

# Mine Safety Operations



NSW DEPARTMENT OF  
PRIMARY INDUSTRIES

# Mine ground control management plan audit tool

Underground metalliferous mines

September 2008

**MEX-009**

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## DISCLAIMER

The compilation of information contained in this document relies upon material and data derived from a number of third party sources and is intended as a guide only in devising risk and safety management systems for the working of mines and is not designed to replace or be used instead of an appropriately designed safety management plan for each individual mine. Users should rely on their own advice, skills and experience in applying risk and safety management systems in individual workplaces.

Use of this document does not relieve the user (or a person on whose behalf it is used) of any obligations or duty that might arise under legislation (including the Occupational Health & Safety Act 2000, any other Act containing requirements relating to mine safety and any regulations and rules under those Acts) covering the activities to which this document has been or is to be applied.

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## OBJECTIVE

To contribute to a safe and viable mining operation with zero harm by providing guidance material for consideration when developing and implementing ground control management systems.

## PREFACE

Management of ground conditions in underground mines and maintaining a safe place of work is an essential element of a sound 'Safety Management Plan'. An effective Safety Management Plan will be part of any sound Business Plan.

The process of adequately managing the behaviour of the rock mass involves:

- Competent personnel with a sound knowledge of ground behaviour, geotechnical properties, mine design and broad experience in ground control methods and equipment;
- Equipment fit for purpose;
- A comprehensive and effective risk management process;
- An engineered approach to developing standards;
- Ongoing review.

Unplanned falls of ground are a major hazard in underground mines, with consequences ranging from insignificant to catastrophic. The risk to personnel and the potential damage associated with falls of ground must therefore be managed.

As mining operations become more extensive and proceed to greater depth, the effects of stress redistribution become more pronounced and in many cases the potential for damaging seismicity increases. As stress levels increase, the zone of damaged rock around excavations tends to increase together with the possibility of significant falls of ground or regional movement. This may require changes to the support systems employed.

A combination of high stress, geological structure and extensive mining can increase the likelihood of seismic events. Given unfavourable conditions, these events can cause significant damage to infrastructure and present a hazard to underground personnel. If seismicity is present, the support system's capacity to perform under dynamic loading and the nature, timing and location of seismic events will be important considerations in the design phase. Mines that experience seismic events need to develop a management strategy that removes or minimises the risk to underground personnel from such events.

Effective management of seismic activity requires:

- Development of a comprehensive data base of structural geology and geotechnical data;
- An effective monitoring and reporting system;
- Stope planning and scheduling; and
- Developing and maintaining an effective 'Ground Control Management Plan'.

The NSW mining legislation includes a duty on the operator of a mine to prepare a Mine Safety Management Plan and to ensure it is

complied with. The non-prescriptive style of the NSW legislation has risk management as a core component with a focus on the development and effective management of safety systems.

This audit tool attempts to provide a structure and content for an effective risk management system to control ground in metalliferous underground mines. Although the NSW legislation does not specifically require a 'Ground Control Management Plan' (GCMP) to be developed, a GCMP that satisfies relevant evidence cited in this audit will generally demonstrate an effective risk based approach to ground stability matters.

A quality GCMP will also provide guidance for 3<sup>rd</sup> parties (consultants, suppliers, contractors and auditors) to understand the mine's expectations.

The audit tool has been developed by the Mine Safety Operations Branch of the NSW Department of Primary Industries. It contains no specific references to NSW mining legislation. It may, therefore, have application in underground metalliferous mines across Australia.

In underground mining effective ground control is one of the key elements for mine management to provide a safe place of work for persons at the mine.

A GCMP formalises and consolidates ground control processes. A good GCMP should address all facets of ground control including:

- Geological setting
- Geotechnical data
- Planning
- Training of personnel
- Provision of equipment
- Safe working procedures
- Maintenance programs and
- Risk management
- Ongoing review

An audit process usually involves five basic steps:

- 1) Notification of the audit, together with a clear indication of the scope and guidelines for the audit;
- 2) Interviews with key personnel;
- 3) Gathering of records, verifying actions by observation of activity;
- 4) Correlations of interview notes, documents and observation in the workplace to finalise the audit report and establish recommendations;
- 5) Auditor's presentation to mine management.

The audit tool will provide mine management with an effective means of assessing the mine's status regarding the management of ground control. The tool addresses many facets of the mining operation including legal requirements, employee competencies, equipment supply, communication and risk management.

The audit tool is set out in four columns:

Column 1. "OBJECTIVES" provides the reasons why the questions in this section are being asked.

Column 2. "QUESTIONS THAT COULD BE ASKED" during the audit provides the basic questions for the auditor. The auditor may not use all questions or may propose additional questions.

Column 3. The "WHAT TO LOOK FOR" column provides different avenues where the auditor is able to verify that the answers provided in Column 2 are supported by documentation or observed actions.

Column 4. The "NOTES" column allows the auditor to record additional/future questions or information that may be required during the interview process or to record agreed actions to address any gaps between observed standards and compliance standards.

## INTERNAL AND EXTERNAL AUDITS

An audit can be conducted:

**INTERNALLY:** by persons within the operation. These persons should be competent in the auditing process and be directly responsible for the activities being audited.

**EXTERNALLY:** by an independent organisation. This process provides a more direct comparison of the mines performance against industry standards and / or the mine's own stated Ground Control Management Plan.

**Note:** Both the internal and external audit process provides a consistent approach, with suggested questions that will provide an opportunity for management to assess the mine's performance in all aspects of ground control. Should there be a need to focus on one or more specific elements of this audit, then this document may be modified so that only part or parts are included in the audit scope.

## HOW TO USE THE GROUND CONTROL AUDIT TOOL

One of the most difficult decisions in regard to auditing is determining what is the scope or objective of the audit. Will I audit against all compliance questions or will I break the audit into smaller parts?

If you are going to audit your mine against all of the questions, then allow sufficient time.

If you are going to conduct an audit against specific parts, then plan what questions you are going to use that relate to those parts.

### TIPS:

- Complete the details on page 9 of the audit. Include the names of all persons conducting the audit.
- Read each question carefully.

- Read the question in conjunction with any relevant legislation
- Determine if the question applies to your mine. If it doesn't, you should record the fact and why not in NOTES (column 4).
- Ask the questions included in QUESTIONS THAT COULD BE ASKED (column 2).
- Verify what is required is being implemented. Seek evidence! WHAT TO LOOK FOR (column 3) will help you find evidence.
- When assessing your response, also consider the documentation you have available on site to support your answer.

- Record your evidence in NOTES (column 4). Non compliance can also be recorded here together with agreed actions to address non compliances
- Use a highlighter pen or create a separate record stating matters that require further work.
- Keep the audit for your own information and to assist in reviewing the Ground Control Management Plan.
- An action plan should be developed to prioritise the issues or non compliances that require improvement.

## DEFINITIONS

**AS** means *Australian Standard*

**JSA** means *Job Safety Analysis*

**GCMP** means *Ground Control Management Plan*

**GC** means *Ground Control*

**MSMP** means *Mine Safety Management Plan*

**Non compliance** means that there is a *gap* or difference between *what is required* and *what you have* at the mine

**OS&H** means *Occupational Safety and Health*

**PPE** means *Personal Protective Equipment*

**S&H** means *Safety and Health*

**SOP** means *Standard Operating Procedure* (also known as *Safe Working Procedure* or *Safe Work Method Statement*)

## FURTHER REFERENCE

- **NSW Mine Health and Safety Act 2004 and Regulation 2007**
- **NSW Occupational Health and Safety Act 2000 and Regulations 2001**
- **Australian Standards AS4801:2001** Occupational health and safety management systems - *Specification with guidance for use*
- **Australian Standards AS4804:2001** Occupational health and safety management systems - *General guidelines on principles, systems and supporting techniques*
- **Australian Centre for Geomechanics** *“Management of Rockfall Risks in Underground Metalliferous Mines”*

*The ‘Mine Ground Control Management Plan – Audit Tool’ was developed by Mine Safety Operations Staff of the Department of Primary Industries with much appreciated input from members of the Eastern Australian Ground Control Group*

# Ground Control Management Plan Audit

Name of Company/Mine:

Date of Audit:

Name of Auditors:

Mine Manager:

Audit Scope:

Audit Notes:

Use additional sheets for NOTES (column 4) if required

## Part 2: Audit Tool

OBJECTIVES	QUESTIONS THAT COULD BE ASKED	WHAT TO LOOK FOR	NOTES
<b>To determine the PURPOSE AND SCOPE of the Ground Control Management Plan (GCMP)</b>	Has a 'Risk Register' been established?	<ul style="list-style-type: none"> <li>• Sight evidence that geotechnical hazards have been identified</li> <li>• Evidence that a formal ground support risk assessment has been conducted</li> </ul>	<i>Ref later section for more detail...</i>
	Does the mine have a Ground Control Management Plan (GCMP)?	<ul style="list-style-type: none"> <li>• A document titled 'Ground Control Management Plan' (or similar)</li> <li>• Contents page of GCMP</li> <li>• Ground Control Policy statement signed by the current Senior Manager</li> <li>• Is the Ground Control Policy consultant with the Company's Policy / Governance?</li> <li>• Evidence that relevant employees are aware of the GCMP. Check with management, supervisors, technical staff and daily paid personnel</li> <li>• Evidence of document control system for the GCMP and associated risk assessments, standards, procedures etc.</li> <li>• Evidence that the most recent version of the GCMP is available to appropriate employees</li> </ul>	
	Does the GCMP cover all aspects of mining?	<ul style="list-style-type: none"> <li>• Scope includes development mining, stoping, vertical development and large infrastructure excavations</li> <li>• Does the GCMP include consideration to and address the effects of rock mass, water and air / gas?</li> <li>• Scope includes interaction with backfill</li> </ul>	

OBJECTIVES	QUESTIONS THAT COULD BE ASKED	WHAT TO LOOK FOR	NOTES
	Have internal / third party audits been conducted?	<ul style="list-style-type: none"> <li>• Evidence of completed internal and / or third party audits</li> <li>• Evidence of a system for the implementation of recommendations and actions resulting from audits</li> </ul>	
<b>To determine the RESPONSIBILITIES and ACCOUNTABILITIES of all personnel involved in the development, management and application of the GCMP</b>	<p>Of:- the Mine Manager</p> <p>Provide:-</p>	<ul style="list-style-type: none"> <li>• Evidence of knowledge of relevant regulatory requirements</li> <li>• Approval of the GCMP</li> <li>• Evidence of approval if minimum ground support regimes</li> <li>• Evidence that key personnel have been formally delegated responsibilities in relation to ground control activities</li> <li>• Evidence that training has been provided to meet statutory obligations</li> <li>• Evidence of training in risk assessment for all employees involved in conducting them</li> <li>• Evidence that an assessment of required technical and operations resources has been made</li> <li>• Evidence that development, stopes, vertical development and large infrastructure excavations have been engineered and designed by qualified persons.</li> <li>• Evidence that all underground employees have a working knowledge of relevant parts of a GCMP</li> <li>• Evidence that underground employee's knowledge includes the minimum ground support regimes</li> <li>• Formal appointments &amp; accountabilities for key ground control positions</li> </ul>	

OBJECTIVES	QUESTIONS THAT COULD BE ASKED	WHAT TO LOOK FOR	NOTES
<p><b>To determine the RESPONSIBILITIES and ACCOUNTABILITIES of all personnel involved in the management and application of the GCMP (cont.)</b></p> <p><b>To determine the</b></p>	<p>Of:- the Production Manager</p> <p>Provide:-</p>	<ul style="list-style-type: none"> <li>• Evidence of knowledge of the GCMP</li> <li>• Appointment of competent personnel</li> <li>• Evidence that the GCMP has been communicated to relevant employees</li> <li>• Evidence of competency based training of mining operators</li> <li>• Provision of fit for purpose equipment</li> <li>• Safe Work Procedures (SWP's) that include all aspects of ground support installation.</li> <li>• Evidence of SWP compliance audits</li> <li>• Evidence that the GCMP is maintained</li> <li>• Evidence that ground control work is planned and scheduled</li> <li>• Evidence that completed ground control work is measured and non-compliances against planned work is recorded</li> <li>• Evidence that a system exists to action any shortfalls in planned work</li> </ul>	

OBJECTIVES	QUESTIONS THAT COULD BE ASKED	WHAT TO LOOK FOR	NOTES
<p><b>RESPONSIBILITIES and ACCOUNTABILITIES of all personnel involved in the management and application of the GCMP (cont.)</b></p> <p><b>To determine the RESPONSIBILITIES</b></p>	<p>Of:- The Geotechnical Engineers and / or Geologists</p> <p>Provide:-</p> <p>Of:- Mine Foreman / Supervisors.</p>	<ul style="list-style-type: none"> <li>• Evidence that a Risk Assessment of geotechnical hazards has been conducted for hazards related to the following areas:- <ul style="list-style-type: none"> <li>➤ Regional</li> <li>➤ Mine</li> <li>➤ Workplace specific</li> <li>➤ Activity specific</li> </ul> </li> <li>• Evidence that Geotechnical data is collected and utilised</li> <li>• GC designs refer to approved ground control regimes</li> <li>• Ground monitoring systems are used</li> <li>• Ground monitoring systems are inspected</li> <li>• Ground monitoring systems are maintained</li> <li>• Evidence of inspection of active mining areas</li> <li>• Evidence of training to mining operations personnel</li> <li>• An optimised mining sequence that is an outcome of a risk assessment incorporating geotechnical inputs</li> <li>• Evidence of prioritised ground control maintenance at worksites and travel ways. e.g. sub-standard or damaged GS installation is rectified on a risk-assessed basis</li> </ul>	

OBJECTIVES	QUESTIONS THAT COULD BE ASKED	WHAT TO LOOK FOR	NOTES
<p><b>and ACCOUNTABILITIES of all personnel involved in the management and application of the GCMP (cont.)</b></p> <p><b>To determine the RESPONSIBILITIES and ACCOUNTABILITIES of all personnel involved in the management and application of the GCMP (cont.)</b></p>	Provide:-	<ul style="list-style-type: none"> <li>• Installation of ground support to agreed / approved standards</li> <li>• Evidence of regular ground control inspections</li> <li>• Evidence that inspections are against an agreed standard</li> <li>• Evidence that scaling plans are implemented</li> <li>• Evidence that Job Safety Analysis is conducted before ground failure events are inspected / investigated</li> <li>• Evidence of reporting and inspecting falls of ground</li> </ul>	
	Of:- Planning Engineers. Provide:-	<ul style="list-style-type: none"> <li>• Evidence that mine designs include geotechnical considerations</li> <li>• Evidence that mine design plans are reviewed and approved</li> <li>• Evidence of training with GCMP</li> </ul>	
	Of:- Ground Control Installation Crews. Provide:-	<ul style="list-style-type: none"> <li>• Evidence that they participate in Inspections by supervisor and / or geotechnical engineer</li> <li>• Evidence that GC crews comply with any GCMP requirements</li> <li>• Evidence of a system for GC Crew to report non-compliant installation</li> <li>• Evidence that GC Crew report non compliances with agreed standards</li> </ul>	

OBJECTIVES	QUESTIONS THAT COULD BE ASKED	WHAT TO LOOK FOR	NOTES
	<p>Of:-</p> <p>All relevant employees, in particular:</p> <ul style="list-style-type: none"> <li>➤ Geotechnical engineers</li> <li>➤ Geologists</li> <li>➤ Mining Engineers</li> <li>➤ Miners</li> <li>➤ Maintenance personnel</li> </ul>	<ul style="list-style-type: none"> <li>• Evidence that employees are aware of ground support standards</li> <li>• Evidence of inspection of ground support by mine operators at each worksite</li> <li>• Evidence of reporting of inspection outcomes</li> <li>• Evidence of a formal workplace hazard reporting system that is used to report ground control related hazards</li> <li>• Evidence of a follow up system / action plans</li> </ul>	
<p><b>To ensure relevant GEOTECHNICAL DATA COLLECTION techniques have been adopted and information is being effectively utilised</b></p>	<p>Of:-</p> <p>Geotechnical Engineers / Geologists</p> <p>What types of geotechnical data is collected?</p>	<ul style="list-style-type: none"> <li>• Geological setting – regional and local</li> <li>• Records of geotechnical core logging</li> <li>• Face mapping records</li> <li>• Structural mapping and data (Major and minor structures)</li> <li>• Rock properties</li> <li>• Geotechnical event reports</li> <li>• Stope behavioural reports</li> <li>• Geotechnical observations/inspections</li> </ul>	

OBJECTIVES	QUESTIONS THAT COULD BE ASKED	WHAT TO LOOK FOR	NOTES
<p><b>To ensure relevant GEOTECHNICAL DATA COLLECTION techniques have been adopted and information is being effectively utilised (cont)</b></p>	<p>Of:- Geotechnical Engineers</p> <p>How this data is being utilised?</p>	<ul style="list-style-type: none"> <li>• Sight summary of geological procedures</li> <li>• Sight evidence that geotechnical engineers are competent in the use of computer software</li> <li>• Sight generic plans and sections showing the network of major geological structures</li> <li>• Short and medium term mine design plans showing structural geology</li> <li>• Evidence that data has been included into stope and development design</li> <li>• Evidence of regular reporting to mining operations</li> <li>• Sight evidence of geological records</li> </ul>	
	<p>Appropriateness of data / information</p>	<ul style="list-style-type: none"> <li>• Is all of above appropriate and adequate engineering design purposes?</li> </ul>	
<p><b>To ensure appropriate GEOTECHNICAL MONITORING is being conducted</b></p> <p><b>To ensure</b></p>	<p>What geotechnical monitoring is being conducted?</p>	<p>Records of Monitoring (frequency, magnitude and location) of:-</p> <ul style="list-style-type: none"> <li>• Stress related damage</li> <li>• Seismic events</li> <li>• Ground movement</li> <li>• Falls of ground <ul style="list-style-type: none"> <li>➤ In 'old' development headings</li> <li>➤ In 'new' development headings</li> <li>➤ In stopes</li> <li>➤ In shafts, ore passes, vent shafts,</li> </ul> </li> <li>• Ground support failure and / or damage</li> <li>• Blast vibration / damage</li> <li>• Backfilling of voids</li> </ul>	

OBJECTIVES	QUESTIONS THAT COULD BE ASKED	WHAT TO LOOK FOR	NOTES
<p><b>appropriate GEOTECHNICAL MONITORING is being conducted (cont.)</b></p>	<p>How is this information utilised? (Reference to each item monitored in the section above)</p> <p>How often is information collected?</p>	<ul style="list-style-type: none"> <li>• Evidence that information has been incorporated into stope or development design</li> <li>• Incorporated into Safe Work Procedures (SWP's)</li> <li>• Sight training records to confirm communication and understanding of relevant SWP's</li> <li>• Evidence of predetermined actions when hazardous situations are identified</li> <li>• Evidence of analysis of ground failure event.</li> <li>• Evidence of failure analysis of ground control materials (bolts, cables, grout etc)</li>   <li>• Evidence that the frequency of information / data collection is reviewed regularly and a system is available to modify the frequency if required</li> <li>• Sight a schedule for data collection / geotechnical monitoring that shows responsibilities and timeframe / frequency</li> </ul>	

OBJECTIVES	QUESTIONS THAT COULD BE ASKED	WHAT TO LOOK FOR	NOTES
<b>To assess the GEOTECHNICAL CONDITIONS that affect the management of ground control</b>	Have records of past mining performances been maintained?	<ul style="list-style-type: none"> <li>• Documented history of stope and development performance. For example:-               <ul style="list-style-type: none"> <li>➤ Overbreak</li> <li>➤ 'Rock noise'</li> <li>➤ Drill and Blast design</li> <li>➤ Drill and Blast actual</li> <li>➤ Fragmentation</li> <li>➤ Fill type / quality / performance</li> <li>➤ Fill variations from design / plan</li> </ul> </li> </ul>	
	Has past mining performance been included in current mine design?	<ul style="list-style-type: none"> <li>• Evidence that stope design risk assessments consider potential influence of past mining</li> <li>• Evidence that stope design risk assessments consider the potential influence of past filling of voids</li> </ul>	
	Has the Geological Setting been determined?	Documented geotechnical details of ore-body and host rock <ul style="list-style-type: none"> <li>• Lithology</li> <li>• Rock Properties</li> <li>• Major Structures</li> <li>• Joint Sets</li> <li>• Virgin Stresses</li> <li>• Ground Water (Flow rates, pressure, corrosiveness)</li> </ul>	

OBJECTIVES	QUESTIONS THAT COULD BE ASKED	WHAT TO LOOK FOR	NOTES
<b>To assess current GEOTECHNICAL ASSESSMENT</b>	<p>What methods are used to assess stability?</p> <p>Are they audited by an independent / 3<sup>rd</sup> party?</p>	<p>1. Numerical techniques:-</p> <ul style="list-style-type: none"> <li>• Map3D</li> <li>• Non-linear models</li> <li>• Void Models (e.g. CMS surveys of all stope voids)</li> <li>• Unwedge</li> </ul> <p>Wedge analysis</p> <p>2. Precedent analysis</p> <p>3. <span style="margin-left: 20px;">▪</span> Rock Mass Classification</p>	
	<p>What modes of failure have been observed?</p> <p>Have these modes been considered in the design risk assessments?</p>	<ul style="list-style-type: none"> <li>• Documented records of gravity , stress, seismicity, blasting induced failures</li> <li>• Wedge failure</li> <li>• Slabbing failure</li> <li>• Strain bursting</li> <li>• Shear failure</li> <li>• Spalling</li> </ul>	

OBJECTIVES	QUESTIONS THAT COULD BE ASKED	WHAT TO LOOK FOR	NOTES
To Review the Current MINE PLANNING Process	What is the mine planning process?	<ul style="list-style-type: none"> <li>• Documented evidence of:-               <ul style="list-style-type: none"> <li>➤ A life of mine plan</li> <li>➤ Short, medium and long term schedules</li> <li>➤ Ore Reserves</li> <li>➤ Mining Block design</li> <li>➤ Stope design</li> <li>➤ Development design</li> <li>➤ Inclusion of geotechnical information in designs</li> <li>➤ Non-compliance / rectification reports against approved schedules and designs</li> </ul> </li> </ul>	
	Are engineers and geologists formally trained in risk assessment?	<ul style="list-style-type: none"> <li>• Sight training records and evidence of risk assessment documentation/ outcomes</li> </ul>	
	Has past mining performance been considered in designs?	<ul style="list-style-type: none"> <li>• Evidence that elements of past mining performance are included in stope design risk assessments</li> </ul>	
	Have geotechnical issues been considered in blast design?	<ul style="list-style-type: none"> <li>• Evidence that standard blast designs have been reviewed/modified to meet local and / or historical conditions</li> </ul>	
	Have stope and development plans been authorised?	<ul style="list-style-type: none"> <li>• Documented procedure for design authorisation</li> <li>• Evidence of compliance to authorisation procedure</li> </ul>	

OBJECTIVES	QUESTIONS THAT COULD BE ASKED	WHAT TO LOOK FOR	NOTES
	Have mine planning meetings been held?	<ul style="list-style-type: none"> <li>• A document that defines the scope of the meeting</li> <li>• Records/minutes of meetings</li> <li>• Evidence of a system that ensures recommendations/action plans have been actioned</li> </ul>	
<b>To review GROUND CONTROL METHODS AND DESIGN</b>	What Ground Control methods have been selected and in what circumstances do they apply?	<ul style="list-style-type: none"> <li>• Evidence that designs have been engineered and consider:-               <ul style="list-style-type: none"> <li>➤ empirical design</li> <li>➤ rock mass classifications</li> <li>➤ RQD</li> <li>➤ joint conditions,</li> <li>➤ factor of safety</li> </ul> </li> <li>• Evidence that specific Ground Control methods are documented for:-               <ul style="list-style-type: none"> <li>➤ Stopes</li> <li>➤ Horizontal and vertical development</li> <li>➤ Short term and long term access</li> </ul> </li> <li>• Pattern bolting (drives, intersections, load bays)</li> <li>• Non standard development</li> </ul>	

OBJECTIVES	QUESTIONS THAT COULD BE ASKED	WHAT TO LOOK FOR	NOTES
	Is ground support installation equipment fit for purpose?	<ul style="list-style-type: none"> <li>• Documented functionality assessment</li> <li>• Documented equipment specifications</li> <li>• Evidence of formal equipment inspections</li> <li>• Evidence of equipment maintenance systems</li> <li>• Evidence that maintenance reports meet system requirements</li> </ul>	
	What ground support types have been selected?	Evidence that selection has considered geotechnical input, past performance and engineering for: <ul style="list-style-type: none"> <li>• Rockbolts</li> <li>• Meshing of backs</li> <li>• Meshing of walls</li> <li>• Shotcrete/Fibrecrete</li> <li>• Cable bolts</li> <li>• Scaling/barring down</li> </ul>	
	Are the regimes selected based on sound engineering?	<ul style="list-style-type: none"> <li>• Evidence that the GCMP includes the engineering calculations that support all approved ground control regimes</li> </ul>	
	What other elements are included in the design of Ground Support?	<ul style="list-style-type: none"> <li>• Material specification</li> <li>• Corrosion</li> <li>• Quality assurance</li> <li>• Testing</li> </ul>	

OBJECTIVES	QUESTIONS THAT COULD BE ASKED	WHAT TO LOOK FOR	NOTES
<b>Assess QUALITY ASSURANCE Methods</b>	Have Ground Support Audits been conducted?	<ul style="list-style-type: none"> <li>• Sight audit process documentation:-               <ul style="list-style-type: none"> <li>➢ Scope</li> <li>➢ Role definitions</li> <li>➢ Standards against which audit is to be conducted</li> <li>➢ Communication of audit objectives</li> <li>➢ Audit records</li> <li>➢ Action plan</li> <li>➢ Communication of audit outcomes</li> </ul> </li> <li>• Sight evidence that audit recommendations have been carried out</li> </ul>	
	Have planned ground support inspections been conducted?	<ul style="list-style-type: none"> <li>• Evidence of Inspection planning / scheduling</li> <li>• Evidence of inspection records</li> <li>• Evidence of task observation planning</li> <li>• Records of systematic task observations</li> <li>• Records of actual v planned inspections and observations</li> </ul>	
	Are independent ground control audits conducted?	<ul style="list-style-type: none"> <li>• Sight audit documents</li> <li>• Sight evidence of implementation of action plans</li> </ul>	
	Does the standard of actual Ground Support installation conform to design?	<ul style="list-style-type: none"> <li>• Evidence that actual installation has been checked against design</li> <li>• Sight ground support testing procedures</li> <li>• Sight approval of testing procedures</li> <li>• Sight testing equipment and equipment inspection reports</li> </ul>	

OBJECTIVES	QUESTIONS THAT COULD BE ASKED	WHAT TO LOOK FOR	NOTES
<b>Assess QUALITY ASSURANCE Methods (cont.)</b>	Have "post" installation tests been conducted?	<ul style="list-style-type: none"> <li>• Sight evidence of how the frequency and number of tests was determined</li> <li>• Sight pull-out test results</li> <li>• Sight records of corrosion and grout conditions observed during tests</li> <li>• Sight agreed risk – based action plan for non-compliant installations</li> </ul>	
	What 'pre-installation' storage and transportation standards are established?	<ul style="list-style-type: none"> <li>• Sight standards for storage and transportation of:               <ul style="list-style-type: none"> <li>➤ Bolts</li> <li>➤ Plates</li> <li>➤ Mesh</li> <li>➤ Resin</li> <li>➤ Cables</li> <li>➤ Cement /shotcrete</li> </ul> </li> </ul>	
	Are inspections conducted of stored ground support consumables?	<ul style="list-style-type: none"> <li>• Sight inspection reports</li> <li>• Sight evidence that action is taken to remedy inspection shortfalls</li> </ul>	
<b>To assess TRAINING AND COMPETENCIES of personnel in Ground Control</b>  <b>To assess</b>	Does initial induction training for all underground employees include aspects of the mine GCMP?	<ul style="list-style-type: none"> <li>• Sight contents of underground employee induction training program</li> <li>• Sight references to GCMP</li> <li>• Sight training records</li> <li>• Sight Standard Work Procedures for Ground Control activities</li> <li>• Sight records of Geotechnical awareness training for all employees who work / visit underground</li> </ul>	

OBJECTIVES	QUESTIONS THAT COULD BE ASKED	WHAT TO LOOK FOR	NOTES
<b>TRAINING AND COMPETENCIES of personnel in Ground Control</b>	Is geotechnical training conducted for relevant personnel?	<ul style="list-style-type: none"> <li>Evidence of training for managers, geotechnical engineers, geologists, mine planning engineers, surveyors and ground control crews</li> </ul>	
	Are regular ground control information sessions conducted?	<ul style="list-style-type: none"> <li>Evidence that outcomes of ground control inspections and risk assessments are communicated to underground employees</li> </ul>	
<b>Audit and Review</b>	Does the GCMP include all the relevant elements from this audit tool?	<ul style="list-style-type: none"> <li>Sight contents page of GCMP and compare with this document</li> <li>Why are there differences (if there are differences)?</li> </ul>	
	Is the GCMP audited by a 3 <sup>rd</sup> party?	<ul style="list-style-type: none"> <li>What are the 3<sup>rd</sup> party's competence in auditing and ground control?</li> <li>Is the audit scope adequate?</li> </ul>	

# Feedback Sheet

Your comments will be very helpful in reviewing and improving this Ground Control Management Plan Audit

Please copy and complete the Feedback Sheet and return it to:

*Senior Inspector of Mines  
Mine Safety Operations  
NSW Department of Primary Industries  
Locked Bag 21  
Orange NSW 2800  
Fax: (02) 63605363  
Phone: (02) 63605333*

**How did you use, or intend to use, this document?**

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**What do you find most useful about this document?**

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**What do you find least useful?**

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**Do you have any suggested changes to the document?**

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Thank you for completing and returning this Feedback Sheet.