

Opal Mining and the Role of the Mines Inspectorate

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History

Opal mining has been ongoing in Queensland for over 100 years. Mining in the early years was often dogged by drought. The Opalton deposit, also called the Fernroy Field, was discovered in 1888. It was one of the largest and most extensively worked opal fields in Queensland. No opal mining of any importance was undertaken at Opalton until 1893.

In 1895 a small rush took place and in 1896 there are said to have been between five and six hundred men on the field. The rush was partly due to the good seasons prevailing, and with an abundance of horse feed and water available, the township flourished.

The early mining operations were very simple, the sandstone being generally soft, and requiring no more than a pick to work it. Blasting was only occasionally resorted to, as when the opal was won in this manner it was usually cracked so much as to be worthless.

All the tools of trade could be carried on a packhorse, greenhide buckets and plaited ropes of the same material being frequently used, and a windlass constructed on site. However, a considerable quantity of stores had to be carried, and the majority of miners found a horse and dray a necessary part of their equipment.

Present Operations

Today, Queensland's opal fields in the south-west of the State include the southern most Yowah Field, the Koroit Field, the Quilpie Field, the Kyabra-Eromanga Field, the Bulgroo Field, the Yarakka Field, the Jurdah Field, the Opalton-Mayneside Field and the most northerly Kynuna Field.

Larger mines worked in recent years are open cut operations, typically using bulldozers, excavators and occasionally trucks. Overburden is stripped from zones of ironstone boulder concretions. Boulders are carefully removed from the ground. Modern heavy earth moving equipment has been used to open up most areas of old workings. The exception being the 'Opalton Designated Fossicking Land' where claims are restricted to a thirty metres by thirty metres surface area. Hand tools only are permitted. Miners work from shallow shafts and use 'light' electrical machinery driven by portable generators.

The Mount Isa Inspectorate's area of jurisdiction includes the Opalton-Mayneside and Kynuna opal fields. The Opalton-Mayneside field is located south of Winton and includes the Opalton, Horse Creek, Mount Vergemont and Mayneside areas. The most northerly opal field, Kynuna is located south of Kynuna. The author's comments made in this paper are restricted to the Opalton-Mayneside and Kynuna fields.

Fifty to sixty miners generally work the Opalton-Mayneside and Kynuna fields on a seasonal basis between April and September. This represents approximately one percent of the mineworkers under the jurisdiction of the Mines Inspectorate in Mount Isa. Summer is avoided due to the high temperatures and possible heavy rains that may make road access impossible in some areas. A few miners live on these fields all year round.

Much antiquated equipment exists throughout the opal fields. It is not uncommon to find many examples of 'A' model Caterpillar and Komatsu loaders and dozers from the 1960's. Excavators are usually later models because they are used more extensively and need replacing more frequently than other equipment. The majority of mining is free digging. Drilling and blasting is avoided because of the inconvenience and the adverse consequence that firing explosives would have on the opal. Much of the material that the excavators dig can be quite hard mudstone and sandstone.

The size of today's operations varies from single person underground mines to family operated or small companies employing three or four people at open cut mines. Similarly, some operations exist on a hand to mouth basis and are little more than hobbies while others are well resourced and capitalised. Additionally, the Opalton area attracts large numbers of visitors and is popular with tourists as a place to 'speck' or 'noodle' fragments of opal or ironstone matrix from the surface, or from the spoil dumps of old workings.

Abstract

The Mines Inspectorate in Queensland is incorporated within the department of Natural Resources and Mines. Its existence is established under the "The Mining and Quarrying Safety and Health Act 1999" and "The Coal Mining and Quarrying Safety and Health Act 1999" and works within regulations and guidelines. The Mines Inspectorate's role is the regulatory control of mining within this state for the purpose of ensuring high standards in terms of safety and health within our industry. This is chiefly brought about through the new legislation that has brought a departure from the previous narrow ranging prescriptive regulations. The new mining legislation confers an obligation upon mine personnel towards ownership and responsibility for risk management at all levels within the organisation.

Part of the focus of the vision and values of the Safety and Health Division is to recognise the service, in addition to the role of regulator that the Mines Inspectorate can provide, especially for small mines. The legislation that applies to metalliferous mines, gemstone mines and quarries is the "Mining and Quarrying Safety and Health Regulation 2001".

One of the interesting components in this new thrust is how the Mines Inspectorate disseminates its responsibilities as an inspectorate towards the opal mining community of Queensland. The tyranny of distance is one of the obstacles encountered in dealing with opal mining in the Winton district. The opal fields such as Opalton and Mayneside are up to 250 kilometres southwest of Winton in some of the most remote parts of western Queensland. It is also an industry that has been under way for over one hundred years in this area.

This paper discusses the major safety and health issues commonly encountered on small mine sites, particularly the opal mines of western Queensland. A view is taken of how the Mines Inspectorate has determined to allocate limited resources for the purpose of achieving the intent of the new mining legislation.

Geology

Opal is Australia's national gemstone. Australia has three main types of natural precious opal, with varieties defined by body tone and transparency characteristics. These include precious opal varieties such as black opal from Lightning Ridge in New South Wales, white opal from South Australia and Queensland boulder and matrix opal. This type of opal is unique to Queensland.

Queensland's opal fields in the west and southwest of the State lie within a 300 kilometre wide belt of deeply weathered Cretaceous sedimentary rocks known as the Winton Formation. The Formation extends in a north, north westerly direction from Hungerford on the New South Wales border, west of the townships of Cunnamulla, Quilpie, Longreach and Winton, to Kynuna, a distance of about 1000 kilometres.

Boulder opal is widely distributed in these rocks within ironstone concretions or boulders, which are generally elongated or ellipsoidal in shape ranging from a few centimetres up to three metres in length. The boulders may be confined to one or more layers known as the boulder layer or may be randomly distributed throughout the sandstone. Their composition ranges from sandstone types, consisting of a rim or crust of ferruginised sandstone surrounding a sandstone core to ironstone types, composed almost entirely of iron oxides. The opal occurs as a filling or lining between the concentric layers, or in radial or random cracks in the ironstone or as a kernel in smaller concretions. Only a small percentage of the boulders contain opal.

- 1: Inspector of Mines - Department of Natural Resources and Mines; Mount Isa District
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Mining Legislation

The object of the *Mining and Quarrying Safety and Health Act 1999* (MQSHA) is to protect the safety and health of persons working at mines and persons who may be affected by operations. It also requires that the risk of injury or illness to any person resulting from operations is at an acceptable level. The way this is to be achieved on mine sites with less than ten people is by:

- The imposition of safety and health obligations on persons who operate mines
- or
- who may affect the safety and health of others at mines.
- The making of regulations and guidelines, which promote risk management and control.
- Providing for inspectors to monitor the effectiveness of risk management and control at mines, taking appropriate action where necessary.
- Provision of a way for competencies of persons at mines to be assessed and recognised.
- Providing for appropriate emergency preparedness.

The main role of the Mines Inspectorate in Queensland is to ensure that all persons who operate a mine are following the obligations of the MQSHA in controlling and managing risk in a satisfactory manner.

In the early 1990's a regular inspection program for the opal fields in the Winton district did not exist. There were limited resources within the Department of Mines of Energy (DME), as it was previously known, and visits to the opal fields were irregular. The review of the Mines Inspectorate in 1996 resulted in the allocation of additional resources including more inspectors. In conjunction with the bolstering of resources it was recognised that there was an opportunity to establish a regular inspection program for the opal fields. The Mines Inspectorate of Mount Isa then embarked upon a regular program of inspections.

Each trip to the Winton district Opal fields takes approximately seven working days to complete and up to twenty-five mines are inspected during one field trip. Not all the same mines are inspected each time. There are approximately fifty active mines within the Opalton-Mayneside and Kynuna District. The map below depicts the area covered. A field trip comprises of a return trip of approximately 1000 kilometres from Mt Isa to Winton and another 1500 kilometres travelling through the opal fields on mainly unsealed remote roads.

Due to the isolated conditions, Mines Inspectors travel in pairs throughout the opal mining districts. The numbers of miners within the Opalton-Mayneside and Kynuna District represent one percent of the total customer base of the Mt Isa District Mines Inspectorate. The inspections carried out each year within this district represent three percent of the Mine's Inspectorate available resources.

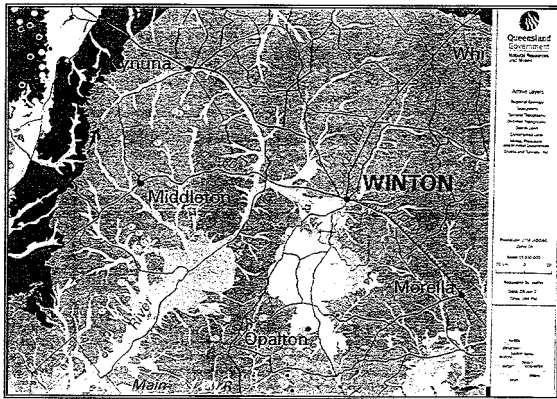
As a consequence of the bush telegraph it is difficult to make unannounced inspections. In fact if the miners do not want to meet with the inspector they can make themselves unavailable. It is not uncommon come upon a mine site that has been deserted with the billy still boiling in the campfire. Therefore it is necessary when dealing with the opal miners to gain their confidence and cooperation. This can be achieved through a conciliatory and facilitative approach where ownership of responsibility is encouraged. Frequent visits to the fields have improved relations between the regulator and miner achieving a certain level of mutual trust and respect.

An opal miner has a number of Acts of Parliament, which they must comply with while conducting mining activities. They include the "Mining Quarrying Safety and Health Act 1999", the "Environmental Protection Act 1994", the "Mineral Resources Act 1989" and the "Explosives Act 1999".

The major objective of the Mines Inspectorate in administration of the MQSHA, in respect of mining operations, is to evaluate and ensure that the effectiveness of risk management and control is adequate.

The major hazards and issues identified on opal mines within the Opalton-Mayneside and Kynuna District include:

- Vertical openings and Rock falls
- Personal Protective Equipment (PPE) & Dust Control
- Explosives
- Mechanical Energy Source Hazards
- Emergency Response and Working alone



Map of the Opalton-Kynuna District

Vertical Openings and Rock Falls

There are numerous shallow shafts within the Opalton fossicking area. Most shafts have suitable covers or guarding to prevent persons inadvertently walking or falling into them. However some operators consider that the remoteness and isolation of their operations is sufficient grounds to not have to provide adequate protection for their shaft openings. So there are occasions where shaft openings are not protected. A recent inspection of an unattended mine identified an unprotected shaft located approximately thirty metres from a public telephone. There was no one at the mine at the time of the inspection.

A common prospecting tool is to drill auger holes. An auger is attached to a hydraulic excavator, which typically drill holes 300 millimetres in diameter up to seven metres deep. The abandoned auger holes present a hazard for persons to fall into if they are not filled or barricaded.

Pit walls of mining operations vary in height from a few metres up to thirty metres. Due to the height of some of the walls scaling is not practical. The walls are almost always vertical, very rarely have safety berms or benches constructed and none have any ground support or reinforcement installed. This situation is exacerbated somewhat by the restriction of lease boundaries and the overlying hard siliceous cap rock. Undercutting of the pit high wall in order to follow a boulder horizon is occasionally practised.

A recent safety and health presentation given to the opal miners at Winton discussed issues relating to pit wall safety. The majority of miners at the presentation acknowledged the need to modify their mining methods. The most recent field trip indicated that miners have adopted the practise of developing safety benches and ensuring pit walls repose at stable angles.

Trenching/costeering is also commonly undertaken as a prospecting method. It has been a practice to leave these excavations open and unprotected for long periods of time for the purpose of re-assessing the geology at a later date. Costeans can be up to seven metres deep and in excess of fifty metres in length. On occasions miners take an unacceptable risk by entering these costeans to inspect/interpret the geology. This is a hazardous procedure that exposes a person to the likelihood of being struck by a rock or buried under a rock fall. A fatality occurred in 1991 when a miner was buried under a slump of ground from a pit wall only three metres in height. See Photo: 1.

The recommendations from the Wardens Inquiry in respect of the above fatality stated that sandstone overburden must be stripped back to a stable angle and a space must be maintained to ensure a clear retreat in the event of a rock fall. The continuous common practice of accessing unsupported vertical walls in trenches to examine the ground violates both of those recommendations in addition to exposing the miner to a high level of risk.

The underground operations around the designated fossicking area of Opalton have inherent risks, some of which are not intentionally created. No mines inspected to date use any form of introduced ground support but rely on the rock strata to support itself. This is an acceptable practice provided wide spans are not mined. The overlying rock mass of most underground mines consists of very weak sandstones and mudstone in the presence of kaolinite. Water causes swelling of the clays present in the rock strata.



Photo: 1 Site of Fatality Where a Miner Was Buried Under Rock Fall

The majority of the rock mass throughout the mines inspected includes sedimentary sandstones that can be highly structured. This can lead to potential wedge formation in pit walls and underground excavations. The large unsupported areas of the backs underground with flat lying beds of the sedimentary sandstone create conditions that may lead to beam type failures of the rock mass. The stability of ground in these underground mines can be threatened through the gradual loss of the supporting rock mass in pillars. This occurs through mechanical weathering by the water and by the mining methods employed, see Photo: 2. The opal is often mined through at a certain level, creating wide spans. Abandoned underground mines can fill with water in the wet season, especially if they are located near a watercourse. Pillars at the boundaries between adjacent leases have failed under the pressure and weathering action of the water.

Personal Protective Equipment (PPE) & Dust Control

Historically, miners in this region have not worn appropriate PPE. The reasons cited by miners for not using PPE are for ones of comfort rather than concern for the health issues. Many miners wear hard hats but some still do not appreciate their worth. Some miners are working at the base of high walls not wearing suitable personal protective equipment. Steel cap boots are worn by many but not all.

Due to the mostly dry conditions dust is constant issue. Dust suppression is not practised. The majority of excavators and dozers do not have dust proof cabins. Operators working in these conditions are reluctant to use personal protective equipment. The long-term ill health effects of this practice are of concern.



Photo: 2. Wide Span Caused Through Mechanical Weathering Action of Water

Explosives

Explosives are not widely used throughout the field, however the overlying capstone, which is too hard to dig, is occasionally blasted. Underground mines also have an occasional requirement to use explosives. Security of explosives whilst operators are away from their site is an issue not effectively controlled or managed.

Mechanical Energy Source Hazards

Some methods and activities carried out on mine sites in the Opalton-Mayneside and Kynuna District have been conducted in a similar manner for many years. Some of these activities expose workers to unacceptable levels of risk. Due to opal occurring in very small proportions constant visual examination of the excavated material is required. This practice requires persons who examine the material to work in close proximity to operating mobile equipment. Examples of these activities include people walking along behind dozers and people inspecting the contents of excavator buckets as they are tipped. These work methods require both the spotter and the equipment operator to remain vigilant and consciously aware of each other's presence at all times. There is the potential through these work methods for a serious accident to occur as a result of human error.

Maintenance of Equipment

No preventive maintenance programs have been observed and generally the equipment is operated until break down. Maintenance for mobile equipment is performed in situ in less than ideal conditions. It is not uncommon to find equipment sitting idle awaiting parts/maintenance. Most loaders and dozers inspected are fitted with suitable roll over protection.

Emergency Response and Working Alone

It is unavoidable that some miners work alone, often for periods of up to several weeks. Up until recently communication with the outside world was only through interaction with other miners and external visitors. Many of the opal mining camps now have satellite telephones, which provide the means to contact emergency services in the event of an accident and the opportunity to maintain social interaction through communication with other miners. All mines inspected have some form of first aid facilities and all have motor vehicles that can be used for transport in an emergency situation to relocate to the closest airfield.

Summary

To date the activities of the Mount Isa District Mines Inspectorate in respect the Opalton-Mayneside and Kynuna opal fields have included:

- Regular inspections twice per season.
- Presentations on mining legislation.
- Attendance at the Boulder opal festivals at Winton to discuss safety and health issues with miners.
- Providing written information on relevant safety and health issues and excerpts of the MQSHA.
- Providing advice and assistance in the field where applicable on matters relating to the MQSHA.
- Issuing of directives to reduce risk where required on mine sites.
- Exchange of information and issues with the Mining Registrar at Winton.
- Producing reports so that the safety and health performance may be evaluated between inspections.

For the purpose of maintaining consistency, the opal fields are inspected at the beginning of the season to establish an early presence and towards the end of the season to follow up on directives issued and to monitor performance. Where unattended mines are inspected and directives are issued, copies are left on site and the original is mailed to the mine operator. In between inspections the Winton Mining Registrar reports on progress of any safety and health issues when he is in the field.

The impact of the regular inspection program has heightened the awareness of the opal miners to the presence of inspectors in the field. The relations between regulator and miner are now well established. This has been achieved despite the tyranny of distance and the fact that there is no permanent representative of the Mines Inspectorate in the Winton district. Almost all miners will now readily and immediately address any safety and health issues raised by the inspector during the course of an inspection. The opal miners are well mindful of the need to cooperate with regulators to avoid disruptions to operations.

It is also recognised that the Mines Inspectorate has an informal role to play in facilitating the flow of information, concerning mining legislation, to the small miner, particularly the opal miner. Prior to and subsequent to the enactment of the new mining legislation presentations were undertaken in Winton. This is the closest regional township to opal miners. It is believed that these presentations have been successful because of the level of attendance and interest shown. Miners in the field are now frequently making reference to the new mining legislation. While the need for giving presentations on the legislation has diminished there will always be a future requirement to periodically present new information. Distribution of pertinent Safety Incident Reports and Safety Alerts can be achieved through the Boulder Opal Association at Winton.

It has been satisfying to observe miners in the field applying some of the knowledge and information they have learned from information sessions with inspectors. It is intended that the Mines Inspectorate will hold future workshops at Winton on selective themes to enhance the knowledge of the miners in the district and assist them further in understanding how to discharge their obligations that are described under the MQSHA. The major hazards identified in this paper will be an area of focus for these workshops that will include reiteration of essential topics such as risk management, ground control and vertical openings, etc.

Currently under proposal is the development and publication of a small miner's handbook of questions and answers covering pertinent topics applicable specifically to opal mines. The handbook will be developed in collaboration with the mining community and legislative bodies. Other States in Australia have developed similar documents relating to small mines. South Australian opal miners developed their own safety handbook and the New South Wales Department of Mineral Resources in conjunction with Lightning Ridge Miners Association and the Garwin-Glengarry Sheep Miners Association have produced the "Lightning Ridge Miners Handbook". This handbook is seen as a way in which the Mines Inspectorate can be of assistance in educating opal miners on legislative and relevant safety and health matters. Some of the immediate benefits will be an increase in knowledge of current risk management processes and hazard identification.

The Mining Registrar at Winton has accompanied Mine Inspectors on various trips and has been of assistance in locating and identifying mine leases/claims and the persons who operate them. In a reciprocal way information has been shared with the Mining Registrar on the safety and health requirements that are imposed on miners in how they are meant to conduct their mining operations. During the protracted absence of the Mines Inspectorate, the Mining Registrar, who makes regular visits to the opal miners throughout the year, has been ensuring that the directives issued by Mines Inspectors are being complied with. This synergistic relationship means that there is very little a miner can do to avoid complying with a directive even in the inspectors absence. Two inspections of the opal fields per season are considered to be the minimum number required to maintain effective control as well as being the maximum number of inspections practicable, given the finite resources of the Mines Inspectorate, the level of risk, and the percentage of the Mount Isa District workforce that opal miners represent.

Plato once said "...not all are alike..." and for this reason it is essential to build a data base of opal miners and history of past performances including directives issued. Safety performance of opal miners can be assimilated over a period of time and a profile constructed from this information database. There may also be the possibility for this information to be utilised by other authorities in the administration of mining claims and leases, etc; safety and health performance may be integrated with the granting of leases. If a person has a poor record of managing risk in relation to safety on a mine site why should they be granted another lease? The Mines Inspectorate will investigate the potential for use of this information as described above. It is worth noting that the owner of a lease is not always the same person who operates a mine. The database will include profiling of respective individual operators, owners and site senior executives who operate small mines.

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