

Opal and gem miners' handbook

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1 Objective

This handbook provides operational advice that lowers the risk of injury associated with small scale opal and gem mining.

2 Obligations

Even though in many cases opal and gemstone miners who work alone and are holders, operators, site senior executives and workers combined, they must ensure that the way they mine and the equipment they use, does not pose an unacceptable level of risk to themselves or other people.

3 Risk Management

Preparation and planning is the key to ensuring the success of any venture, in this case mining. Thinking about how someone might be hurt or injured at the mine, by the way they are working or the plant and equipment used is a simple way of identifying hazards.

Once identified, implementing controls to prevent a person from being hurt or injured by the hazards is essential.

When deciding which hazard control to use, chose the most effective and reliable that if put in place would prevent someone from being injured or killed?

In summary ask yourself:

- What am I about to do?
- What could go wrong or how could I or someone else get hurt?
- What do I need to do to stop this happening?

4 Operational advice from experienced miners

4.1 Access

Often gem and opal mining occurs in very isolated places and the following must be considered:

- Due to the isolation of some sites a contingency plan for survival must be in place
- Consider vehicle breakdown and water supply
- Ensure you have appropriate communication (satellite phones etc)
- Ensure someone knows where you are and when you are expected to be back
- Know your exact location as there can be a maze of dirt tracks which can be very disorientating even for the most experienced prospector. A tracking device such as a GPS can assist.
- Despite mining taking place in generally arid areas, consider the hazard of flash flooding from storm events. Creeks can rise quickly, rain may fall upstream and you can lose access.

4.2 Surface mining

4.2.1 Geology

An important aspect of mining safety is to have an understanding of the Opal bearing geology of the ground you are going to work in. It is advisable to ask local miners what the ground is like where you are considering digging.

Most Opal deposits have a common association with localised geological anomalies with the most favoured and generally productive Opal hunting ground being in the near proximity to Faulting. Excavations large or small can unwittingly unlock the foot foundation of the angled fault plane supporting entire sections of a pit face.

Understanding & respecting the physical nature of the ground you a working can prevent a major disasters. Slope stability in large excavations requires constant consideration & ongoing preparation.

4.2.2 Mining

Plan your excavation, dove tail into a wall rather than slotting

Never undermine a trench or work under over hanging material

If material is identified in a side wall you should either bench it back or batter the wall to reduce the height and increase stability.

In October 2016 an opal miner who had been working alone was found deceased in a collapsed trench at his remote mining claim. It is believed he was working with hand tools in the bottom of the trench mining into one side of the trench wall when part of the undercut section of the wall collapsed on him

Don't ever trust the integrity of a standing free face, especially narrow exploration trenches

The greatest potential for ground failure is caused by fault zones and changes in ground conditions causing instability in the ground

Crush injuries from heavy machinery; always appreciate the slew radius of an excavator, either as an operator or stone checker.

Never approach a working machine without making positive communication with the operator before being signalled into the work zone.

Stay clear of bulldozing operations. Bulldozers either ripping or pushing a full blade in a drive appear a slow as snails, however on the reverse side in 2nd or 3rd gear they are slick quick, and powerful with sharp snappy corrections. Pedestrians and light vehicle's mixing with dozers don't mix.

Do not operate a machine on the surface with its track frame in parallel a pits free face, always approach and work perpendicular to the face.

Barricade open edges

If working at heights above 2.4 metres or near vertical edges you must have a way of preventing a person falling

When possible use the prevailing winds to your dust free advantage. Dust protection is recommended (dust masks and dust filters on enclosed equipment) as silica is often present

If blasting is undertaken the potential for fly rock must be considered.

A tidy miner is the hallmark of a safe miner.

4.3 Underground mining

For safety reasons you should have a partner in this venture.

When first starting out in an opal mining area and you are new to the area, it is advisable to ask local miners what the ground is like where you are considering digging. Places to avoid may include:

- Creeks that could cause flooding of shafts and drives
- Ground that has been mined and has been backfilled leaving loose material
- Areas where many old shafts/drives have been worked underground. These may have become unstable and or flooded out over the years.

If possible ask the locals if you can go underground and have a look at their mining methods and shafts /drives. This will give you a better understanding of the ground and how and where to find opals or gems.

When you have considered all of the above you will need to plan how you are going to mine.

Basic equipment would often include: a windlass, electric/air jackhammer, generator power, (kept well away from the shaft) for extension leads for lighting and mining equipment, air compressor (for generator for air jack hammer), suitable ladders etc. You may also use a more conventional method using an automatic hoist.

All equipment should be in good working order and have been well maintained and checked both mechanically and electrically.

4.3.1 Digging the shaft

Safety Helmets and steel capped boots and safety glasses should be worn at all times.

Shafts can be dug by:

- Hand, using jackhammers. The most preferred being a rectangle approximately 1m x 1.5m.
- A Caldwell Drill that can drill various diameter shafts and depths. The most preferred diameter is 1m.

Other shafts should be drilled to allow for ventilation and emergency egress.

When the shaft is dug or drilled you need to install a collar that sits just above the surface and is deep enough to contain any loose material from falling down the shaft.

For drilled shafts the collars are often made from small galvanised tanks with the top and bottom cut out. For hand dug shafts the collars are often made from roofing iron.

Always ensure that the collars are far enough above ground to stop and water going down the shaft during heavy rainfall. Placing a good layer of mullock around the collars can be used for this.

4.3.2 Ladders

If digging by hand then you will need to attach ladders as you go. Ladders can vary in length and width but must have a suitable and fail safe method of attachment.

Remember you and others may be going up and down this shaft and they need to be safe and strong enough to support the weight.

When removing dirt consider that the bucket may fall.

In November 2016 an opal miner in NSW was fatally injured after being struck by a steel material hoist bucket that fell down the shaft.

If you used a drill then you will now have your ladders attached down the wall of the hole. You may join all the ladders to a certain depth then lower them.

In all cases here you should wear a safety harness securely attached to the surface. If using the harness then you can attach the ladders separately as you descend.

Ensure that ladders are secure and fit for purpose

- Extend 900mm above collar of shaft
- Off set and pinned 200mm off the wall
- Rungs between 250mm – 300mm apart
- Ladder between 375mm – 525mm wide

4.3.3 Underground

As you descend down the ladder you will be able to assess how stable the ground is. Look for any large cracks and any loose material or major changes. Loose ground may require scaling or further shoring.

When mining underground ensure that before commencing a horizontal drive the shaft is in consolidated competent ground. The minimum depth is at least 4m below the surface.

The width and height of a drive should allow reasonable access for a person at all times.

When mining out a drive wider than the normal width consideration must be given to the use of ground support (such as props with headboards, pillars, backfill) given the wider excavation span.

You will need to have brought down all extension leads, suitable lighting, fans to circulate the air and all equipment used in mining.

Make sure that you have potable water and a basic first aid kit with you underground.

You will be breaking rock that would likely be silica bearing and creating dust that may not always be visible to the naked eye so wearing of a suitable dust mask is recommended.

- Use mining method and equipment that minimises dust generation
- Suppress generated dust at the source
- Use Class p2 respiratory protection to protect yourself from dust inhalation.

It is critical to maintain a pillar around the shaft and between drives at all times as this assists in stabilising the ground.

Always try and determine if there are any old workings in the area you're mining as mining into unconsolidated fill can result in engulfment.

In March 2011 an opal miner working alone in old shallow underground workings was fatally injured while removing mullock used to backfill a shaft. The material flowed and engulfed him

(This would be an area where there could be a separate comment on ground support for opal mining and gem mining) and comment on belling out / ballroom.

4.3.4 Safety aspects to look for while digging drives

Each day or whenever you're mining you should conduct a thorough inspection to identify such things as:

Opal

- cracks appearing in the ceiling, these can be hairline or wider and if left un-managed can become dangerous
- slips or slides in the clay, these occur due to slight moisture and can result in large blocks of clay falling out from the wall off the drive. Gaps can sometimes appear between the clay and the ironstone level and can mean that a slip & and or slide is giving way or it just the drying out of the clay. Using the jackhammer to dig some of the clay away will show whether it drying out or there is clay about give way
- Moisture in the ground.

Gemstone

- cracks appearing in the ceiling, these can be hairline or wider and if left un-managed can become dangerous
- undercutting of sidewalls that create a brow / overhang
- evidence of entry into workings by snakes
- thorough inspection of ground conditions following rain events.

4.3.5 Ventilation

When working underground you will need to dig or drill another shaft, mainly for emergency egress and ventilation. The use of fans will aid in circulating air throughout the drives. Further holes can also help in this.

4.3.6 Daily Checks

Fully check the operation of all above ground equipment. This includes windlass/auto hoist, and the cables. Run the generator, check wiring and leads, check and test the ladders while descending to ensure they have remained fully secured to the wall of the shaft.

Underground do a thorough check of mining equipment, drives and pillars for any noticeable changes, ventilation and moisture.

Some aspects of safety are common sense, however if good practices are adhered to then you should have a safe and rewarding experience.

5 Additional operational advice

5.1 Communication

- Establish and maintain a method of communication with the surface. This should be tested regularly

5.2 Accessing shafts

- Don't carry things while climbing ladders or accessing and egressing earthmoving equipment
- All shafts should have barricades and edge protection and a method to securely cover when not in use

5.3 Flooding

- Install a collar ring that extends as a minimum of 500 mm above the shaft entry
- Profile the ground around all shafts so that water does not pool and is diverted away from the shaft
- Be aware of the extent of surrounding workings and that these may contain water
- Seek advice and information on the extent and locations of flooding that may occur in the area you are working
- Avoid sinking shafts or excavating in water courses or flood prone areas.

5.4 Hydraulic pressure

- Turn off and bleed hydraulic lines before working on them
- Isolate the plant using locks and tags
- If looking for a hydraulic leak never use your fingers or hand and wear eye protection
- Ensure hoses and fitting are rated for the correct pressure
- Never stand under an elevated boom or bucket

- Always have the safety pins in place on quick hitch attachments.

5.5 Tyre pressure

- Always deflate tyres before working on them
- If working on dual wheels deflate both tyres
- When inflating tyres, establish an exclusion zone, stand clear and to the side
- Only suitably qualified personnel should conduct work on earthmover wheels tyres and rims.

5.6 Air pressure

- Maintain and check pressure gauges and relief valves
- Ensure hoses and fittings are correctly rated for the pressure
- Regularly drain air receivers and tanks
- Before working on any air system components ensure they are turned off and depressurised
- Isolate the plant using locks and tags
- If using couplings or joiners ensure they are secure. Use pins or clips.

5.7 Gas cylinders

- Ensure they are stored upright, secured and out of direct sunlight in a well ventilated area
- Turn off when not in use
- Check gauges, regulators and hoses regularly
- Always use flash back arrestors on both the oxy and acetylene
- Don't use or store LPG cylinders indoors.

5.8 Electricity

- Where ever possible use battery powered tools
- Only qualified persons to undertake work on electrical equipment
- Ensure that earth leakage\safety switch are installed on all circuits
- Regularly test all safety switches
- Run leads so that they are protected from damage and off the ground and away from water and wet areas
- Check and inspect electrical equipment, leads and plugs prior to use. Replace any that are found to be damaged

- Large generators that supply a switch board must have an earth stake
- Smaller generators can have an earth stake or be bonded to main metal structures to main metal structures joining into the mine (ladder) and generator frame.

5.9 Mobile plant

- Never use mobile plant unless the brakes and steering are operational and effective.
- Conduct a prestart check on equipment at least daily, including testing, brakes (including emergency brakes), steering, safety features, emergency stops, guards and hoist/winch ropes and attachments.
- Obtain and use the OEM brake test procedure
- Ensure that any maintenance and repairs to plant and equipment is done to OEM standards

5.10 Winches and hoists

- Winches and hoists must never be used for man riding unless specifically designed and engineered for the purpose
- If winches and hoists are used in the main access shaft then a second means of egress independent of this shaft must be established
- When installing bulldog clamps on wire rope, use at least 3 installed 50mm apart, the clamp portion must be on the live rope and not the tail (refer diagram)
- Wire ropes should be installed, inspected and maintained as per the manufacturer's recommendation.

5.11 Pedestrians near mobile plant.

- Never allow personnel to be on foot in areas where mobile equipment is operating
- If personnel do enter an area where equipment is operating stop the equipment and lower all implements
- Operators and persons on foot have a communication method or set of agreed signals between them.

5.12 Rotating machinery

- Ensure that guards are installed on all pulleys, flywheels and rotating equipment
- Stop, isolate and lockout equipment before conducting any maintenance, repairs or adjustments.

5.13 Fumes

- Never use petrol motors underground or in confined spaces
- Position petrol motor driven equipment well away from shafts or mine ventilation points

- Establish and use mechanical ventilation devices to provide adequate ventilation flow in underground workings
- Always ventilate old underground workings before entering them.

5.14 Heat and extreme weather

- Monitor the weather conditions and plan work activities to suit the conditions
- Understand the signs and symptoms of heat stress/stroke and take early action
- Ensure that you have available and drink adequate amount of water
- Pace your work according to the environmental conditions and how you are feeling
- Ensure that you take regular breaks away from the hot environment.

6 Operational Competency

Personnel who undertake mining activities must have adequate knowledge, skills and understanding of the mining methods, handling of materials and operation of plant

All personnel who use and operate mobile equipment must be trained and competent in its safe use.

Personnel who carry out repairs and maintenance must be competent to ensure that it is serviced and maintained so that the plant is capable of performing its intended function and is within the condition and performance limits of its specifications.

7 Emergencies

Who knows where you are what you are doing, how long you will be there and how do they know you need assistance and can they find you or get to you. If something goes wrong who do they tell?

As a minimum, you should:

- Install a sign or notice at the surface advising if you are working underground.
- Advise someone of your intended activities, location/s and how long you will be there
- Provide enough information so that help can be sent to you if needed
- Have at least one reliable method of communication but two would be better
- Establish a communication/contact schedule with that person
- Ensure the contact person knows what to do and who to contact to initiate an emergency.
- Carry and use an EPIRB
- Maintain a well-equipped first aid kit
- Undertake a first aid course
- Ensure that you have fire extinguishers in your mobile equipment and at your camp

8 Incident and accident reporting

The MQSHA requires the SSE to report fatalities, serious accidents (person had to go to hospital) and high potential incidents to an inspector of mines. The on call numbers and notification details are shown below.

Region/District	On call/Emergency Phone	Email for written notice
North Region: Townsville	(07) 4447 9282	tsvmines@dnrme.qld.gov.au
North West Region: Mount Isa	(07) 4747 2151	isamines@dnrme.qld.gov.au
South Region	(07) 3330 4273	sthmines@dnrme.qld.gov.au

If you are not sure if you should report it call an Inspector of Mines on the on-call number and they will advise you.

9 Cessation of mining (seasonal) and mine closure

How do you make safe and secure your mine when you are away from the mine, taking into account;

- Visitors, fossickers, tourists, station owners, livestock and other animals
- Leaving the mine briefly when you are working
- Securing shafts and voids

How do you make it safe when you have finished mining and will not come back either closure, surrender or abandonment.

- Comply with requirements of the Environmental Authority
- Backfilling shafts, trenches and voids
- Profiling the walls of open cut workings
- Establishing bunding where there is a risk of falling more than 2.4 metres.