures are identified and

provides technical assistance to the mine department in the form of an action plan. The crew leader is responsible for implementing the action plan to make the potentially unstable structures safe.

The action plan identifies a potentially unstable structural feature, presents a solution based on sound rock mechanics principles and is issued to the mine department in a timely fashion. The problem and necessary action will be recorded in the *Ground Control Logbook*.

Driving Layouts:

Engineering will provide u/g supervision with driving layouts identifying unusual structural features, potential problem areas or hazards, minimum recommended support and special support requirements.

The requirements for the specific ground support and any special information will be listed on the driving layout by engineering.

Each layout will be designed by engineering using sound rock mechanics principles.

Changes in Ground Conditions:

The front-line supervisor will notify the crews of any known changes in ground conditions and give specific workplace instructions to the worker at the morning line-up. Any emergency situation will be relayed to the crews as soon as possible.

The front-line supervisor will ensure crews are aware of the driving layouts provided by engineering identifying structural features, potential problem areas and special support requirements. Underground supervision will also ensure crews are aware of concerns expressed by fellow workers.

All u/g crews will verbally inform supervisors of any ground control concerns and unusual occurrences such as falls of ground, excessive loose, jumping steel, adverse structures, signs of high stress, rockbursts, ground working more than usual, change in ground conditions, stressed bolts, ground support damage, structures encountered during drilling, ground lost around existing bolts, water, etc. The worker will record these observations in the 5-Point Safety System Book. The supervisor on the worker's shift will receive the book at the end of each shift and enter the comments into the *Ground Control Logbook*. The cross-shift supervisor will read the entries in the *Ground Control Logbook* pertaining to his or her workplaces and transfer any new comments in writing to the cross-shift worker's 5-Point Safety System Book under the Special Instructions Section.

The crew leaders, mine supervisors and engineering designate will read and initial the shifter's *Ground Control Logbook* daily and follow-up on any concerns.

Unusual Occurrence:

The mine engineer will prepare a ground control incident report if any of the following situations occur:

- a) ground fall or rockburst resulting in death, injury and/or damage to equipment;
- b) rockburst resulting in a fall of ground of more than 5 tonnes;
- c) uncontrolled fall of ground of more than 50 tonnes;
- d) workplace closed because of ground conditions; or
- e) requested by the worker.

Forward copies of the ground control incident report to the mine manager, mine superintendent, mine production coordinator, crew leaders, chief engineer, mine engineer, chief geologist, safety and training coordinator, joint health and safety committee and u/g safety supervisor.

If an unusual occurrence (a), (b) or (c) happens, the mine engineer must fill out an *Unusual Occurrence Report for Ground fall/Rockburst* and send it to the Ministry of Labour within 48 hours. The mine engineer will maintain an up-to-date database of unusual occurrences.

If any of the incidents described in (a) to (e) occur the following steps will be taken:

Worker

1. Leave area immediately and proceed to a safe location;
2. Secure area to prevent inadvertent access;
3. Report to supervisor;
4. Notify engineering if on day shift; and
5. Await further instruction.

Supervisor

- a) Assess the severity of the incident by discussing it with worker and any other available resources.
 - (i) The crew leader and crew(s) will decide whether work can continue safely.
 - (ii) If the decision to stop work is made, the heading(s) will be shut down until such time a proper investigation/incident report can be done. A request will be made to have the mine engineer evaluate the area.

- (iii) A written action plan will be developed by the crew, u/g supervision, engineering, geology and Joint Health and Safety representative. The action plan will be approved by the crew leader, mine superintendent and joint health and safety committee.
 - (iv) The crew leader will ensure all others affected by this action plan will be informed and have been given a copy of the action plan and understand it.
 - (v) In all cases the occurrence is to be recorded in the 5-Point Safety System Book for the workplace and the *Ground Control Logbook*.
 - (vi) The crew leader will fill out an incident report and arrange an investigation with the crew, mine engineer, geology and a health and safety committee member.
- b. Ensure barricades are installed to prevent access until a proper investigation is conducted.
 - c. If multiple areas are affected these areas will be evaluated and the mine superintendent will be contacted.
 - d. If any other unforeseen change in ground conditions occurs which pose a potential hazard to the worker then the heading, level, zone, etc. will be shut down and barricaded until the area can be inspected by the proper personnel.

Emergencies:

The response, levels of communication and procedures in emergencies is outlined in the Emergency Preparedness Plan - ***** Mine.

APPENDIX B

SAMPLE COMMUNICATION PROGRAMS FROM OPERATING UNDERGROUND MINES

CRITICAL	STANDARD PROCEDURE	PROCEDURE NO. 17EMER08
YES X NO		
OSHA. REG. 854 Section 21(5)		
SIGNIFICANT SEISMIC EVENT ELEVATED SEISMIC ACTIVITY BLAST CLEARING		

AREA:			
CROSS REFERENCES	MR: MINES REFERENCE MANUAL	MT: MINES TRAINING	
	SPI: SPECIAL PROCEDURE INSTRUCTION	LP: LOCAL PROCEDURES	
MR:		OSHA: Reg.854 S.64 Rec.of Dangerous Conditions	
MT:		OSHA: Reg.854 S.65 Communication Program	
OSHA Reg.854 S.21 (5) Notice in writing		OSHA: Reg.854 S.66 Workplace Examinations	
OSHA C.0.1, S.53 Accidents, Explosions, etc.		OSHA: Reg.854 S.68 Isolation of Hazardous Areas	
OSHA Reg.854 S. 62 Check-in System		OSHA: Reg.854 S.72 Rockburst Record	

ORIGINATOR:	DATE: Nov. 23, 2004
1ST REVIEW/REVISION BY:	DATE: Sept. 30, 2005
2ND REVIEW/REVISION BY:	DATE: April 26, 2006
3RD REVIEW/REVISION BY:	DATE: Dec. 10, 2008
4TH REVIEW/REVISION BY:	DATE: Jan 4, 2011
5TH REVIEW/REVISION BY:	DATE: Nov. 22, 2011
6TH REVIEW/REVISION BY:	DATE: February 7, 2013
7TH REVIEW/REVISION BY:	DATE: December 1, 2014
8TH REVIEW/REVISION BY:	DATE: January 6, 2016
9TH REVIEW/REVISION BY:	DATE: February 28, 2017
10TH REVIEW/REVISION BY:	DATE: May 10, 2018

REVIEW					
CONTROL ROOM	Name		CHIEF MINE ENGINEER	Name	
	Signature			Signature	
CONTROL ROOM	Name		SAFETY Supervisor:	Name	
	Signature			Signature	
CONTROL ROOM	Name		JHSC:	Name	
	Signature			Signature	
CONTROL ROOM	Name		SUPERINTENDENT	Name	
	Signature			Signature	
CONTROL ROOM	Name		SUPERINTENDENT	Name	
	Signature			Signature	
SUPERINTENDENT	Name		CHIEF MINE ENGINEER	Name	
	Signature			Signature	
SUPERINTENDENT	Name		CHIEF MINE GEOLOGIST	Name	
	Signature			Signature	
LOGISTICS	Name		SUPERINTENDENT	Name	
	Signature			Signature	
APPROVER: (MANAGER)	Name		CHIEF MINE ENGINEER (Ground Control)	Name	
	Signature			Signature	
DATE: May 10, 2018					
NEXT REVIEW DATE: May 10, 2019					

SAFETY REQUIREMENTS:

RISK ASSESSMENT

RISK WITHOUT CONTROL		Circle the appropriate area.				
LIKELIHOOD	CONSEQUENCES					
	Low	Minor	Moderate	Major	Severe	
Certain (> 1/month)	Moderate	High	Extreme	Extreme	Extreme	
Likely (every 1 - 2 years)	Moderate	High	High	Extreme	Extreme	
Possible (every 2 - 10 years)	Low	Moderate	High	High	Extreme	
Unlikely (every 10 - 30 years)	Low	Moderate	Moderate	High	High	
Rare (1/lifetime of facility)	Low	Low	Low	Moderate	High	

TASK ANALYSIS REVIEW WORKSHEET

Department: _____

OCCUPATION: GROUND CONTROL

Task/Procedure: The procedure to be followed will apply to:

- Significant Seismic Event
- Elevated Seismic Activity

Number: _____

Date: December 1, 2014
March 30th, 2018 Review

EVALUATED BY: _____

TASK ANALYSIS		
SEQUENCE OF TASK STEPS	POTENTIAL PROBLEMS	RECOMMENDED CONTROLS
The seismic event must be reported to the Shift Supervisor (or directly to the Control Room Supervisor if the Shift Supervisor cannot be immediately contacted).	Cannot get through, too many callers.	The Control Room Operator may be busy responding to the event following the initial call. Further communication will follow on the radio. Proceed to Nearest Refuge Station.
The Supervisor will immediately radio or phone the Control Room Supervisor	No Answer	Supervisor will contact Ground Control on-call as required.
The Control Room Supervisor will request the location and any details regarding the event (e.g. name of caller, location of caller at the time of the event, any damage noticed).	Control Room Supervisor not familiar with the area.	Contact Ground Control On-Call for assistance. Supervisors can check seismic visualizer from Refuge Station to review where seismic activity is occurring in their area.

<p>The Control Room Supervisor will initiate a First Response action (refer to figure 1) and make recommendations based on the severity of the event.</p> <p>The Control Room Supervisor will contact Ground Control On-Call as per the Control Room's list of contacts as required due to severity.</p> <p>Control Room Operators must receive training from Ground Control beyond normal Supervisor Induction Program requirements.</p>	<p>Control Room Supervisor not familiar with the procedure.</p> <p>No Answer</p> <p>Supervisor unfamiliar with the area where the seismic event has occurred or not yet fully familiar with the microseismic system.</p>	<p>Control Room Supervisors must receive training from Ground Control. If there is any doubt, contact Ground Control On-Call</p> <p>Ground Control staff have provided their contact information to the Control Room and are available to take calls.</p> <p>Supervisor must Call Ground Control when required. Upon request, further training from Ground Control, will be provided.</p>
<p>The Control Room Supervisor will advise the caller as to the area affected by the seismic activity and estimated strong ground motion (SGM) magnitude of the event if available (If the caller was not the Shift Supervisor, the Control Room Supervisor will contact the Shift Supervisor and discuss the occurrence).</p>	<p>Following a major seismic event, all men have returned to the nearest Refuge Station or safe location, but subsequently the Control Room Supervisor or Ground Control In-Charge observes seismic activity migrating in close proximity to the area of refuge.</p>	<p>Evacuate the area, relocating all employees to a safe location (refuge station) elsewhere in the mine. Ensure the route of egress is not through adverse seismic activity (relocation to deeper levels may be required for egress).</p>
<p>Control Room Supervisors will send the "All Stations" message via radio communications if the magnitude of an event occurrence reaches/approaches 3.0Mn.</p> <p>Personnel in the areas affected by a significant seismic event or elevated seismic activity are to proceed to the nearest safe location (normally Refuge Station) or as subsequently re-directed by the Control Room Supervisor in consultation with Ground Control as required.</p>	<p>Underground Supervisors feel that regardless of the magnitude, an "All Stations" alert should be initiated</p> <p>Workers retreat to the closest refuge station and find that a rockburst has occurred on route from their workplace prior to Control Room having assessed the situation.</p> <p>Worker does not feel comfortable in travelling deeper in the mine and decides to head up ramp into danger area.</p>	<p>The Underground Supervisor will contact the Control Room Supervisor and request that the "All Stations" message is sent.</p> <p>Retreat in the opposite direction towards the next safe location. Contact Supervisor and inform him what has occurred to alert other workers of the hazard. Use alternate radio channels until someone has made contact.</p> <p>Workers must be aware of protocols and the fact that in doing so, they may be jeopardizing their personal safety.</p>

<u>CRITICAL</u>	STANDARD PROCEDURE	PROCEDURE NO.
<u>YES</u> <input checked="" type="checkbox"/> <u>NO</u>	SIGNIFICANT SEISMIC EVENT ELEVATED SEISMIC ACTIVITY BLAST CLEARING	
<u>OSHA, REG. 854</u> <u>Section 21(5)</u>		

SAFETY REMINDER:

The location of a large seismic event or 'bump' is very difficult to guess. Source locations can easily be thousands of feet away from a 'suspected' location. It is therefore very important for personnel to stay tuned to the appropriate mine radio channels for instructions to avoid walking into a seismically active area or rockburst.

Communication will take place through the Central Control Room (CCR) or as assigned by the Senior Supervisor in Charge during an emergency. All communication shall be related in a clear and concise manner.

All persons employed underground, and those who are required to go underground for any reason, must know the standard practice for significant seismic events/ rock bursting.

This procedure must be reviewed yearly and logged in Safety Track:

Activity Type - "Procedure Review"

Activity Topic – "Standard Procedure for Seismic Events"

Notes: Copies of this procedure will be posted in all active Refuge Stations and in the Control Room.

Mine will extend microseismic array coverage of all seismically active working headings as they are driven.

In the event of microseismic system outages (power interruptions, fibre optic cable damage, etc.):

- Ground Control will issue temporary blasting restrictions until corrective measures have been completed.
- Such outages will result in an alarm sent from the microseismic system to Ground Control personnel in the form of an email/text message indicating a suspected problem.
- If the problem cannot be immediately resolved, restrictions will be issued to Superintendents by the Ground Control Supervisor/Specialist/Engineer in charge of Ground Control at the plant or his/her representative.
- Restrictions will be based on knowledge of rockmass response to mining which could result in seismic activity. This knowledge is supported by historic database of microseismic activity and rockbursts due to blasting activities.

Seismic Processing & Reporting

- On weekdays, all Seismic Data is processed prior to the morning Supervisor's line-up meeting.
- Pertinent information such as event locations, magnitudes and restrictions are communicated by the MTS representative at the Supervisor's line-up meeting.
- Copies of any documentation related to the occurrence (s) are issued to the Supervisors as well as the Project Service Contract Supervisor (Resources Management).
- The Beat Supervisor (s) responsible for the affected area (s) will convey this information to his crews.
- All blasts and magnitude events (>0.8Mn) are recorded.
- Large production blasts such as crown blasts which are expected to induce significant seismicity will always be cleared by Ground Control personnel.
- When a seismic event reaches a magnitude threshold, The ESG software is configured to send alerts and notifications to Ground Control personnel via text/email. These applications are web based software which can be limited during internet interruptions. The notification process during these outages are temporarily suspended.

		JOB PROCEDURE CHECKLIST		FORM # REV: 4 00-03-16	
A.) CHECK (✓) ONE OF THE FOLLOWING-----NEW - () <u>or</u> EXISTING - (x)					
B.) CROSS REFERENCE NUMBERS (if applicable):					
> P.M. Inspection Form Number _____					
> Other Job Procedure Number (Mtce or Optg) _____					
		<u>YES</u>	<u>NO</u>	<u>COMMENTS</u>	
1.)	IS THIS A CRITICAL JOB PROCEDURE?	(X)	()	_____	
2.)	IS RISK ANALYSIS FILLED IN?	(X)	()	_____	
3.)	IS TASK ANALYSIS ATTACHED? (new procedures only)	()	(X)	N/A_____	
4.)	IS SAFETY REMINDER(s) INCLUDED?	(X)	()	_____	
5.)	IS TASK PURPOSE DESCRIBED?				
6.)	IS MEN & MATERIAL LIST COMPLETE?	()	(X)	N/A_____	
7.)	IS PREPARATORY WORK LISTED?	()	(X)	_____	
8.)	ARE JOB STEPS COMPLETE & CORRECT?	(X)	()	_____	
9.)	ENGINEERING DATA (if applicable)	(X)	()	Checklists_____	
10.)	TRAINING DATA (if applicable)	(X)	()	Recorded by Ground Control	
11.)	JHSC REFERENCE # (if applicable)	(X)	()	_____	
12.)	IS FIELD REVIEW REQUIRED?	()	(X)	_____	
13.)	IS PROCEDURE READY FOR USE?	(X)	()	_____	
C.) Check this procedure for the items listed below and for the content within each item as requested. (SEE PREVIOUS PAGE FOR FURTHER EXPLANATIONS)					
DATE		REQUIRED SIGNATURES			
		EMPLOYEE(S)	Chief Mine Engineer	JHSC / WORKER REP	SAFETY SUPERVISOR
2018/05/07					

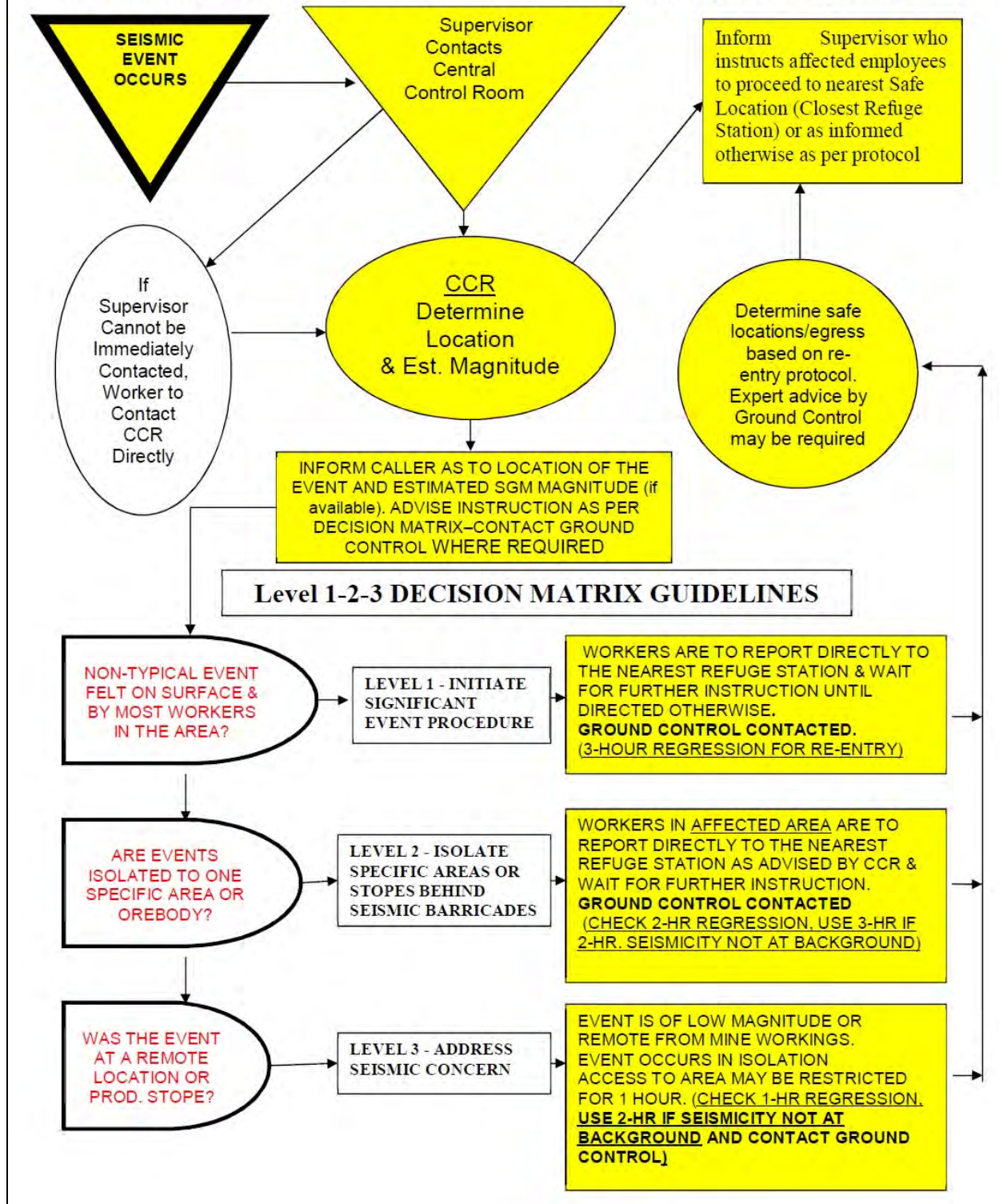
<u>CRITICAL</u>	<u>STANDARD PROCEDURE</u>	<u>PROCEDURE NO.</u>
YES X NO OSHA. REG. 854 Section 21(5)	SIGNIFICANT SEISMIC EVENT ELEVATED SEISMIC ACTIVITY BLAST CLEARING	

JOB STEPS FOR IMMEDIATE RESPONSE TO SEISMIC ACTIVITY

The procedure to be followed will apply to:

- Significant Seismic Event (L1)
 - Elevated Seismic Activity (L2)
1. The seismic event must be reported to the Shift Supervisor (or directly to the Control Room Supervisor if the Shift Supervisor cannot be immediately contacted). The Supervisor will immediately radio or phone the Control Room Supervisor. The Control Room Supervisor will request the location and any details regarding the event (e.g. name of caller, location of caller at the time of the event, any damage noticed).
 2. The Control Room Supervisor will initiate a First Response action (refer to figure 1) and make recommendations based on the severity of the event. The Control Room Supervisor will contact Ground Control On-Call as per the Control Room's list of contacts as required due to severity. Control Room Operators must receive training from Ground Control beyond normal Supervisor Induction Program requirements.
 3. The Control Room Supervisor will advise the caller as to the area affected by the seismic activity and estimated strong ground motion (SGM) magnitude of the event if available (If the caller was not the Shift Supervisor, the Control Room Supervisor will contact the Shift Supervisor and discuss the occurrence).
 4. Personnel in the areas affected by a significant seismic event or elevated seismic activity are to proceed to the nearest safe location (normally Refuge Station) or as subsequently re-directed by the Control Room Supervisor in consultation with Ground Control as required.

Seismic Protocol – FIRST RESPONSE



GUIDELINES FOR MAKING A DECISION FOLLOWING REPORTED EVENT / SEISMICITY

These are guidelines in a making decision following a reported event / seismicity:

(L1) SIGNIFICANT EVENT / ROCKBURST:

The occurrence of any of the following situations may warrant the initiation of the significant seismic event / rockburst protocol:

- Any seismic event associated with a large magnitude warranting the closure of critical areas affecting second egress or all mine workings. It may be felt on surface and by many workers, regardless of location and whether or not there was damage to mine excavations.
- The event may be of large magnitude 3.0Mn and greater requiring the initiation of a Major Seismic Activity notification protocol.
- The Seismic "All Stations" may be initiated at the discretion of the Control Room, Underground Supervisors or Ground Control personnel. PSPs (Protection Services Professional) are trained to modify and send the "All Stations" message. They can assist with this communication.

List of automated messages for L1 type Significant Events:

1. There's been a Seismic Event. All Mine personnel must report to the nearest refuge stations.
2. There's been a Seismic Event. All personnel in Division must report to the nearest refuge stations.
3. Ramp in Division is clear. All personnel are to proceed to station.
4. Seismicity is clear in Division . Follow Supervisor's instructions before resuming work.

Note: All areas affected by seismicity will be restricted as per Ground Control instructions. Underground Supervisors will install barricades prior to releasing crews to return to work.

- The seismic event triggers a major rockburst or results in critical injury to a worker.
- The event affects the main accesses (e.g. ramp, footwall drifts), which likely requires workers to be confined to underground refuge stations for periods of greater than 4 hours or requires the evacuation of some or all workers.
- Seismicity which prohibits some or all workers from going underground, restrictions as per the seismic work function of the microseismic system.

Notes:

- The decision to initiate the significant event / rockburst procedure is made by:
 - Senior Supervisor on site, based on information from the Beat Supervisor, Control Room Supervisor and Ground Control recommendation.

- Beat and Control Room Supervisors (night shift and weekends) with input from Ground Control. Control Room will contact Ground Control and the Senior Supervisor on-call.
- **A minimum 3-Hour Regression will be used for re-entry.** For emergency egress of personnel, follow rescue instructions of the Control Group in direct consultation with Ground Control.

(L2) ELEVATED SEISMIC ACTIVITY:

The occurrence of any of the following situations warrants the initiation of the elevated seismic activity protocol:

- Any seismicity which is isolated to a specific area of the mine which can be restricted and does not migrate to other locations. Workers can be isolated from the seismic activity. These types of events may be related to strain-type events following production activities.
- Events confined to remote areas of the mine such as the hangingwall.
- Any seismic event triggering a rockburst (damage to mine excavation).
- Excessive seismicity in close proximity of mine excavations where the area can be effectively restricted.
- **A minimum 2-Hour Regression will be used for re-entry.** In the event that background energy levels have not been achieved following a 2-Hour period, 3- Hour Regression will apply.

(L3) SEISMIC CONCERN:

The occurrence of any of the following situations warrants the initiation of the seismic concern protocol:

- Events are isolated or low magnitude events that do not result in excessive seismicity.

Notes:

- Apply L2 designation or contact Ground Control if not certain.
- **A minimum 1-Hour Regression and review will be used for re-entry** where an area has been restricted as a Seismic Concern requiring temporary restriction.
- **The seismic work re-entry software may not be applicable** due to low number of events. In this case, event frequency will determine background levels.
- **In both scenarios, L2 designation will be assigned if energy levels exceed 1-Hour Regression values.**
- Temporary barricades must be put in place as applicable until cleared.

SEISMIC PROTOCOLS

LEVEL 1 - SIGNIFICANT EVENT / ROCKBURST PROTOCOL:

1. The Control Room Supervisor will follow the notification protocol for reportable incident (Reg. 21-5) of the Mine Incident/Injury Notification Protocol for Frontline Supervision and fill out the checklist for significant event / rockburst procedure (attached)
2. The Control Room Supervisor will inform the most senior official present at the mine or Senior on-call (Nights & Weekends). When required, the Senior on-call must fill out the "Checklist for Senior Supervisors".
3. The Control Room supervisor will call Ground Control (Dayshift weekdays) or contact Ground Control On-Call personnel (Nights & Weekends). Ground Control Supervisor may be reached
4. Where means of egress (i.e. ramp) is deemed to be safe as per CCR and/or Ground Control recommendation based on seismic parameters and sound judgment, the Senior Supervisor in charge may make a decision to evacuate everyone to a different level away from affected areas.
5. When required, the most senior official present at the mine will be in direct charge of the rescue and assessment in conjunction with the Division Superintendent and Ground Control Supervisor or their designates. A Seismic "All-Stations" alert may be issued as required.
6. When required, a Control Group will be formed in the Manager's office by the Senior Official on site or his/her designate.
 1. The Control Group will appoint one or more Surface Recorder and Tag-In Board duties.
 2. The Surface Recorder is to call all affected Refuge Stations and record the names and serial numbers of personnel signed in at the affected refuge stations.
 3. This information is then relayed to the Tag-In Board responsibility until all personnel have been accounted for in the affected areas as per the Fire Procedure
7. All affected personnel gathered at a Refuge Station will proceed to fill in the "Refuge Station Report to Surface for Seismic Activity" form (attached). A copy can be found at the back of this procedure posted at all active refuge stations. On it, a Supervisor or delegate will list the names and the serial numbers of all personnel who have reported in at the Refuge Station. If you have not been contacted within 1 hour you are to telephone the Control Base (Mine Manager's Office) and report.
8. All persons must remain in the Refuge Station until they are signed in after which point they may wash-up outside the door provided they remain in the immediate area.
9. Any area restricted due to significant event / rockburst must remain restricted until an investigation is completed. Areas affected will not be investigated until the seismic work (energy) is at or below background noise level. Evacuation also falls in the same category unless, based on clear rational knowledge and experience of the Ground Control Supervisor or his/her designate, it is recommended otherwise.

LEVEL 2 - ELEVATED SEISMIC ACTIVITY PROTOCOL:

1. A qualified Control Room Supervisor (trained by Ground Control on the use of the seismic system) will make initial recommendations to restrict an area based on the location of seismic activity.
2. If the information is clear and areas are promptly restricted as per protocol, the Control Room Supervisor may elect to communicate such restrictions and clear for subsequent re-entry.
3. The Control Room Supervisor will call Ground Control _____ or contact Ground Control On-Call personnel (Nights & Weekends) to request guidance or to take over and initiate the protocol. _____ Ground Control Supervisor may be reached at _____.
4. Ground Control Personnel will provide recommendations about area(s) to be restricted to the Senior Supervisors in charge at the mine (ie. Beat Supervisors, Control Room Supervisors, Superintendents).
5. The Beat Supervisor or his/her designate will ensure that all areas affected by the assigned restriction are restricted with proper barricades in place and recorded in the Supervisor logbook. The Beat Supervisor is also responsible for clearing such areas when instructed to do so as per the _____ Mine Protocol for Re-Entry.
6. Any restricted area due to elevated seismicity (L2 Protocol) will remain restricted for a period of time as follows based on _____ Mine microseismic system calibration for re-entry:
 - i. A minimum 2-hour regression will initially be applied. If after 2-hours, energy release rate is established at background, the area may be re-opened for inspection (follow re-entry protocol).
 - ii. If energy remains above background after 2-hours, the area will remain restricted until 3-hour regression background energy levels are established (minimum 3-hr time restriction from the time of the initial event).

For all L1 and L2 classifications, Ground Control personnel will send pertinent documentation with event source locations, magnitudes and barricade locations to recipient groups of the VALE Global address list. They include the _____ Mine Supervisors", " _____ Mine MTS Department", _____ Mine OSHE Committee", _____ Mine PMO Group", _____ Mine Training, and _____ Superintendents.

LEVEL 3 - SEISMIC CONCERN PROTOCOL:

1. The Beat Supervisor will consult with the Control Room to determine the source location of a random seismic event. Such an event may fall in a remote area outside of where it was felt or could even be a blast _____ in which no action is required. Events which do not trigger subsequent (L2) activity fit into this category.
2. If a random event occurs where workers are normally required such as at a development face, or production area, access to such areas may be restricted following assessment of microseismic activity. Small events triggered by drilling fit into this category and are considered a normal part of the development cycle. An example of this type of an event is small snapping and popping which can be commonly triggered by mining activities such as production drilling, introduction of water at a development face, rattling the face with a drill steel, bolting a heading or filling of a production stope. It is recommended that where these events cause concern to an employee, the area is restricted for a period of minimum one hour with review of the microseismic system based on subsequent seismicity or energy levels where required.
3. At any time, where seismic energy levels elevate to above background levels, L2 restrictions apply.
4. The Beat Supervisor must ensure restricted areas are double barricaded and clear upon re-entry in consultation with the Control Room or Ground Control as required. All information pertinent to the seismic activity must be recorded in the Supervisor's logbook.

PROCEDURE IN CASE OF A LEVEL 1 SIGNIFICANT EVENT / ROCKBURST

CHECKLIST FOR CONTROL ROOM SUPERVISORS

DATE OF EVENT: _____ TIME: _____
TIME OF EVENT ON MS: _____ MAGNITUDE OF EVENT(S): _____
LOCATION: LEVEL _____ AREA: _____
REPORTED BY: _____ BEAT SUPERVISOR(S): _____
DESCRIPTION OF SIGNIFICANT EVENT/ROCKBURST: _____

Note: Description of event includes pertinent information to the occurrence such as (damage reported, everyone in affected area accounted for according to beat Supervisor, etc...).

1. Time event reported: _____ TIME: _____
 2. Beat Supervisor contacted: _____ TIME: _____
 3. Ground Control contacted: _____ TIME: _____
 4. Senior on call contacted: _____ TIME: _____

 5. Notification Beat Supervisor(s) of the significant event / rockburst and to restrict affected area(s).
TIME of Notification _____ ALL STATIONS: Y ___ N__

 6. If applicable, notification of all personnel at the mine to report to respective refuge stations:
TIME of Notification _____ Not Applicable: _____

 7. Notification of "PSP"s - Protection Services Personnel (if all personnel at the mine are notified to report to refuge station).
TIME of Notification _____ Not Applicable: _____

 8. Notify _____ If there is no answer call _____ wait 5
seconds and leave message stating that there's been a seismic event and that they must return
your call.
If All Stations was sent, request that they account for _____ personnel and follow up with a
"Report to Surface" list of names.
TIME of Notification _____ Not Applicable: _____

 9. Contact the Sand plant to have the pour stopped (if a Stope in the affected area is being poured
or if all personnel at the mine are notified to report to refuge station):
TIME of Notification _____ Not Applicable: _____

 10. Shut down the muck circuit (If any area of the muck circuit is affected by the occurrence or if all
personnel at the mine are notified to report to refuge station):
TIME of Notification _____ Not Applicable: _____
- Control Room Operator _____

Please return this form to the Ground Control Dept.

Table 1 - Refuge station report to surface for seismic activity

**REFUGE STATION REPORT TO SURFACE
For SEISMIC ACTIVITY**

LEVEL _____ TIME _____ SURFACE RECORDER _____
 DATE _____ ALL CLEAR _____

Last up-date: **November 2, 2012**

Account #	STAFF		Account #	MAINTENANCE		Account #	OPERATING		Account #	OPERATING	
	Employee No.	Name		Empl. No.	Name		Empl. No.	Name		Empl. No.	Name
Account #	MINE RESCUE		Account #	CONTRACTORS		Account #	OPERATING		Account #	OPERATING	
	Employee No.	Name		Empl. No.	Name		Empl. No.	Name		Empl. No.	Name
Account #	VISITORS		Account #	OPERATING		Account #	OPERATING		Account #	OPERATING	
	Name	Company		Empl. No.	Name		Empl. No.	Name		Empl. No.	Name

NOTE: This form is to be used by the Surface Recorder to record information of all personnel reporting to a Refuge Station where a Significant Seismic Event has occurred. The tag-in board will be used to identify all personnel within a division affected by seismic activity. Information will be provided over the phone to the Surface Recorder when a refuge station is contacted. Personnel must remain within visual contact of the refuge station after having identified themselves to the Supervisor or Person in Charge at the Refuge Station.

RETURN THIS FORM TO GROUND CONTROL

X:\Safe production\Emergency Preparedness\Emergency Procedures\Significant event\Rockburst\Procedure2012

Protocol for re-entry to an area previously closed due to Seismic Activity

Any area that has been closed due to a seismic event will remain closed until a Seismic Evaluation has been completed as previously defined. Once an area has been restricted, it will not re-open for minimum periods dependent on L1-L3 event severity. Regression periods commence from the time an event or excessive seismicity responsible for the initial closure occurred, pending a seismic evaluation of all restricted areas.

The Seismic Evaluation will be carried out by Ground Control or trained Control Room Supervisor. Pertinent information and clear recommendations will be given to the Senior Supervisor in Charge to base re-entry decisions. In the case of a significant event / rockburst, Ground Control will communicate all pertinent information to Senior Supervisor in charge and / or the Control Group.

When a decision has been made to allow re-entry, the Shift Supervisor must clear all restricted areas prior to opening them, and send a notification to Management, JHSC representatives and Ground Control. If a rockburst or fall of ground is encountered, the area must remain restricted until a Ground Control investigation is completed as legislated. All rockburst occurrences, both reportable and non-reportable will be investigated with detailed reports filed at the mine site.

Ground Control ON-CALL Procedure:

The Ground Control ON-CALL Procedure is implemented for all L1 & L2 events and as required where a Control Room Supervisor requires assistance for L3 events. Ground Control must be promptly informed of any rockburst or fall of ground.

The Senior Supervisor and Shift Supervisor in charge of the restricted area will decide on a course of action based on input and clear recommendations from the Control Room Supervisor in consultation with Ground Control personnel as defined above. Ground Control will liaise with the Control Room Supervisor who will communicate directly to the Shift Supervisor. Seismic activity presentations will be emailed to Supervisors at the mine-site as required.

Where a qualified Control Room Supervisor has issued a restriction without contacting Ground Control for L3 areas as defined above, a notification must be emailed to Ground Control personnel indicating the time and location of L3 areas restricted along with barricade locations.

When affected areas are cleared and inspected for re-entry, the Beat Supervisor in charge of the inspection must reply to the previous email indicating whether or not the restricted area has been re-opened. Areas must remain double barricaded for inspection by Ground Control where damage has occurred to the excavation.

Protocol Rockburst / Fall of Ground Investigation

Ground Control Supervisors/Specialists/Engineers or delegate shall complete an investigation prior to re-opening an area affected by a rock burst or fall of ground.

A rockburst displacing 5 tons of material or greater and/or an unexpected fall of ground exceeding 50 tons must be reported to the Ministry of Labour by Ground Control within 48 hours of the incident. Any damage resulting in injury or damage to equipment from the displaced material is to be reported, regardless of the amount of material displaced.

A report will be generated stating recommendations to Operations (and as prescribed in Section 53 and Reg 21 (5) of the Occupational Health and Safety Act).

Procedure to Clear Production Blasts

(refer also to procedure for clearing crown blasts)

1. Restrict (double barricade) access to the top and bottomsill of all planned production blasts as indicated on the blast safety notice prior to blasting.
2. Ground Control, the Control Room Supervisor or Underground Supervisor trained on the blast clearing protocols will review seismic activity following the blast and determine if any additional barricades are required at any areas affected by seismic activity following the blast. No personnel are to enter the affected levels prior to instruction from the Control Room Supervisor, the Underground Supervisor or Ground Control. For large seismic events, follow seismicity protocol.
3. The Control Room Supervisor, or Ground Control will review the seismic event clustering and ensure that seismicity is confined to the stope currently blasted and that the area remains isolated to the restricted area (step 1) indicated above. Communication of this information will be made at the day and afternoon shift line-up meetings by MMTS representatives or the Control Room Supervisor following review of the system.
4. For access beyond level Footwall Drifts (or locations as determined otherwise), permission to proceed to clear all areas unaffected by microseismic activity will be communicated to the person in charge of clearing by the Control Room Supervisor or Ground Control. If additional barricades are required to isolate seismic activity, their location will be communicated to, and setup by the person in charge of clearing.
5. Details of seismic activity parameters will be completed by the reviewer for each blast. The log is to be filled out and temporarily stored at a central location at the Control Room. Ground Control will pick up the forms regularly and enter information as part of the blast record.
6. Where adverse microseismic activity occurs following a production blast, access to top and bottomsills will remain restricted for a period of three hours. This three hour time period was initially based on four years of historic decay periods for SS blasting in the Deep and holds true through

Normal stress re-adjustments due to blasting usually decay within a short period of time following a production blast in a low-stress area. All production blasts will be pro-actively restricted for a minimum period of 1.5 hours to allow for this decay.

- A production stope is declared at background levels if there have been no SGM events 0.8Mn or greater and the 1-Hour Regression is at background (regression less than a slope of 3.7e

+004 Units/hour) after 1.5 hours following blasting. At this time, the checklist can be filled out and previously restricted top and bottomsills may be re-opened for normal activities.

- If during the 1.5 hours wait period, events 0.8Mn and greater have occurred following the blast, the stope will remain restricted a minimum 3-Hour period following the initial blast time.

Sills may re-open following the three hour review when the following conditions have been met:

- a. A one hour blast regression period reveals that energy levels have receded to background levels or where the seismic work graph is not available, microseismic levels have clearly returned to background as defined above. The background level for seismic work is defined as a one hour regression less than a slope of $3.7e +004$ Units/hour as defined on the chart.
- b. It has been ensured that no damage has occurred in the previously restricted areas.

Procedure to Clear Production Blasts

(crown blasts)

Crown blast reviews will be completed for each stope. Production blast clearing procedure will apply unless otherwise noted in a crown blast review.

Procedure to Clear Development Blasts

1. Restrict (double barricade) access to the development blast heading(s) prior to blasting.
2. No personnel are to enter the affected development headings until the Supervisor confirms that the headings are clear of microseismic activity on the Shifter's Visualizer or is advised of the same by Ground Control or the Control Room Supervisor.
3. The Supervisor is to contact the Control Room Supervisor or Ground Control for further instruction where seismicity is excessive and audible.
4. Follow Production Blast Clearing protocols if seismic event frequencies have not decayed one hour after blast times.
5. The Control Room Supervisor, will log details of seismic activity parameters when contacted by the Supervisor (as per checklist). The log is to be filled out and stored temporarily at a central location at the Control Room. Ground Control will pick-up the form and log data as required.

PRODUCTION BLAST CHECKLIST FOR CONTROL ROOM SUPERVISORS

NAME: _____ **DATE:** _____

Fill out one box below for each PRODUCTION BLAST taken:

NAME: _____ **DATE:** _____

Fill out one page for each PRODUCTION BLAST to be cleared :

STOPE NAME: _____ TIME BLASTED: _____

TOP SILL LEVEL: _____ BOTTOM SILL LEVEL: _____

Select the blast event and open the Seiswatch Tool (use a 1 hour regression):

TOP SILL ENERGY READING: _____ TIME: _____

BELOW 3.7×10^4 Units/Hour? YES NO

BOTTOM SILL ENERGY READING: _____ TIME: _____

BELOW 3.7×10^4 Units/Hour? YES NO

Are both bottom sill and top sill below background energy levels? YES NO

If YES – stope is clear.

If NO - fill out box below when energy levels are below background levels.

ABNORMAL DEVELOPMENT BLAST CHECKLIST FOR CONTROL ROOM SUPERVISORS

NAME: _____

DATE: _____

LEVEL: _____

HEADING: _____

Fill out the box that corresponds to the reason the development blast is abnormal:

SGM EVENTS

SGM Events? YES NO

TIME: _____ MAGNITUDE: _____

TIME: _____ MAGNITUDE: _____

TIME: _____ MAGNITUDE: _____

SEISMIC CONCERN

Excessive Seismicity? YES NO

Were you contacted by underground? YES NO

If yes, name of contact individual: _____

Time of contact: _____

Below 3.7e004 Units/Hour? YES NO

If YES – Heading is clear.

Energy Levels when Heading is Clear

ENERGY LEVEL READING: _____ TIME: _____

Ground Control Program – Responsibilities and Communication

1.0 Introduction

1.1 Objective

To ensure the timely and accurate communication between workers, supervisors, technical staff and management with respect to ground stability, ground movement, falls of ground, ground monitoring equipment, support recommendations and emergencies.

1.2 Scope

All employees and contractors are working on or about Mine Sites will be found under the scope of this SOP.

1.3 Training/Responsibilities

1.3.1 The **General Manager** is responsible for:

- The overall management of site safety.

1.3.2 The **Health and Safety (HS) Superintendent** is responsible for:

- Monitoring the implementation of this procedure; and
- Ensuring that this procedure is maintained

1.3.3 **UG Superintendent / Mine Captain** are responsible for:

- Ensuring that this procedure is communicated to their employees;
- Ensuring that their employees have received the appropriate training;
- Ensuring Shift Supervisors are communicating ground issues & remedies to employees; and
- Reviewing ground control logbook on a daily basis.

1.3.4 **Engineering Department** is responsible for:

- Reviewing ground control logbook on a daily basis;
- Investigating all ground control issues and producing a report in the findings (including remedial actions).

1.3.5 Supervisors are responsible for:





- Communicating ground issues & remedies to employees;
- Ensuring these procedures are followed; and
- Reviewing ground control logbook on a daily basis.

1.3.6 All Employees are responsible for:

- Understanding and practicing this procedure as required; and
- Asking their supervisor for clarification if they are unsure of any aspect of this procedure.

2.0 Procedure

It is your responsibility to ensure that you understand this procedure before performing the following tasks. Contact the document author or supervisor if you have any questions about this procedure.

Step	Action
	Inspect your work area for unsafe conditions. If deficiencies are observed, document and report them to your supervisor immediately. Never work in an unsafe environment, if you are unsure about an issue, speak with a supervisor before proceeding.
	Required PPE for this job/task include: High Vis work wear, hardhat, safety glasses, safety toe boots (6 Inches) or miners boots, head lamp, fall restraint safety belt, and hearing protection where required. Additional PPE & requirements:
	This program is designed to ensure the timely and accurate communication of information between workers, supervisors and technical staff in the mine with respect to ground stability, ground movement, falls of ground, ground monitoring equipment report of findings, remedial actions and emergencies
	<p>64. (1) Where in an underground mine a potential or actual danger to the health or safety of a worker has not been remedied or removed at the end of a work shift, a record in writing shall be made by the supervisor of the work shift and signed by the supervisor describing,</p> <ul style="list-style-type: none"> (a) the dangerous condition; and (b) the state of corrective measures taken. R.R.O. 1990, Reg. 854, s. 64 (1). <p>(2) The record required by subsection (1) shall be read and countersigned by the supervisor of the next work shift before a worker on such shift does any work in the area of the dangerous condition and the workers on such shift who may be affected by the dangerous condition shall be advised of,</p> <ul style="list-style-type: none"> (a) the dangerous condition; (b) the state of corrective measures undertaken; and (c) the work required to be done to remove or remedy the dangerous condition. <p>65. (1) An employer in an underground mine, in consultation with the joint health and safety committee, if any, for the mine, shall develop a written program to provide for the timely communication of information between workers and supervisors in the mine respecting ground stability, ground movement, falls of ground, ground monitoring equipment and emergencies. R.R.O. 1990, Reg. 854, s. 65 (1).</p> <p>(2) The communications program shall set out,</p> <ul style="list-style-type: none"> (a) means and procedures for communicating information; (b) the kind of information to be communicated; and (c) the actions to be taken by supervisors and workers with respect to information that is communicated to them. R.R.O. 1990, Reg. 854, s. 65 (2).

2.1 Means and Procedure for Communicating Information

Transfer of ground control information is the responsibility of all supervisors, technical staff and workers in the underground operation. This includes contractors. Transfer of information may be communicated by any of the following means:

2.1.1 Daily Instructions (Pre-Shift Huddle)

Supervisors will communicate any hazards or special ground control requirements to the oncoming shift via the Supervisor's logbook. The oncoming Supervisor will also check the *Ground Control Logbook* for information related to their work areas. This information will be passed on to the crews when they check in at the start of the shift.

2.1.2 Verbal and Written Communication between Workers and Supervision

Workers are required to bring any Ground Control concerns to the attention of their Supervisor. Concerns include:

- falls of ground
- rock burst (damage caused by a verified seismic event)
- excessive loose
- excessively incompetent ground (over break of blast holes)
- voids, faults, rock unit contacts
- structure encountered while drilling (perhaps there is an overlooked mineralization zone)
- signs of high stress (the constant appearance of loose, crushing etc.)
- indications of ground movement (cracks appearing)
- unusual or abnormal noises
- change in the ground conditions
- squeezing holes
- stressed bolts (the domed washer plates are collapsed, deforming or the squeeze blocks show an indentation)
- rusted bolts
- installation problems (holes are crumbling)
- ground lost around existing bolts
- ground support damage (including damage to screen)
- timber taking load (wedges being squeezed, signs of buckling)
- unexpected breakthroughs while bolting or drilling
- broken or missing timber
- spalling or hour glassing of pillars
- adverse structure (blocky ground, weak bonding between rock units)
- monitoring devices showing movement (wedge falling out of a crevice)
- sudden change in water elevation
- unusual water flow or dripping back, or unexpected loss of water
- difficulty or issues properly installing ground support

This information will be recorded by the worker on their daily timecard and by the Supervisors in the Supervisor's Logbook and in the *Ground Control Logbook*. The oncoming Supervisor shall take appropriate action as the situation dictates.

The Supervisor on the worker's shift will transfer significant and pertinent information to the Supervisor's Logbook at the end of each shift and enters any ground control concerns or unusual occurrences into the *Ground Control Logbook*.

The Superintendent or equivalent will read the entries in the Shifter's Logbook and the *Ground Control Logbook* pertaining to their workplaces and communicate any information to the oncoming workers and give specific workplace instructions to the workers at the morning line-up and on the worker's daily timecard.

The Superintendent or equivalent will ensure that workers are aware of the driving layouts or stope plans provided by engineering identifying structural features, potential problem areas and special standards or support requirements. Current copies of these plans are kept in the workplace.

2.1.3 Ground Control Logbook

The *Ground Control Logbook* is meant to communicate ground control information and document follow-up action that may be required. A report in the Ground Control Logbook is to be entered for concerns in a workplace such as:

- falls of ground
- rock burst
- excessive loose
- excessively drummy ground
- excessive voids in the rock
- structure encountered while drilling
- signs of stress
- ground working
- unusual noises
- change in ground conditions
- squeezing holes
- stressed bolts
- rusted bolts
- ground support Installation problems
- ground lost around existing bolts
- ground support damage
- timber taking load
- broken or missing timber
- rotten timbers
- spalling or hour glassing of pillars
- adverse structure
- monitoring devices showing movement
- sudden loss or accumulation of ditch water

- unusual water flow or dripping back
- unexpected breakthroughs while bolting or drilling holes
- undercutting of walls and pillars

Anyone can make an entry in the *Ground Control Logbook* for any ground control related or unusual occurrence. Miners should also use their 10 Point Safety Card. People, other than the Superintendent, their designated representatives or the ground control engineer, making a log entry must ensure that the Superintendent or equivalent is immediately notified. The Superintendent or designate will note in the Supervisor's Logbook that a *Ground Control Logbook* entry has been made.

The Superintendent or designated representatives and Ground Control Engineer will review *Ground Control Logbook* daily and follow up on any concerns.

2.1.4 Safety Meetings

Ground control shall be an annual topic of the monthly safety meetings, with additional monthly Safety meetings being dedicated to ground control issues if required. This meeting shall be facilitated by the engineering department in conjunction with the safety and mining departments.

Each monthly safety meeting has time allotted where any concerns may be raised. If the U/G workers and Supervisors cannot satisfactorily address any ground control related issues raised during the meeting, the concern shall be entered into the minutes of the meeting and into the *Ground Control Logbook* by the shift supervisor. The issue will then be investigated by the superintendent (or designate) and the ground control engineer. The findings and subsequent report will then be discussed with the crews at pre-shift huddles and as a follow-up item at the next monthly safety meeting.

3.0 Accident at a Project Site or Mine

A written report to the Ministry of Labour is required if any of the following ground control related situations apply:

Reg. 854 Sec.21 (5)

- (e) a rockburst occurs causing damage to equipment or the displacement of more than five tonnes of material;
- (f) an uncontrolled fall of ground occurs causing damage to equipment or the displacement of more than fifty tonnes of material;
- (i) an unexpected and uncontrolled run of material, water or slimes in excess of one cubic meter occurs that could have endangered a worker. R.R.O. 1990, Reg. 854, s. 21 (5); O. Reg. 60/94, s. 3; O. Reg. 34/14, s. 2.

If a reportable incident occurs, the Ground Control Engineer in conjunction with the safety department must complete a notice in writing and send it to Ministry of Labour, and a member of the Joint Health and Safety Committee.

The Ground Control Engineer & the safety department will maintain a file of all completed reportable incidents.

4.0 General Procedures for Dealing with Ground Control Related issues

If an event requires an incident report, the following guidelines shall be followed:

- The on-shift Supervisors will decide whether work can continue safely.
- If the decision is made to cease work; the heading(s) will be shut down until a proper investigation /incident report can be done. An entry will be made in the *Ground Control Logbook*.
- An investigation team will be assembled as required.
- A written action plan will be developed by the crew, U/G supervision, Engineering, Geology and a JH&SC member before work resumes. This action plan will be detailed in the *Ground Control Inspection Report*.
- The Supervisor and the Superintendent or designate will ensure that others affected by this action plan are informed and given a copy of the action plan.
- In all cases, the occurrence is to be recorded in the Shifter's Logbook.
- Ensure barricades and signs are installed to prevent others from accessing the hazard.

Once an investigation and the remedial action is completed, the Superintendent or designated representative will note this in the *Ground Control Logbook*.

5.0 Basic Training

All employees and contractors who work underground are required to have their Basic Underground Common Core Modules. They must receive an induction and orientation tour with a competent person. During the induction, personnel are instructed on the means for communicating sub-standard conditions, unsafe conditions, work refusals and emergency situations. During the site orientation tour, workers will be shown examples of poor ground conditions and what would require a report in the Ground Control Logbook.

All underground employees and contractors will review the current version of the Ground Control Policy and Standards. These standards can be found on the back of every drive layout or issued print. Anyone not understanding these prints or having concerns must immediately bring this to the attention of their supervisor.

Training in the workplace (work specific and product specific) will be given by qualified persons. Underground workers must have adequate knowledge of ground control theory and practice.

Supervisors will receive training on resolving minor ground control issues through 770121 Common Core for Underground Frontline Supervisors module U6107 – Identify geological features and supervise ground control installations.