

# A STRUCTURED APPROACH TO INSPECTION OF MINES

Author: Peter Power. Acting District Inspector of Mines Qld Department of Natural Resources and Mines Mount Isa QLD

Co-Author: Hermann Fasching. Acting Mechanical Inspector of Mines Qld Department of Natural Resources and Mines Mount Isa QLD

## Abstract

The regional business plan of the Mines Inspectorate (MI) in Mount Isa Queensland incorporates the values and mission objectives of the Department of Natural Resources and Mines (NR&M).

### OUR VISION

'Our Industries Free of Safety and Health Incidents'

### OUR MISSION

'Continually Improve the Safety and Health Standards and

Practices in the Explosives, Gas, Petroleum and Mining industries'

This plan is achieved primarily through mine and quarry site inspections within Queensland. The fundamental aim of these inspections is to assist our customers, at the mine and quarry operations, achieve a standard of safety and health within the mining industry that is incident and accident free.

## Executive summary

This is a non-technical paper that describes the re-engineering of part of the business process of conducting mine and quarry inspections by the MI. Until recently, mine/quarry inspections were for the large part unstructured in nature and not formally scheduled. The MI management team in Mount Isa, led by the District Inspector, recognised that the inspection resources of the MI could be managed more effectively if it developed and implemented a suitable system of control. A system was required that would demonstrate that all the pertinent areas of mine/quarry operations, were being appropriately inspected and monitored.

Reviews of the MI have also been conducted through the Australian Business Excellence Framework. One common issue recognised through this forum is that relations and interactions with the mine and quarry operations during inspections, and the people, who operate them and work there, must continually improve.

A system of structured audits and inspections have been developed in response to addressing the issues of customer relations and management of the mine inspection process. The issues discussed in this paper include short descriptions of the previous inspection process, attributes of the new system of inspecting mines and the benefits for the MI and their customers.

## Previous inspection process

Prior to the introduction of the Mining Quarrying Safety and Health Act (MQSHA) in early 2001 the Mines Regulation Act 1964 (MRA) and the Metalliferous Mining Regulations 1985 were in force.

This legislation was prescriptive in nature and in many circumstances required an inspector to provide 'approval' for a particular activity or piece of plant to be used and operated on a mine/quarry site.

This led to many of the inspections undertaken by inspectors being focused on ensuring that compliance with the legislation or particular conditions relevant to an approval were maintained.

Many inspectors developed notable expertise within their field or discipline and focused mainly on these areas during their inspections.

This ensured a high level of compliance in those particular areas but other areas of the operation were not as thoroughly audited.

There was also potential for inconsistency to develop when an inspector provided approval for an issue, activity and/or conducted an inspection outside their area of expertise.

It was recognised that the variance that sometimes resulted between inspections was an opportunity to capture and combine the expertise of all inspectors in a manner and format that would eliminate, as far as possible, the inconsistencies.

## Mine record entries

At completion of a mine/quarry inspection, an inspector will make a written report within the mine record. The report is a summary of the inspection that may include statement/s directing the mine/quarry to undertake corrective action of one kind or another to address non-conformance identified by the inspector.

If a review of the mine record was conducted at a later date it was often difficult to determine exactly what activities, what sections of the operations and to what depth the inspection had encompassed.

The greater the length of time between when the inspection had taken place and when the review occurred, the greater the difficulty in determining exactly what had occurred.

This meant that it was also difficult to determine whether all areas of a mine that required inspection were being appropriately monitored.

A process was required that would permit an

inspector to review previous inspections and understand completely the nature and depth of activities conducted by him/her thus overcoming the obscurity inherent in the mine record entries.

At the same time this was considered it was believed that the quality of inspections could improve if they were better able to detect non-conformance.

It was decided that this could be achieved by refocussing inspections on narrower fields and activities as opposed to attempting to inspect too much in one inspection.

#### **Safeguard and introduction of structured inspections**

A change in focus of the activities undertaken by MI also occurred following the introduction of the MQSHA in 1999.

The current legislation is less prescriptive and is performance based. Mines/quarries with more than ten persons are now required to develop and implement safety management systems to control risk of injury to personnel.

Inspectors were no longer required to issue approvals and the MI now has to refocus to a large degree on how effectively mines/quarries are controlling risk and re-configure its inspection procedures accordingly.

An excellent auditing process known as 'Safeguard,' implemented in the mid 1990s, is used to review safety and health management systems

and risk management performance on mine/quarry sites in Queensland. While Safeguard effectively audits higher-level systems and policies it cannot be used to review every facet and level of an organisation's activities.

This would be impracticable, as it would take a team of inspectors weeks and possibly months to complete such a review.

However a system of lower level inspections that combines the expertise of all inspectors, conducted infrequently throughout the course of 12months, in a structured format and manner can be used to comprehensively inspect all pertinent areas of a mine/quarry operation.

#### **Review of activities**

The Safety and Health Division of the then Department of Mines and Energy adopted the Australian Business Excellence Framework in 1997 and reviews of the MI have been conducted annually.

This process has highlighted a number of areas where improvement can be made, one particularly area is customer focus.

The management team of the MI within the Mount Isa District began to review its activities in early 2001.

Reviews were focused on how the effectiveness, value and consistency of the inspections being undertaken could be improved. In particular how these

**Table: 1 Table from Emergency Procedures Proforma**

ITEM	Yes	No	P	F	G	OBSERVATION
<b>EMERGENCY PROCEDURES ALL MINES</b>						
1. Is there a documented emergency response plan? <b>Part 5-35.1R</b>						
2. Was the overall emergency response procedure and system subjected to a formal risk assessment during development for all foreseeable emergencies per requirements of section 32? <b>Part 5-32.1R</b>						
3. Does the risk assessment consider the following: 1. Coordinating control of emergencies? 2. Giving notice, information and warning about emergencies? 3. The immediate availability of trained rescue persons or emergency services? 4. Locating and accounting for persons? 5. Controlling or re-establishing control of the hazard causing the emergency? 6. Isolation of the area including cutting of supply of energy to the area of the incident? 7. Emergency egress and evacuation, including refuges? 8. First aide and persons trained in first aid? 9. Liaising with and using local or state emergency services? 10. Back up services and facilities for the emergency? <b>Part 5-32.2R</b>						
4. Has the mine ensured that it has all of the resources, facilities and procedures identified in the risk assessment available and in place? <b>Part 5-33R</b>						
5. What inspections are carried out on the emergency response facilities? <b>Part 5-40.1R</b>						
6. Is there a formal review of actual emergency performance? How often does the mine test and review its emergency response plan? (should be annually 40.2.a) <b>Part 5-40.2R</b>						

could be better aligned with the MI's vision and mission and address the legacies present in the inspection procedure at the time.

It was unnecessary for inspections to be structured or pointed while the prescriptive MRA was in force, however mines/quarries now wanted assistance in understanding their obligations under the new MQSHA and improving their safety and health management systems.

One of the key developments to address all these issues was the introduction of the structured inspection process.

A process that addresses all the concerns of obscurity in mine record entries, varied expertise of inspectors and a way in which all facets of an operation can be inspected.

**Structured inspections**

The first change implemented by the MI was to introduce the structured inspection process and support it with documentation.

These auditing tools are benchmarked against the Queensland mining legislation, Australian Standards and good industry practice to provide a system of inspections that ensures consistency amongst inspections and inspectors.

In Table: 1, a section of the emergency response proforma has been reproduced to display the format that these structured inspections undertake.

In column one of Table: 1, reference to the relevant section of the MQSHA legislation is denoted at the end of each question. The table also includes columns for making a value judgement about the degree of compliance, ie poor, fair

and good (PFG).

A notification may be issued to the mine/quarry informing it that corrective action should be taken to rectify a substandard condition or practice.

If compliance is non-existent a directive will be issued to the mine/quarry being audited.

In summarising, the purpose and intent of the structured inspection philosophy it is to provide a way to review a pre-selected section of the safety and health management system, examine documentation and then verify that the mine/quarry is in compliance with legislation and its own procedures through conducting physical inspections of activities and the operations.

All regions within the state of Queensland have developed these tools in the past however they were tailored to suit the mines in the district they were created in.

Furthermore it was thought expedient that a suite of proformas be developed for all the critical processes and hazards as opposed to having only a few strategic ones. A total of 36 proformas (elements), outlined in Table: 2, have been identified to date and developed under the five broad categories of mining, mechanical, chemical, electrical and general.

The frequency of when an element should be inspected at a mine has also been considered using the utilitarian principle.

For example higher level audits pertaining to ground control and winding operations are tentatively flagged at four yearly intervals. Lower level inspections, such as heat stress measurements and development mining, are to be conducted more than

**Table: 2 Elements of Structured Inspections**

ELEMENT	CATERGORY				
	MINING	MECHANICAL	ELECTRICAL	GENERAL	CHEMICAL
	Development mining	Cranes Fixed and Mobile	Plant Equipment	Emergency Procedures	SXEW Plants
	Ground Control	Fuel and Oil Storage	Sub Stations and Switch Rooms	Project Management & Contractors	Smelting
	Production	Forklifts	Motor Control Centres	Exploration	Concentrating
	Transport and Haulage	Crushing and Conveying	Bore fields	Warehousing	Sulphuric Acid
	Remote Control Equipment	Workshops and Maintenance Services	Power Generation and Distribution		Reagents and Chemical Batching
	Explosives Storage and Transport	Vehicle Management Svstems	Accommodation Facilities		Leaching
	Ventilation and Working in Heat	Structural Inspection	Welders		
	Hoisting and Shaft Inspection		Pump Stations Workshop Installations		
	Backfill		Trailing Cables and DCB's		
			Mobile Electrical		

twice a year.

The frequency of when the element should be re-inspected is determined by considering the degree of risk, the sustainability of the systems of control and how well a particular mine is managing the risk associated with that element.

It is believed by the MI that the majority of activities, issues and hazards have been adequately covered by all of the elements described in Table: 2, however they are under constant review and will be added to and modified as required.

**Immediate customer benefits**

The tangible benefits for our customers through the use of structured inspections have been the capacity to assist mines/quarries in identifying non-conformances and hence reduce and manage risk associated with the elements being audited.

Feedback from the industry, to date, has been mostly positive and there have been requests for the MI to hand out the information detailed in the proformas.

However the MI believes that releasing these documents to the industry would encourage some of our clients to only manage safety and health at the level the proforma is defined at rather than allowing them the opportunity to improve the safety and health standards through their own systems.

**Record of inspections**

In order to ensure that all elements were being inspected at appropriate intervals it was necessary to begin to record them. It should be noted here that Lotus Notes remains the network database platform used for management of statutory information and mine records

for the MI, however, it is not presently configured to capture and display information in a format that permits identification of the previously mentioned limitations with mine record entries.

There are approximately 580 inspections to conduct in the Mount Isa District if each element pertinent to a mine/quarry is inspected.

To manage such a large number, recognising that the frequency of when an element should be inspected varies from mine to mine and throughout the duration of one year, a database was developed in Microsoft Excel named the 'Inspection Performance Database' (IPD).

A section of the database is duplicated below in Table: 3. The database includes provision for input of information pertaining to the date and type of inspection performed by the inspector.

Note that, the table also includes hyperlinks to the relevant proforma documents making the database a one-stop shop. It includes a risk matrix rating that will be discussed later.

The next stage of the process in managing the large number of structured inspections to be conducted, amongst seven inspectors, involved scheduling activities. Our customers again were considered in this process. It was decided by the MI in Mount Isa to observe a protocol, where possible, of ensuring during scheduling that each major entity, quarry or mine is inspected at least once a month.

Microsoft Excel has been used quite effectively to address this issue by providing a database that can produce schedules which ensure timely intervals between inspections and that appropriate elements are inspected.

**Table: 3 Inspection Performance Database (RIPS) Scheduling**

ELEMENT					Ground Control	Explosive Storage/ Transport
Frequency Of Inspection per annum					0.25	1
Structured Inspection Proformas					<a href="#">Ground Control</a>	<a href="#">Explosives Storage 1.doc</a>
<b>MINE</b>						
<b>Mine 1</b>						
Risk Matrix Index		Inspection progress				
Ranking	Score	No of SI's Completed	No of Investigations Completed	No of SA's Completed		
<b>23</b>	<b>7</b>	<b>11</b>	<b>1</b>	<b>2</b>		
Structured Inspections Per Annum for the Individual Mine						
<b>Quarry 2</b>						
Risk Matrix Index		Inspection progress				
Ranking	Score	No of SI's Completed	No of Investigations Completed	No of SA's Completed		
<b>22</b>	<b>11</b>	<b>6</b>				
Structured Inspections Per Annum for the Individual Mine						
		13	3	18	18	
Date	Person	SA/SI	Date	Person	SA/SI	
		0.25	1.00			
Date	Person	SA/SI	Date	Person	SA/SI	
		0.25	1.00			

Prior to the use of formal inspection schedules mines/quarries could be inadvertently inspected two or three times a week by different inspectors. Mine management could find this to be disruptive especially in light of the fact that a lot of inspections are not announced to the mine.

The MI will notify a mine/quarry in most cases of its intention to conduct an inspection however there are times when a surprise inspection will be carried out. Mines/quarries need notification of higher level audits so that documentation and people can be prepared and provided accordingly.

However while mines/quarries may often be notified of the intention to inspect, the element or the content of the inspection might not be revealed.

Inspectors enter data into the IPD relating to the date and element inspected.

Formulas and macros within Microsoft Excel are used to transform, what was once a full day's activity of scheduling one month worth of inspections for seven inspectors, into a 15-second process.

### **Risk matrix index**

Prior to the development of the IPD the Technical Services Branch (TS) of the then Department of Mines and Energy had developed a risk matrix index (RMI) for all mines and quarries within the state.

The TS determined that a risk management process would be used to evaluate the safety performance at mine sites for the purpose of enabling the MI to schedule and deploy its inspection/auditing resources more effectively.

Mines and quarries are rated in the RMI on a scale in terms of risk associated with the operations.

The overall site surveillance rating for any particular mine or quarry is obtained from objective and subjective analysis of safety and health management performance and inherent mine hazards on that site.

For example an underground mine is presumed to have a higher amount of residual risk because of the nature of its operation as opposed to an open cut operation.

However an underground operation may conduct very effective accident/incident analyses and score better overall than an open cut operation that does not do as good as investigations despite its inherent nature.

Note that, this is one of the many performance indicators that are considered during evaluation of a mine or quarry's safety and health performance in the RMI.

The RMI is reviewed at timely intervals and therefore the rating of an operation's safety performance will change over time as improvements are made.

One of the most powerful indicators that the RMI can demonstrate is the overall performance of the mining industry's safety performance. The RMI combines traditional indicators such as lost time injury and fatality rates with positive performance indicators to provide an overall rating score.

The RMI and the IPD are legacies brought about by the initiatives of the MI and TS in the endeavour by both parties to enhance its inspection performance and achieve the mission and vision goals of the MI.

They remained two distinct systems for a period of time and were not greatly utilised. Both of these systems were integrated in early 2002 in order that the benefits of both might be realised.

The combined database is known as the Risk Based Inspection Performance and Scheduling Database (RIPS).

The result is a database that schedules activities (structured inspections) based on the risk score evaluated in the RMI, the degree of risk associated with the element being inspected and how well an operation is managing the risk associated with the element.

### **Summary of benefits for mi and customers**

The RIPS is a database that is used for decision support, management of information and automation of scheduling activities.

Through RIPS and the business process described a system has been developed that:

- Permits demonstrable performance of inspection progress
- Enables manageable scheduling of activities
- Identifies objectively the resource requirements required for the MI to achieve its objectives under the MQSHA
- Comprehensively audits safety and health performance on mine and quarry sites hence, ensuring risk is being appropriately managed
- Protects the MI to a degree from loss of corporate memory
- Assists the MI to achieve its mission statement and hence many other attributes associated with good sound business management practice

For customers it has enabled the following:

- It has created a mostly non-disruptive inspection routine
- Assists clients in identification of non-conformance
- Allows contribution towards improvement of a mines Safety and Health Management System
- As a whole of government initiative it contributes towards a safer and healthier industry for people to work in

### **Future direction**

Although the RIPS system and its associated documentation is only relatively new it is based on a quality process and as such is subject to continual review and improvement.

The potential use of Arcview, a Geographical Information System (GIS), to further enhance the user interface with the RIPS will be explored in the future.

It is envisaged that Arcview can be used for visual representation of database information that has been collected for RIPS.

As mines sites move towards full compliance with the legislation there will be an opportunity to introduce other elements into the structured inspections. As already discussed the concept of continuous improvement is inherent in the mission statement of the MI within the NR&M.

Secondly the inclusion of continuous improvement elements in the structured inspection document will enable the MI to identify areas in mine site safety and health management systems where improvements can be made and encourage the mines to refine the

application and approach of their systems towards best practice.

Part of this process will include expansion of the number and scope of the structured inspections.

#### **References**

1 Laudon, K.C. & Laudon, J.P. 2000. *Sixth Edition Management Information Systems*, International Edition, Prentice Hall, Upper Saddle river, New Jersey.

2 Queensland Department of Mines and Energy. October 1996, Review of Mining and Energy Inspectorate, Internal Document.

3 Queensland Mining and Quarrying Safety and Health Act 1999.

4 Porter. M.E. 1985, *Competitive Advantage: Creating and Sustaining Superior Performance*, New York Free Press