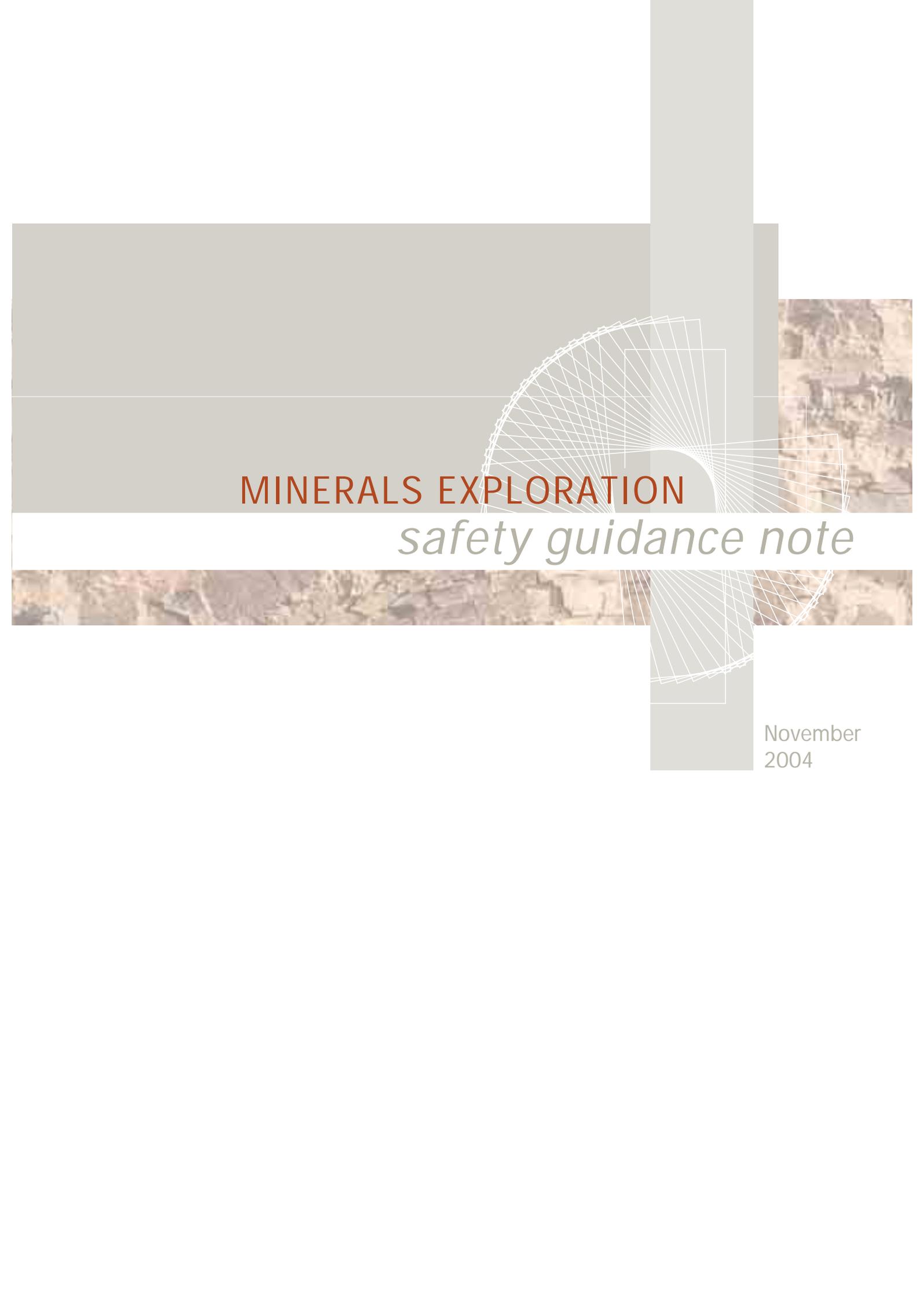


MINERALS EXPLORATION
safety guidance note

November
2004



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MINERALS EXPLORATION

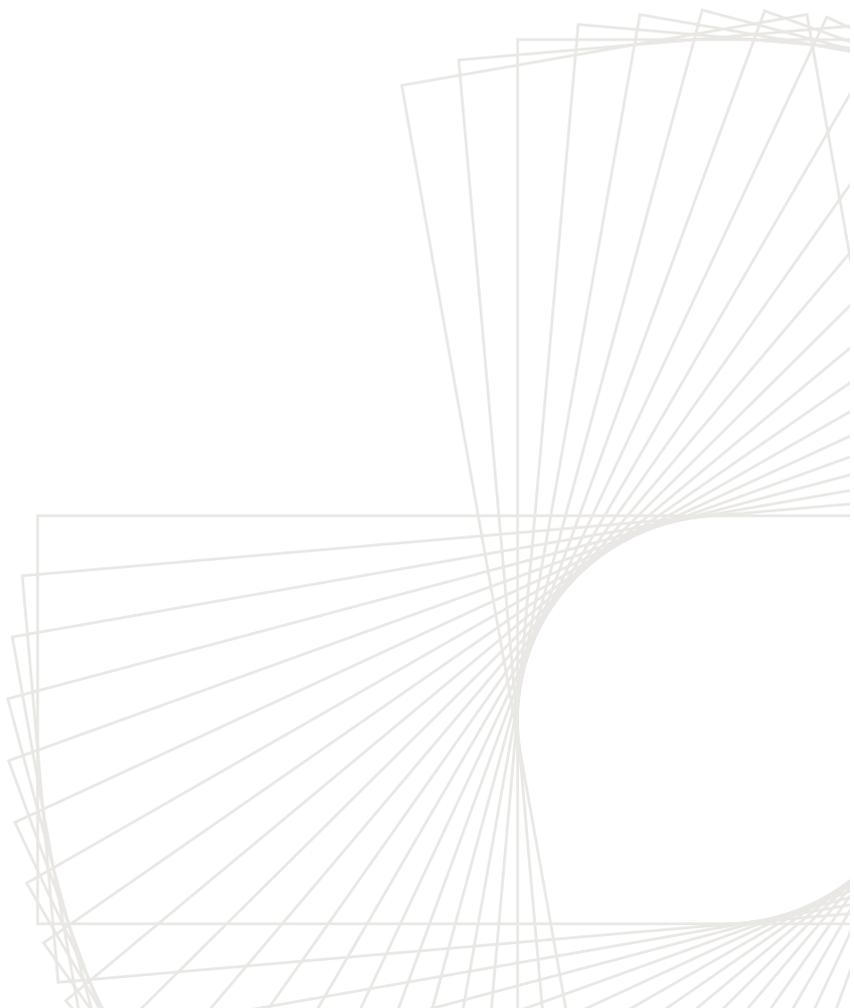
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#27173 QNRM04092



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foreword TO FIRST EDITION (1998)

In 1995, the Queensland Resources Council and the then Queensland Department of Mines and Energy established an Exploration Safety Working Group to consider means of improving exploration safety, including drafting guidelines and increasing promotion and awareness of safety. The working group consists of exploration managers, drilling contractors and representatives of the Department of Mines and Energy and the Australian Workers Union.

The objectives of the guidelines are to assist in reducing accidents, injuries, incidents and occupational diseases in the exploration industry by ensuring that proper attention is given to safety management in all on-shore exploration activities. The guidelines are not to be interpreted as legislation and have no legislative standing.

The Department of Natural Resources and Mines and the Queensland Resources Council thank all those who have contributed to production of the guidelines, in particular members of the Exploration Safety Working Group:

Roger Billingham	Department of Natural Resources and Mines
Barry Clark	Rockdril Contractors Pty Ltd
Simon Fitzgerald	Rockdril Contractors Pty Ltd
Steve Horseman	BHP Coal Exploration
Tim Kassulke	North Ltd
Nathan Mitchell	Mitchell Drilling
David Morwood	Department of Natural Resources and Mines
Graham Muggeridge	CRAE
David Munt	MIM Exploration
Rick Nelson	CRAE
Brian Scholefield	AWU
Bob Skrzeczynski	BHP Minerals
David Wightman	North Ltd
Ian Willis	MIM Exploration

Since publication of the *Minerals exploration safety guidelines* in 1998 and its reprinting in 2000, changes in Queensland's mining safety legislation, and popular demand, have resulted in preparation of this second edition.

In March 2001, the *Mining and Quarrying Safety and Health Act 1999* and the *Coal Mining Safety and Health Act 1999* came into force. These Acts represented a major rewrite of the legislation applying to mine safety in Queensland, and introduced the concepts of obligations to ensure that risks at mines are managed to an acceptable standard. For the first time exploration for coal in Queensland comes under the same legislation as the mining and processing of coal.

As a result of the new legislation, Section 3 of this publication, Legal responsibilities, was fully revised for this new edition. As the term 'guideline' now has a specific meaning under the Queensland *Mining and Quarrying Safety and Health Act 1999*, the publication was renamed *Minerals exploration safety guidance note*.

Most of the contents of this edition have remained unchanged, as they were originally written to cover generic situations. However, references have been checked and updated. Unless otherwise specified, all legislation cited in the publication is Queensland legislation.

Demand for this publication has remained high, and it is still considered one of the most useful documents covering safety and health in the Australian minerals exploration industry.

The Department of Natural Resources and Mines thanks all those who contributed to the revised second edition of the *Minerals exploration safety guidance note*.



section 1 INTRODUCTION

The *Minerals exploration safety guidance note* will assist explorers by providing a simple reference or check list of safety issues that should be considered when planning fieldwork. It will also assist exploration managers and contractors to develop their own safety programs for their particular needs. Safety works best when it is built into all tasks rather than treated as a separate issue.

Legal responsibilities for safety and health may be stipulated in various laws, but unless everyone involved in the industry works together willingly to provide and maintain a safe and healthy working environment, positive improvements are less likely to be achieved.

While there are several laws covering safety and health in exploration, and each state of Australia has its own legislation, there is a similar trend throughout each state's laws. A common law duty of care also exists in each state. The duties and responsibilities also remain similar, whether exploring for minerals, coal, oil or petroleum, and whatever exploration techniques are used.

The range of activities involved in exploration is vast, and each one may present different hazards and risks to employees. They vary from flying aeromagnetic surveys to travelling on foot in remote inhospitable country, establishing major campsites, undertaking earthworks, and drilling.

Statistics show that most accidents and injuries occur during travelling, manual handling or drilling, and frequently are caused by slipping and falling. Fatal accidents in the exploration industry in Australia have involved fixed wing aircraft and helicopter crashes, heatstroke, vehicles overturning, and people being caught by rotating rods on drill rigs. Another fatality involved a hydrofluoric acid spill.

The best way to reduce accidents is by employers, in conjunction with employees:

- ensuring that all employees are competently trained to do their work
- identifying hazards in the job
- assessing the risks from the hazards
- managing the risks.

Without commitment from all senior executives of organisations such as exploration companies, safety and good occupational health in the workplace cannot be achieved. This commitment must then flow through all levels of the organisation.

The Queensland Government and the Queensland Mining Council showed their commitment to safety and health by establishing the tripartite Exploration Safety Working Group in 1995 to improve safety in the exploration industry. At its first meeting the working group adopted the following Statement of Commitment:

The Exploration Safety Working Group is committed to achieving maximum safety in the exploration industry with an ultimate goal of zero lost time incidents. The Exploration Safety Working Group will foster industry-wide awareness and cooperation in safety to develop an environment in which all participants can work safely and productively. This will be achieved by industry acceptance of safety standards and procedures as recommended in guidelines to be produced by the Exploration Safety Working Group.

The working group's commitment was demonstrated by the development of guidance notes, presentation of awareness seminars, and the publication and dissemination of safety information. The group also provides encouragement and assistance to employers and employees, if needed.

To further reinforce the safety and health ethos, exploration companies and contractors need to promote a company-wide statement from the chief executive officer. This statement should send a clear message to all employees, suppliers and contractors that safety and health are an integral part of the management of all operations of that organisation.

A safety and health policy should:

- be in writing and be signed and dated by the chief executive
- clearly state the organisation's safety and health objectives
- declare management's commitment and determination to achieve those objectives
- be clearly understandable
- be available to all employees
- be implemented at all levels
- be reviewed periodically.

Management can show its commitment to safety and health by:

- providing adequate financial and human resources to cover safety and health needs
- providing adequate training to carry out work safely
- developing and adopting safety management systems
- involving all employees in safety issues relevant to their work
- introducing safety committees and 'tool box' meetings
- empowering employees to take the necessary action to improve safety
- providing feedback to safety requests
- reviewing policies and procedures as required.

Employees will be committed to a safety and health ethos only if they believe, and are shown, that the company itself is committed. They must be able to see that improvements in safety are being made and that policies are implemented in the field.

The legal responsibilities for safety and health for exploration companies, exploration managers, contractors, contractors' managers and workers vary depending upon where in Australia the operations are carried out. Two aspects of responsibilities must always be considered:

- Compliance with the statutory law of the relevant state, for example, in Queensland the *Mining and Quarrying Safety and Health Act 1999*.
- Common law duty of care, which requires an employer to take reasonable care for the safety of people.

Statutory law results from Acts of Parliament. Common law results from precedents established by judges in courts of law.

Relevant statutory law relating to occupational health and safety in exploration work in Queensland includes the:

- *Mining and Quarrying Safety and Health Act 1999* and the Mining and Quarrying Safety and Health Regulation 2001. This law relates to safety and health in metalliferous mining and quarrying operations, and to mineral exploration other than exploration for coal, oil and gas.
- *Coal Mining Safety and Health Act 1999* and the Coal Mining Safety and Health Regulation 2001. This law relates to safety and health in the coalmining industry, including exploration for coal.
- *Petroleum Act 1923*. This law relates to the production of and exploration for oil and gas. The legislation has been completely reviewed and will be replaced by the *Petroleum and Gas Production and Safety) Act 2004*. This new Act comes into force during 2005.
- *Workplace Health and Safety Act 1995* together with its Regulations, Codes and Standards. This legislation covers all occupational health and safety matters in Queensland except where the *Mining and Quarrying Safety and Health Act 1999*, the *Coal Mining Safety and Health Act 1999* and the *Petroleum Act 1923* apply.

Other laws which may impact on safety and health for specific exploration activities include the:

- *Explosives Act 1999* (administered by the Department of Natural Resources and Mines)
- *Radiation Safety Act 1999* (administered by Queensland Health)
- *Transport Operations (Marine Safety) Act 1994* (administered by Queensland Transport)
- *Civil Aviation Act 1988* (administered by the Commonwealth Department of Transport)
- *Water Act 2000* (administered by the Department of Natural Resources and Mines).

Mining and Quarrying Safety and Health Act 1999 and Coal Mining Safety and Health Act 1999

In Queensland, exploration for minerals other than petroleum and gas is conducted under the relevant mining safety and health legislation: the *Mining and Quarrying Safety and Health Act 1999* and the *Coal Mining Safety and Health Act 1999*. These two Acts are almost identical and follow common principles. However, the Regulations for each Act are different, because of the different natures and sizes of metalliferous mines and quarries when compared with coalmines. In the definition of 'mine' and 'coalmine', the Acts include exploration activities carried out on mining tenure issued under the *Mineral Resources Act 1989*.

The Acts apply to:

- everyone who may affect the safety or health of persons at a mine
- everyone who may affect the safety or health of persons as a result of operations or coalmining activities
- any person whose safety and health may be affected while at a mine or as a result of operations or coalmining activities.

The objectives of the Acts are to:

- protect the safety and health of persons at mines and persons who may be affected by mining operations or activities
- require that the risk of injury or illness to any person resulting from mining operations or activities is at an acceptable level.

Basic principles

The principles of the Acts are that risks must be managed at an acceptable level and that all persons involved in the industries have obligations relating to safety and health. The level of obligation is dependent on, to a certain extent, the ability of the person to have an impact on safety and health. The greater the ability, the greater is the obligation.

The Acts refer to appointment of operators by the mining tenure holder and to appointment by the operator of a site senior executive. The Acts seek to achieve cooperation between operators, site senior executives and workers to meet the objects of the Acts. Cooperation includes involving workers in management of the risk.

As well as coalmines, metalliferous mines and quarries that employ 11 or more workers are required to have documented safety and health management systems.

All persons working at mines must be competent to perform their duties. Competence for a task is the demonstrated skill and knowledge required to carry out the task to a standard necessary for a person's safety and health.

Control and management of risks

The Queensland legislation requires that the level of risk of injury or illness is:

- within acceptable limits
- as low as reasonably achievable.

To decide whether risk meets the above requirements, the likelihood of injury or illness from the risk, and the severity of the risk, must be considered.

Risk is effectively managed when all persons individually and as part of the work group and organisation take action to keep the risk to an acceptable level. In particular, this means following risk management procedures and practices that are appropriate for the work being carried out.

Risk management is the systematic application of policies, procedures and practices to:

- identify, analyse and assess risk
- avoid or remove unacceptable risk
- monitor levels of risk and the adverse consequences of retained residual risk
- investigate and analyse causes of accidents and high potential incidents to prevent their recurrence
- review effectiveness of risk control measures
- take appropriate corrective and preventive action.

If there is an unacceptable level of risk to persons, they must be evacuated to a safe location and action must be taken to reduce the risk to an acceptable level.

When hazards are identified and risks analysed, the standard hierarchy of hazard controls should be adopted, as follows:

- elimination of the hazard
- substitution with a lesser hazard
- separation of persons from the hazard
- engineering controls
- administrative controls
- use of personal protective equipment (PPE).

To obtain a greater understanding of risk management, refer to the following publications:

- MDG 1010—*Risk management for the mining industry* (Department of Mineral Resources, New South Wales)
- AS/NZS 4360—*Risk management* (Standards Australia)

- *National minerals industry safety and health risk assessment guidelines* (Minerals Council of Australia)
- *Workplace health and safety risk management advisory standard* (Division of Workplace Health and Safety, Queensland).

Safety and health obligations

The Queensland legislation places clear obligations on workers and other persons at mines who may affect safety and health. These persons include:

- holders of tenements issued under the *Mineral Resources Act 1989*
- operators of mines as appointed by holders
- site senior executives (the most senior person on site)
- contractors
- designers, manufacturers, importers and suppliers of plant for use at the mine
- erectors and installers of plant
- manufacturers, importers and suppliers of substances for use at a mine
- suppliers of services.

The Acts clearly state the obligations for persons generally and for each of the above persons. Some of the obligations of workers and other persons generally are to:

- comply with the Acts and with procedures applying at the mine
- share information about risks
- take any reasonable and necessary course of action to ensure persons are not exposed to an unacceptable level of risk
- ensure, to the extent of the responsibilities and duties allocated to the worker, that the risks of injury to the worker or any other person is at an acceptable level
- comply with instructions for safety and health
- work at the mine only if in a fit condition to carry out the work without affecting their own safety and health or that of others.

Operators of mines have specific obligations to ensure that:

- there is an acceptable level of risk to workers at the mine
- they provide a safe place of work and safe plant
- they maintain plant in a safe state
- the operator's own safety and the safety of others is not affected by the way the operator works.

Appointment of operators and site senior executives

The holder of the mining tenement may appoint an operator for the mine. If an operator is not appointed, then the holder is also the operator and has all the obligations of an operator.

When appointing an operator, the mining tenement holder must give a departmental inspector of mines for the region written notice of the:

- name and address of the operator
- name of and a description of the land comprising the mine.

The operator must provide the inspector with a description of the processes to be used, the layout of operations, and information on plant and equipment at the mine (facility description) before operations start. The inspector must also be advised of the day on which operations are to start.

The operator must also appoint a site senior executive who is the most senior officer employed by the operator for the mine and who has responsibility for the mine. The site senior executive has specific responsibilities, including developing a management structure and providing for competent supervision.

Obligations of the site senior executive include:

- ensuring risks from operations are at an acceptable level
- developing a safety and health management system if 11 or more workers are employed at a mine
- training workers so that they are competent
- inspecting and monitoring the workplace.

Mine record

Under the Acts the operator must keep a mine record, which includes:

- reports, findings and recommendations resulting from inspections, audits and investigations
- directives issued under the Acts by inspectors, inspection officers and other persons allowed to issue directives
- records of remedial actions taken
- records and reports about all serious accidents and high potential incidents that have happened at the mine
- any reports and information prescribed under the regulations.

The Acts do not specify the format of the mine record. It may be kept in the form of a hard-bound book or electronically. Whatever method is used, it must:

- be kept for seven years
- be available at all reasonable times for inspection by workers
- not be destroyed, defaced or altered so that it is no longer a correct and complete record.

The Mines Inspectorate has produced a Guidance Note—*Keeping and using the mine record at mining and quarrying operations in Queensland*.

Accident and incident reporting

The Acts have specific requirements for reporting serious accidents and high potential incidents.

General requirements are for:

- immediate notification to an inspector of mines in the case of:
 - an accident causing death
 - an accident causing admission to hospital for a bodily injury endangering or likely to endanger life
 - a high potential incident of a type prescribed by regulation
- monthly reporting of all lost time accidents.

If there is a serious accident or high potential incident at a mine, the site senior executive must investigate the accident or incident and prepare a report. The report must include recommendations to prevent the accident or incident happening again.

To assist operators and site senior executives to understand and comply with reporting requirements, the Mines Inspectorate has produced guidance notes about reporting serious accidents and high potential incidents. They are:

- Guidance Note QGN 06—*Guidance to metalliferous mines and quarries in reporting serious accidents and high potential incidents to an inspector of mines and a district workers' representative*
- Guidance Note QGN 07—*Guidance to coal mines in reporting serious accidents and high potential incidents to an inspector of mines and an industry safety and health representative.*

Common law duty of care

While breaches of statutory law are criminal offences heard in a magistrate's court, common law cases are dealt with in civil courts. The most frequent cases of common law action are those for damages and compensation following a workplace injury. Under common law duty of care the employer has a duty to take reasonable care to ensure that employees are not subject to unnecessary risks.

In general the employer must provide:

- a safe place to work
- a safe system of work
- proper plant and well-maintained equipment
- adequate supervision
- adequate training and instruction.

The courts can award compensation if it is shown that the employer is negligent and has failed to adopt a reasonable standard of care. A reasonable standard of care would include compliance with statutory law, Australian standards, Worksafe Australia codes of practice, industry association standards or any other similar codes commonly known in the community.

General

Exploration companies, their managers and safety officers, and those in charge of exploration programs must make certain that all people employed on a program, including contractors, are fully aware of their responsibilities, duties and obligations. They must ensure that these people are competent and fully trained to do the work for which they are engaged.

It is not sufficient to comply with the law. There must be compliance with relevant standards and codes of practice.



section 4 CONTRACTOR RELATIONSHIPS

Exploration companies often engage contractors at an early stage in any program. It is important that the contractor/principal relationship be properly established at this time.

In Queensland, when exploration activities are carried out under the mining safety and health legislation, engagement of a contractor does not relieve the site senior executive of responsibilities for safety and health issues of the contractor's work. It is only if the contractor were appointed to be the operator for that work that responsibilities and accountabilities can be delegated. In any case, contractors retain obligations under the legislation.

Relationships between exploration companies and any contractor must consider the safety of all employees. Too often, in the past, the principals have tended to ignore any responsibility for safety of the contractor's employees and operations.

Fortunately, exploration companies are now more aware of their responsibilities under various mining safety laws and common law. They also recognise that poor performance in safety and environmental matters by their contractors reflects badly on the exploration company. More importantly, exploration companies realise that they can influence the safety performance of contractors.

Most exploration tasks that involve the use of uncommon or heavy equipment are carried out by contracted specialists. Many projects involve a single, site-specific contract, such as a series of drill holes, bulldozed trenches and tracks, or use of an excavator. Use of heavy equipment can create new hazards.

New hazards can occur when:

- exploration company employees are working around unfamiliar heavy equipment
- exploration companies fail to explain all potential hazards at the site
- the contractor is under pressure for increased production
- the contractor's employees are paid production bonuses
- different safety standards or operating practices exist between the principal and the contractor.

These potential problems can be overcome by establishing good cooperative relationships at an early stage, and by writing tender briefs which include safety issues. These could include:

- detailing the laws and safety standards under which the contract will operate
- providing copies of the principal's safety manuals and policies to the contractor
- detailing known hazards in the exploration area
- requiring the tenderer to include details of their safety policies, manuals and safety records in their tenders
- requiring the tenderer to show how compliance with the principal's standards will be achieved
- requiring details of what training will be given by contractors to their employees
- providing details of training and inductions that will be provided by the principal.

The contract itself should include clauses on:

- compliance with safety laws and standards
- compliance with the principal's and the contractor's policies, procedures and rules concerning health and safety
- cooperation in the promotion of health and safety awareness
- safety training, certificates of competency and skills training
- safety auditing of the contractor's equipment and work methods by both the principal and the contractor, and removal of defective equipment
- reporting of accidents and incidents to the principal and to the mines inspector
- conduct of employees of both the principal and the contractor
- supervision, safety representatives and first aid certificates.



section 5 INDUCTIONS AND TRAINING

Everyone involved in exploration, including employees, consultants, contractors and visitors, should undergo formal basic induction training on all relevant aspects of safe working practice before starting employment. Induction should be carried out by suitably qualified persons, and on completion should be recorded and acknowledged by the participant in writing.

Inductions should be considered in two parts:

- general induction covering common requirements for all exploration activities
- specific induction for the particular site and type of exploration being undertaken.

Refresher inductions should be conducted as required and as appropriate. A shorter induction may be more appropriate for visitors.

Everyone involved in exploration work should be trained to carry out their work in a safe and competent manner.

General basic inductions

Several subjects could be included in general inductions and in refresher inductions, depending on the work to be carried out and the location. Possible subjects follow, along with suggested topics for each.

Occupational health and safety

- Relevant company health and safety policy, and safety management systems
- Relevant standard work procedures
- Assessment of hazards in the field
- Use of all types of personal protective equipment (PPE) such as sun protection, sun and safety glasses, and safety footwear
- Safe use of hand and power tools
- Safe practices around drill rigs and heavy equipment
- Housekeeping and basic hygiene while camping
- The need to carry or have access to potable water
- Ensuring work plans and destinations are known by others
- Advising companions of allergies, afflictions, etc.
- Correct practices for manual handling of equipment
- Hazards associated with petrol, diesel fuel, liquefied petroleum gas (LPG), other flammables and chemicals
- Fire prevention, firefighting and bush fires

- Company policy on drug and alcohol usage
- General communications with companions
- Reporting safety incidents
- Emergency procedures

First aid

- Explanation of the principles of DRABC (danger, response, airways, breathing, circulation)
- Treatment of sunburn and other burns
- Treatment of snake, spider and scorpion bites
- Stemming bleeding and treating broken bones
- Dehydration and heat exhaustion
- Exposure and hypothermia
- Treatment of shock
- Contents of various first aid kits, their use and their locations

Radios and communication

- Need for regular communication between field parties and base
- Company standard operating procedures
- Search and rescue procedures
- Thorough instruction in and demonstration of the use of transceivers, installation of aerials, use of frequencies, selcall (all-purpose ground to air communications), radio telephone and Royal Flying Doctor Service (RFDS) network

Maintenance of equipment

- Coverage of mobile phone networks and the use of satellite telephones

Vehicle/driver awareness and driving techniques

- Attitudes to road safety, road rules, traffic laws and responsibility towards passengers and other road users
- Driving practices for prevailing conditions
- Driver fatigue, safe driving periods and rest intervals
- Basic vehicle spare parts
- Understanding four-wheel drive vehicles and practising relevant driving and recovery techniques
- Daily vehicle checks, maintenance and road worthiness
- Vehicle loading, carrying capacity and towing procedures

Bush sense and survival skills

- Correct use of maps, compasses, global positioning systems (GPS) units, etc.
- Planning daily work schedules and notifying others of the schedules
- Vehicle breakdowns, staying with the vehicle, parking in a clear area
- Knowledge of contents of first aid and survival kits
- Basic survival skills and preparation of a survival plan
- Awareness of weather reports

Site-specific inductions

In addition to the general induction it is essential that each person is fully aware of relevant health and safety policies, and of the work and hazards at specific exploration sites or for each exploration program. These should be discussed at initial site meetings and reviewed periodically.

Topics for site specific inductions include:

- special emergency procedures for the area being explored including specific emergency contact numbers and names, air strip locations and dimensions
- safety aspects of the particular geographical area such as climatic conditions, vegetation, plant species, isolation, access, tides, river flows, dangerous animals and insects
- safety aspects of particular exploration methods
- equipment to be used such as earthmoving equipment, drill rigs, helicopters, boats, etc.
- land use hazards and practices including electric fences and herbicides/pesticides
- potential hazards such as ground water, gas and liquids under pressure in drill holes, surface and underground excavations, toxins such as cyanide or arsenic around abandoned sites and radioactive ores
- local community contact.

Training

Training is a planned process designed to develop the necessary knowledge, skills and attitudes to achieve the desired results and ensure work is done safely. All training should be competency based and records should be maintained of all those who have completed such training.

Competency-based training involves practical assessments of theoretical and practical skills learned during the training process. Competence is the ability to perform activities within an occupation or function to the standard expected in employment.

To ensure that training is effective, a systems approach should be used which:

- identifies and analyses training needs and relevant performance standards
- sets objectives for the training and establishes a method for measuring results
- assesses the current performance level of trainees against agreed standards
- designs appropriate training to satisfy the objectives and address safety aspects of the task
- produces a training module for each task in a standard format
- evaluates results against the objectives.

The detail required for each training program will vary considerably according to the task to be undertaken but the principles remain the same. Each person must be capable of performing the task safely and productively, whether it is cutting lines with a chainsaw or drilling.

Training needs to be ongoing to ensure that performance standards are maintained.

section 6 PERSONAL CARE AND HYGIENE

Employers must provide safe systems of work and safe equipment for employees in the field. People working in the field are more likely to receive injuries or suffer illness and disease than those working in towns and cities. People involved in exploration work must also protect themselves by complying with their employer's instructions, rules, job guides and standard work procedures. They must also adopt a commonsense approach to good safety and health, and must not take undue risks which may also jeopardise the safety and health of fellow workers.

Personal care, whether it be wearing the correct clothing, avoiding sun hazards, keeping the work site clean by general good housekeeping or making sure the drinking water is pure, is essential to safety and health.

Personal protective equipment

Personal protective equipment (PPE) needs vary according to the work being done and should be assessed before going into the field. The equipment should be carefully chosen so that it is suitable for the task and guards against the specific hazard being considered. Most PPE is covered by Australian Standards and, where relevant, those standards should apply. Additional information is available from the Division of Workplace Health and Safety's Advisory Standard Risk Management 2000–Supplement No. 1–*Personal protective equipment*.

The right PPE should be chosen for the job. For instance, drillers are exposed to noise around drill rigs from diesel engines, compressors, compressed air tools, pumps, etc. Noise levels should be measured using noise meters and daily exposure levels established. By using these figures it is possible to select the correct hearing protection for the drill crew to make sure that noise levels will not affect their hearing in the long term. Seek professional advice to help you choose the correct type of hearing protection.

Safety glasses prevent eye injuries when chipping samples.

Typical protective equipment required and the relevant Australian Standard could be:

- hard hats and safety boots for use at all times around drill rigs (AS / NZS 1800, AS / NZS 2210)
- hearing protection for around drill rigs and earthmoving equipment or in helicopters (AS / NZS 1270)
- safety harnesses and belts for working up drill masts (AS / NZS 1891)
- gloves for handling sharp rocks, drill steels, etc. (AS 2161)
- safety glasses for use when chipping samples or using grinders and corrosive liquids (AS 1336, AS 1338)

- welding gloves, aprons and shields (AS 1338)
- respiratory protection against dusts (AS 1716)
- appropriate footwear for travelling on foot in the bush or in rough country
- hats, sunscreen and sunglasses to reduce damage to skin and eyes.

It is the employer's or contractor's duty to provide correct PPE and training to ensure that staff know how to use and maintain it. It is the employee's duty to use the PPE when needed.

Health and hygiene

General health, hygiene and sanitation facilities and procedures must be maintained in the field for the benefit of individuals and the field team.

Points that need consideration include:

- correct location and treatment of toilet and general waste disposal facilities
- provision of washing and showering facilities at the work site and in camps
- cleanliness with food storage, preparation and utensils
- provision of fresh drinking water
- good dietary habits
- general housekeeping around work sites and camps
- advising companions of allergies, afflictions and personal medication needs, e.g. diabetes
- reporting of injuries and illnesses
- up-to-date tetanus, Hepatitis A and Hepatitis B vaccinations
- pre-employment and regular medical checks
- mosquito repellents, nets and breeding areas; awareness of Ross River fever, etc.
- prohibition of drugs and alcohol at work sites, control of alcohol at camps; recommended action when someone is under the influence of drugs or alcohol.

Most injuries occur while people are manually handling equipment. Some of these accidents involve cuts, bruising and crush injuries when fingers and hands are caught between equipment being lifted or when various hand tools are being used. Other equally common and often more serious injuries are long-term twist, strain and sprain injuries from unsafe manual lifting procedures. These more serious injuries can be the result of years of muscular stress from frequent lifting of heavy loads or, more traumatically, from poor lifting of a single load.

People speak about the 'bad back' syndrome, but anyone who has experienced either chronic or acute back pain is aware of the suffering it can cause.



section 7 MANUAL HANDLING

Manual handling occurs in a variety of situations. It can be as simple as changing vehicle tyres, carrying rock samples, handling drill rods, etc. Consideration should be given to eliminating manual handling where possible. In all cases proper equipment should be provided to reduce the amount of lifting required. Everyone must be instructed in the correct methods of lifting and the use of different tools for each job.

Prevention of hand injuries

Cuts, bruising and crush injuries to hands and fingers can be reduced by:

- training in the correct methods for using hand tools
- using the right tools for the job
- maintaining hand tools in good clean condition
- stacking materials securely, particularly tubular materials which can roll
- providing guards on moving machinery
- using the right gloves to suit the job
- providing clean and clear work areas and storage places
- providing tools for handling rods or casing when possible
- using correct procedures and good coordination when handling drill bits, core barrels, drill rods, etc. during drilling operations
- removing burrs from rod threads.

Manual handling and lifting

Training for manual handling should include information on:

- the effects of lifting, stretching, twisting and bending on the body
- correct posture and lifting techniques
- arrangement of work and storage areas to reduce risks from manual handling
- methods of team lifting
- use of aids to improve lifting safety
- personal protective equipment.

Where possible mechanical handling devices should be used. These can include:

- small hoists on the back of utilities and tray top vehicles
- tools for moving, lifting and opening fuel drums
- sharp crowbars to act as levers
- carrying frames to assist better posture
- stands and platforms for stacking equipment
- trolleys, hand trucks and forklifts
- automatic rod handling on drill rigs.

Because of the variety of materials being manually handled during exploration activities, it is not possible to provide specific advice for individual tasks.

It is important, however, that common general principles are used to reduce the incidence of sprains, strains and general musculo-skeletal injuries from manual handling.

The following general principles should be incorporated into the design of the workplace and any plant and equipment:

- minimise the lifting and lowering forces exerted
- avoid the need for bending, twisting and reaching movements
- reduce pushing, pulling, carrying and holding.

Aspects to be considered when laying out the workplace or drill site include:

- workplace layout and general environment, including conditions underfoot
- size, surface characteristics, shape, stability and weight of objects
- vertical and horizontal movements involved
- work postures and space requirements.

For major tasks or long-term continuous jobs such as drilling, it is advisable to:

- identify the manual handling tasks likely to be a risk
- assess the risk by standard risk assessment procedures which analyse all aspects of the job
- control the risk by job redesign, use of mechanical equipment, and proper training.

Useful guidance can be obtained from the Workplace Health and Safety Division's *Advisory standard—manual tasks*.



section 8 CAMP MANAGEMENT

Occupational injuries associated with camping include all those associated with cooking in domestic dwellings, such as burns and knife cuts, and those caused by slipping/tripping. Some camp-specific injuries could be caused by flood or bush fires. Other common causes of injury arise from lifting heavy weights, poor lighting conditions, horseplay, etc. A poorly chosen site or lack of attention to hygiene can lead to illness or disease.

A camp manager should be appointed, even for a small temporary camp, to exercise control over establishment and operation of the camp. The camp manager should have the authority to exercise disciplinary action in the event of misbehaviour by anyone in the camp.

In the case of permanent or larger camps, it is advisable to make early contact with local emergency services, rural fire brigades, doctors, Royal Flying Doctor Service, etc. so that they can provide rapid response, if needed.

Safety guides

Recommended practices for a safe camp include the following:

- The camp site and layout chosen should provide acceptable standards of safety and hygiene, and minimise risks from fire or flood.
- Sites should be reasonably level, with a few shade trees but a minimum of tree stumps and fallen timber. In the best sites, you should be able to walk about the camp without watching where you put your feet.
- Camps should not be placed among trees which might shed branches. In forests the site should be in as open an area as possible, so that it will be cooled by the prevailing winds.
- Sandy to gravelly ground is preferable to clay soils, which will break up with traffic and become dusty in dry weather and muddy in rain.
- Vehicle access tracks should be downwind of the camp, to avoid dust from vehicles. It may be necessary to rope off a large camp to keep vehicles and their dust away from the camp.
- Larger camps should have a separate vehicle and fuel storage park, safe from bush fires, with at least two access roads, and downwind from the living areas.
- The site should be an easy walking distance from a water supply, and upstream from any pollutants.
- Walkways should be adequately lit.
- Camps should be sited on high ground, above flood level.

- Good hygiene is essential to good health of any field party. Consideration must be given to
 - provision of adequate water supplies. For a long-term camp have the drinking water analysed.
 - correct disposal of food scraps, cooking and showering water, and human waste. For short-term camps and only a few people, food scraps can be buried or burned, and water allowed to drain away naturally. Empty cans and bottles should be placed in a garbage bag for disposal at the nearest rubbish dump.
 - provision at large and more permanent camps of a substantial first aid kit, adequate refrigerator and freezer capacity, and a fly-screened food preparation area. Waste water should be directed by drains to a covered sullage pit. Enclosed showers with a concrete floor and hot water should be provided. The common 'donkey' water heater should have a pressure relief pipe or valve, or the drum may burst. Local council approval may be required for a permanent camp.
 - disposal of all rubbish in a deep pit and covering it with dirt, or tying-off in heavy-duty garbage bags. Bags should be taken to a rubbish dump every few days, or daily in summer. Human waste will require a permanent latrine or chemical toilets.
 - personal cleanliness (necessary to avoid illness). In addition to hot showers, there should also be handwashing facilities in cooking and latrine areas, and some facilities exclusively for washing clothing.

Liquefied petroleum gas (LPG)

Bottled gas is heavier than air, and accumulates in confined areas where it can explode if it is sparked or lighted. It is a common cause of fires, explosions and injuries at camp sites. Precautions include:

- making sure all connections are tight, and checking for gas leaks with a detergent and water solution which will bubble at a leaking connection
- storing gas bottles away from naked flames and open fires
- not keeping gas bottles for stoves or refrigerators in confined places where gas can accumulate
- making sure that gas systems in larger or permanent camp sites are installed by a licensed gas fitter
- returning or safely disposing of any damaged bottles.

Flood and bushfire hazards

Precautions against flood and bushfire hazards which should be considered when selecting a camp site include:

- building on a site that is higher than the maximum flood level, as shown by the flood debris in trees
- avoiding fire damage by making a firebreak around the camp site, fuel stores and parking areas
- placing appropriate fire extinguishers at the vehicle park, helicopter base, fuel storage depot, generator, kitchen or any area of potential fire risk.

Generators

A reliable generator and a regulated pattern of use can make for comfortable and safe camping. The ability to obtain instant electric light in an emergency may make the difference between a tragedy and a sensibly managed safety incident. Safe practice includes:

- choosing generators for bush camps carefully, and then servicing them regularly to obtain a long working life
- having 30 milliamps earth leakage protection fitted to generator power outlets, where possible
- appointing particular people in each camp to be responsible for the generator and associated electrical wiring and equipment. These people should manage the installation of all electrical equipment and keep a record of all servicing and repairs
- maintaining all wiring and equipment in good working order and having it checked by a qualified electrician at least every six months. Wiring, appliances and fuses should be chosen to suit the output of the generator
- laying out cables so that they do not pose a tripping hazard or get wet
- refuelling, inspecting and servicing the generator at least daily. The amount of fuel in the tank at sunset should be sufficient to run the generator all night
- starting the generator each morning and switching off each night at an agreed time. Under no circumstances should a generator be allowed to run dry of fuel so that it cannot be instantly restarted. If a generator is used every day, it should be completely serviced (including an oil change) once a week, preferably on the same day every week
- storing fuel in the correct manner and at a safe distance from the generator
- locating the generator so that noise levels and exhaust nuisance are as low as possible.

First aid and emergency facilities

First aid and emergency facilities required at a camp site will vary according to the hazards and risks employees may be exposed to, location of the camp relative to other facilities, and the number of people living in the camp.

Large camps in remote areas, where several drill rigs are operating, may require a well-equipped first aid room with a highly qualified first aid officer on permanent call. They may also require a permanent radio room. A working relationship should also be established with the Royal Flying Doctor Service and other emergency services.

At a small, tented camp, normal first aid kits and two-way radios carried in the vehicles may be satisfactory for emergencies. A medium-sized camp may require a first aid kit permanently in the camp.

All field employees should have at least basic first aid qualifications.



section 9 FIRST AID

Adequate first aid training and equipment are essential for reducing the impact of any injury or sudden illness. Standards of training and equipment will vary according to the injuries that may occur. Injuries occurring in the office environment are likely to be less severe than those occurring at remote exploration and drilling sites.

First aid is usually the first medical assistance given to save lives and reduce the impact of an injury before professional medical assistance is available. In remote exploration activities, the time delay between an accident and arrival of professional assistance can be many hours, or even days. This delay has a significant influence on the training and equipment required, and also on the mental preparedness of the first aider.

This *Minerals exploration safety guidance note* is not a first aid manual. Details of first aid practices are available in numerous manuals and training programs conducted by the Red Cross, St John Ambulance, Queensland Ambulance Service and the Royal Flying Doctor Service.

Important first aid points to consider for exploration work include the following:

- All field staff, including contractors' staff, should hold at least a basic first aid certificate and receive basic refresher training each field season.
- All field parties should have at least one person with a senior first aid certificate or higher qualification.
- As the size, remoteness or hazards of the exploration work increase, the higher the first aid qualifications required. In a large remote camp, a paramedic may also be required.
- Full use should be made of remote area first aid training provided by the Queensland Ambulance Service and the Royal Flying Doctor Service.

First aid kit requirements will also vary depending upon locations and hazards. In general consider:

- providing appropriate first aid kits in all vehicles
- providing a substantial first aid kit with each field party
- not allowing any person without immediate access to a first aid kit into the field
- providing a well-equipped first aid room in a major camp in a remote location.

Each exploration group is responsible for developing and maintaining standard operating procedures for routine communications and for emergencies. The choice of communication method, equipment and schedules should be determined after considering the isolation, terrain, means of transportation and other pertinent risks. Effective and regular communications are important for morale, safety, and the quality and productivity of work.



The term 'communications' includes all aspects of field communications between field parties (both on foot and in vehicles), base camps, fly in-fly out camps and the office. It also includes check-in systems when work is conducted out of hotels and motels; and procedures for emergency situations.

Check your communication systems before going bush

Equipment

Select equipment appropriate to the terrain, transmission distance and atmospheric conditions under which operations are expected. This may include HF, UHF and VHF radios, satellite phones, mobile phones, etc. Satellite phones, whether fixed, portable or vehicle mounted, are used extensively and provide considerably improved communications.

Whatever the system used, all or most of the following apply:

- Before each field trip, check that all equipment is working properly.
- Ensure that all personnel are fully trained in maintenance and operation of all equipment in use.
- Store and protect clear instructions for radio use, emergency procedures and frequencies in vehicle glove boxes and other visible locations near radios.
- Make sure frequencies appropriate to the work area are available and that personnel are aware which frequencies provide weather and emergency information.
- Make certain all radio aerials are suitable for frequencies to be used.
- Always stow whip aerials correctly.
- Carry and know how to rig an emergency aerial and how to replace a broken one.

- When setting up a new camp, set up the radio immediately and ensure that it works before any support party departs.
- Make certain that battery chargers and enough fully charged batteries are available.
- Before leaving on a traverse each day, check that communication equipment works properly.
- When air support is used, make sure that equipment (walkie-talkies, smoke flares or a signal mirror) is carried to signal a helicopter or plane from the ground.

Standard operating procedures to minimise risk

Observing the following principles and procedures will help minimise risk:

- Regular communication schedules and routine reporting procedures are essential to a safe and efficiently run field program.
- A central or common base should be maintained for receiving and recording communications by the most appropriate means available.
- Communications should be maintained according to a predetermined regular schedule, which should be adhered to at all times. Ideally, this should be twice daily.
- Base personnel must ensure that each member of a field party is accounted for during the radio schedule.
- The highest priority in any standard operating procedure is careful prior planning and preparation for the work proposed. These details (such as map coordinates, daily work plans, contact phone numbers, local station contacts, estimated times of arrivals, etc.) should be documented at the communications base.
- In addition to a written log book recording daily work plans and communications, a whiteboard can be kept at the base to display a brief daily summary of personnel, vehicle and aircraft movements so that overall activities and location of people can be seen at a glance.
- A nominated person must be responsible for receiving and recording information.
- A fax or answering machine should be available for messages, should the base be temporarily unattended.
- If work is conducted out of a motel or hotel, and communications are not to be maintained with the office or base, information outlining the plans for the day and an estimated time of return should be left at the reception desk. A similar situation can apply when working out of a village or pastoral station, where police or the property manager should be advised.
- If an individual or a party is overdue by a predetermined (say, two hour) period, a local search should start. Base must be notified of this search in advance. Radio contact should be maintained for the duration of the search.
- Search parties must comprise at least two people.

- A search must be restricted to existing tracks and roads, if it is near dusk.
- Local searches should be coordinated by one person.
- All important information and facts should be compiled in anticipation of a potential emergency.

If a local search is unsuccessful, an emergency should be declared and base personnel should notify the police. The police will then be responsible for coordinating any further search.

Emergency operating procedures

Once an emergency has been declared, these emergency operating procedures should be followed:

- Emergency search and rescue operations should be coordinated by the police.
- Following the declaration of an emergency, appropriate management contacts should be notified.
- Important information on the missing party or emergency situation should be collated. This should include
 - names of people involved and relevant personal details
 - map coordinates of the work area or site, and details of the terrain
 - equipment and provisions available
 - registration, colour and type of vehicle
 - details of any other personnel in the area
 - weather conditions
 - list of nearby landowners and contacts
 - details of nearby airstrips.
- Nearby personnel should be notified that there is an emergency.
- If the emergency is current overnight, an aircraft can be chartered to try to locate a beacon fire for ground reference.
- An emergency plan should have a trial run to ensure that it works efficiently and effectively.
- Additional emergency procedures should be established to cover situations which may occur in large camps or bases. For example
 - accident and injury—appropriate medical facilities should be available
 - fire and explosion—fire muster and evacuation plans should be in place
 - flood and cyclone—a shelter and evacuation plan should be in place.

Every emergency procedure must be practised regularly to ensure that it is current and is understood by all people involved.



section 11 BUSH SENSE AND SURVIVAL

Travel and work in remote hostile locations requires careful planning and preparation to reduce the threat to safety. Circumstances and events which are commonplace in well-populated regions can become life-threatening in the bush and desert. No one should be employed in such locations without proper training and equipment.

It is unacceptable to expect an employee to work alone in a remote area, dense bush or deserts. People should traverse these areas at least in pairs. Before allowing an employee to work alone in the field—and this is not encouraged—any hazards and potential hazards should be thoroughly assessed before a decision is made.

Previous sections of this guidance note have covered many of the planning issues for work in the bush. These include:

- **Section 5, Inductions and training.** Good induction courses will include basic issues related to first aid, communications, driving techniques, bush sense and survival.
- **Section 6, Personal care and hygiene.** Issues related to health and hygiene are extremely relevant to work in remote areas.
- **Section 8, Camp management.** Adoption of relevant points will improve comfort and safety in remote camps.
- **Section 9, First aid.** First aid training and equipment relevant to the work and location are required.
- **Section 10, Communications and emergency procedures.** Compliance with this section will reduce the possibilities of becoming isolated from the field party and ensure that communications with emergency assistance are maintained.
- **Section 14, Vehicles and travelling.** Correct choice, preparation and equipping of vehicles for use in remote areas, together with good driving techniques and maintenance, will reduce the chances of being stranded or an incident arising.

Preparation and planning

Essentials to be considered when planning a field trip include:

- prior training for outback work and in survival skills
- selecting the vehicle carefully so that it is suitable for all expected road, terrain and weather conditions
- planning the route carefully to ensure prior knowledge of conditions, food and water sources, emergency services and local inhabitants
- obtaining any necessary maps, aerial photos, etc. and studying them in detail before leaving
- preparing and equipping the vehicle with necessary tools, spares, recovery equipment, winches, dual batteries, fuel, fire extinguishers, etc.

- knowing how to use a compass, maps, global positioning system (GPS), radios, signalling devices and emergency position indicating radio beacons (EPIRBs)
- making sure radio communications work and are adequate for the area to be travelled
- considering timetable, schedule, camping spots, and allowing safety margins
- establishing reporting schedules with base and police, if necessary
- packing emergency food, water, clothing and survival kits
- loading vehicle correctly
- knowing, and periodically checking, contents of first aid and survival kits.

Proper attention to these points will ensure that, even in an emergency, the least amount of time is spent in a survival situation.



Survival

The chances of being lost or stranded and experiencing a life-threatening situation are low if proper planning has been carried out. However, field crews do become stranded for various reasons, such as vehicle breakdown, becoming bogged in sand, or flooding.

The first rule of survival is 'don't panic'. The best way of avoiding panic is to be prepared and trained to overcome the hazards that may be encountered. Training will help in development of a positive mental attitude. Water, shelter, warmth and food will always be required, but the priorities may vary.

Basic training for survival and how to prepare a survival plan includes:

- making sure a survival kit is always available
- assessing the situation and determining a course of action
- being aware of water requirements, fluid loss, minimum daily requirements, and water collection and purification methods
- finding shelter from extremes of temperature, and how to build shelters from natural materials; how to light fires
- finding natural food sources if needed, but food is not essential
- staying with the vehicle or aircraft and using vehicle or aircraft parts in a 'stranded' situation to build shelter, etc.

Let people know your itinerary before venturing out on foot

- not sending someone, particularly alone, to find help
- training in radio communications and emergency signalling, using mirrors, fires, flares, ground to air codes, etc.
- direction finding, navigation, map reading and use of global positioning systems (GPS)
- surviving in bush fires and floods.

Survival kits, including water, should always be carried when leaving a vehicle or aircraft, even for short periods.

Survival kits should include:

- survival instruction booklet protected from the elements
- water bottle, water and water purifying tablets
- knife, cord, matches, signalling mirror, compass
- plastic bags, tape, rescue blanket, aluminium foil
- high energy foods
- first aid kit, pencil and paper.

All field crew members should be encouraged to use and carry personal survival kits, particularly if a person has individual medication needs. In remote locations, personal survival kits and EPIRBs are essential.

Many ore bodies are either extensions of known mine ore bodies or are close to old mine workings. Underground exploration, often by entering abandoned workings, may be needed in both situations. Entry into old mines presents unusual and severe hazards, which must be thoroughly assessed before attempting to go underground. Entry should be strongly discouraged because of the dangers. Inexperienced people should not take risks just because they want to have 'a quick look around underground'.

Extensive preparation and planning is needed before considering entering old mines. This may include:

- discussions with previous owners or employees to determine the extent and condition of the workings
- visits to the Department Natural Resources and Mines to obtain old plans or reports, and seek advice from experts including inspectors of mines
- careful study of the surface for indications of old shafts, stopes and underground collapses (this should be carried out even when exploring only on the surface of old mines)
- employment of competent experienced underground miners.

Please note that you should not try to enter old shafts, either vertical or inclined, until they have been examined and made safe by a competent experienced shaft worker.

If preliminary underground exploration cannot be avoided, great caution must be exercised before and during entry. Hazards may be encountered from the nature of the rock and the mining methods, and from the hidden dangers of poor ventilation. Under no circumstances should anyone venture underground alone. Physical dangers may include:

- unsupported bad ground which may collapse at any time
- ground support which has deteriorated but appears sound, giving a false sense of security
- rotten timbers in shafts which will break under any load or weight



*An accident
waiting to
happen?*

- rotten timber supports which may allow rock falls, if disturbed
- corroded steel supports and steel rungs of old ladders
- open passes in drives which may not be safely covered
- hung-up ore passes or shrinkage stopes
- deep water and flooded workings
- unknown dangers both above and underfoot
- poisonous snakes and spiders
- diseases from bats, bat droppings and mould.

Hidden dangers in the underground atmosphere caused by poor ventilation may include:

- oxygen deficiency caused by oxidation of ores or timbers. Pockets of oxygen-deficient atmosphere can exist in any mine and could cause the sudden collapse of an unwary person
- excess carbon dioxide, also caused by oxidation of carbonaceous matter and frequently associated with oxygen deficiency
- hydrogen sulphide, sulphur dioxide and other poisonous gases
- flammable gases such as methane
- alterations to underground ventilation from pressure and temperature changes during the day, and with seasonal changes.

Field crews going underground should be equipped with:

- hard hats, lamps (and spares), scaling bars, spray paint (for marking unsafe ground, route taken, etc.), tape, and safety lines
- oxygen detector, flammable and toxic gas detectors, and possibly oxygen self-rescuers
- any available relevant plans.

Important points to consider when going underground are as follows:

- Undertake initial investigations. Examine ground conditions, ventilation and presence of water, and advance when safe to do so.
- Always check back to the entrance at frequent intervals to get your bearings.
- Always make sure that at least two crew members stay on the surface with suitable communications equipment to raise the alarm, should the party not return within a specified time.
- Under no circumstances should any person continue exploration near areas found to have inadequate air or toxic gases.
- Old shafts, adits or other workings which may pose a hazard to field crews or contractors working in the area should be fenced or roped off.

Employers are responsible for making sure all employees are properly instructed so they can perform their work safely. Everyone must have knowledge of and understanding of the work they do. The knowledge and understanding can come from formal and informal training, and from experience gained from:

- operating and maintenance manuals
- design specifications of equipment
- personal instruction
- hands-on competency-based training.

Employee and contractor training should be acknowledged by the trainee and recorded in a training register.

For many high risk activities, manuals, plans and formal training are not always available. In such cases documented Standard Work Instructions (SWIs) may need to be established. (Alternative names for SWIs are Safe Operating Procedures and Standard Operating Procedures, etc.) An SWI is a documented step-by-step procedure for doing a job correctly and safely.

SWIs should be developed for any jobs which may be considered hazardous, have potential to cause serious injury or frequently cause injury. Such jobs could include:

- changing tyres or wheels on vehicles, particularly wheels with split rims
- using chain saws for clearing or felling trees
- erecting and dismantling drill rigs
- changing bits/hammers/rods, particularly on large drill rigs
- using radioactive sources or hydrofluoric acid.

SWIs must be developed jointly by people who know the job and those who perform the job and, if necessary, by formal risk assessment.

The SWIs must be:

- carefully planned so that all hazards and risks are covered
- well and clearly documented
- properly understood by those performing the task
- readily available on the job site
- properly implemented
- reviewed periodically and amended as necessary.

The following steps are a guide to developing SWIs:

- define the work to be covered by the SWI
- identify work hazards and assess risks from those hazards
- identify means of controlling the hazards and eliminating risk
- determine the sequence of events and procedures to be followed
- identify special tools or aids that may be required
- evaluate personal protective equipment needs
- test the SWI and, if necessary review it before introduction to employees.

When the SWI is to be introduced, all relevant employees must be trained so that they can do the job competently in accordance with the SWI.

Actual work practices must be periodically audited to check that they are in accordance with the established SWI. Many accidents happen when standard procedures are ignored.

Hazards and guides

Motor vehicle accidents cause many exploration fatalities and vehicle travel produces numerous other injuries.

The most severe and obvious vehicle accidents are overturning and head-on collisions. Both occur because of some combination of poor training, driver inattention, poor visibility, excessive speed, rough roads and poor vehicle maintenance.

Severe injuries also occur from vibration or poor seating causing long-term back injuries, particularly when driving extensively over rough roads or striking holes or rocks. Other and often less severe injuries involve stationary vehicles, and arise during jacking, winching or loading operations, with some injuries arising from trailer hitching or unloading.

High vehicles such as drill rigs need to be operated with caution near power lines and electrified rail crossings. Many rural power lines on private land do not display warning signs before road crossings.

Each company should establish its own guides for safe operation of vehicles. All employees should be properly trained to drive the vehicles that they are expected to drive, and in the driving conditions they are likely to encounter. This applies to standard, off-highway and heavy vehicles. A maintenance routine at least equivalent to manufacturer's standards should be developed for each vehicle.

The following points are suggested for inclusion in vehicle and travelling safety guides:

- Vehicles should be driven only by those with a valid licence for that type of vehicle.
- All employees should pass a standard training program before being permitted to drive four-wheel drive vehicles either on or off road. Periodic refresher courses should be held as required and for driver rehabilitation after an accident.
- Vehicles should always be driven sensibly, with consideration to the comfort and safety of others.
- Drivers must obey all traffic regulations and specific company rules.



Drive according to road conditions, or serious accidents can result

- Alcohol or drugs must not be used before or during driving.
- All occupants must wear properly fastened seatbelts while a vehicle is moving. Passengers must be properly seated within the cabin of the vehicle. No one should be riding on the back of a utility.
- Vehicles must be loaded safely; overloading is prohibited.
- 'Walkman' type tape or CD players, hand-held mobile phones or radios should not be used while driving.
- Tyres should be inspected for stakes and other weaknesses, which may cause a blow-out at high speed, after each episode of off-road driving. Special and lower than standard speed limits may apply to vehicles fitted with off-road tyres.
- The mechanical condition of each vehicle should be checked by a responsible person daily and weekly in accordance with a specific check list, and faults recorded.
- All employees should be instructed in and practise tasks such as jacking, puncture repairs (particularly with split rim wheels) and winching in accordance with standard work procedures.

Safety precautions

The following are some standard precautions that should be taken by all drivers and included in the training program:

- Drive at a speed to suit prevailing conditions and that will allow the vehicle to be stopped safely. The poor visibility/high speed/rough road combination of hazards must be avoided.
- Proceed slowly through dust clouds, and be ready to avoid cattle or other animals and vehicles which may suddenly appear.
- Do not attempt to pass a vehicle in a cloud of dust. A vehicle is easier to see in areas of poor visibility (dust, smoke, fog, rain, twilight) if headlights are on.
- Plan long distance travel by road carefully; try to avoid travel at night.
- Rest frequently on a long trip to avoid travel fatigue; include a 'driver reviver' stop at least every two hours.
- Do not travel closer to the vehicle ahead than the driver's reaction time, braking distance and prevailing conditions allow.
- Get out of the vehicle and inspect any gully, creek crossing or rocky area that looks dangerous or difficult to cross.
- Take extra care when entering built-up areas after long periods of travel at high speed because speed is difficult to judge.

Vehicle accidents

The following procedures are recommended for any person involved in a motor vehicle accident, or any person who wishes to help at an accident:

- Make the scene of the accident safe so that no more injuries occur.
- See who is injured and assist them as best you can.
- Call for help on your mobile radio or phone or, if that is not possible, send for help.
- Advise the police of any accident in which a person is injured.
- Collect information such as names and addresses of injured persons and witnesses, time, date and location, description of accident.

Mechanical breakdowns

Mechanical problems can be minimised by sensible driving habits, frequent inspections and regular maintenance. A breakdown on a field trip can compromise safety. Thorough checks of steering and braking systems are recommended after each field trip, with the vehicle on a hoist or ramp. Any faults should be recorded and repaired, preferably by a qualified mechanic, as soon as they are recognised.

Points for recommended practice include the the following:

- Establish daily and weekly mechanical and equipment check lists, which must be carried out by the person in charge of the vehicle. Items in the daily check list include
 - tyres for pressure and condition
 - radiator, engine oil, steering, brake and clutch fluid levels
 - checks for leaks of any fluids
 - lights, batteries and electrical connections
 - satellite phones, two-way radio and emergency equipment
 - air cleaners, radiator fins
 - underbody.
- Items in the weekly check list should include
 - tyres, wheels, wheel nuts, etc. including spares
 - all tools, breakdown and emergency equipment
 - brakes, clutch, steering, fan/alternator belts, etc.

- Ensure that all necessary spare parts, such as extra spare wheel, fuses, globes, hoses, oil, coolant and belts are available when travelling off-road or long distances.
- Change mechanical and electrical systems only if qualified to do so.
- Check the underside of the vehicle during and at the end of each period of bush driving. When the vehicle arrives at the first stretch of graded road, remove any grass, sticks or other items stuck in tyres or wheels, and check for damage.

Vehicle equipment

When travelling long distances or off-highway it is important that the vehicle is equipped to cope with emergencies. Emergencies could arise from accidents, breakdowns, being trapped by floods or fires, or becoming bogged in mud or sand. In extreme conditions these emergencies could be life-threatening. A list of all standard safety and emergency equipment to be carried on board should be fitted to each field vehicle.

Recommended equipment, depending upon the intended trip, includes:

- essential vehicle spare parts
- jacks, chocks, fire extinguisher, tools to suit the vehicle
- satellite phones, two-way radios with agreed contact schedules
- dual batteries, long-range fuel tanks or spare fuel suitably stored
- jumper leads of adequate capacity
- winches, shovels, picks, axes, ropes and other recovery equipment
- emergency signalling equipment, survival kits, first aid kits
- adequate supplies of food, water and fuel
- current edition maps or air photos
- spare ignition keys.

Safe work cannot be done without the correct tools and equipment, maintained in good operating condition. Incorrect selection of a hand tool can create as great a hazard as incorrect selection of drill rigs or heavy equipment. Additional risks are created when hand tools or heavy equipment are poorly maintained or of poor quality.

Correct selection of tools and equipment requires detailed knowledge of the task to be done. Planning is essential.

Before embarking on a field trip, do an inventory of all necessary tools and their condition. With good planning, weight and space can be saved.

Hand tools

Hand tools are made to do a particular job and, if correctly used and maintained, to do that job safely.

Points to be considered for safe use of hand tools include the following:

- Select the correct tool and size of tool for the job. Too large a tool can cause damage to other equipment; too small a tool can cause overexertion.
- Inspect tools regularly for signs of damage or wear. Hammers with loose heads or damaged handles, bent spanners or crowbars, etc. should be repaired or replaced.
- Keep cutting tools such as axes, saws and chisels sharp. Blunt tools are difficult to control. Cutting tools must be stored properly to prevent damage and injury.
- Carefully check wooden handles for splits and splinters, and keep them smooth.
- Keep tools clean and lubricated.
- Use spanners in preference to wrenches.
- Establish a good footing and balance. Keep fingers away from where they can get crushed.
- Watch out for other people working nearby.
- Lock tools away when not in use.
- Properly label any lifting gear, which must be inspected and maintained and the details registered.



Use correct safety equipment when using power tools

Power tools and welding equipment

Electric, pneumatic and fuel-powered tools have particular hazards and must be handled with care. Hazards can arise from the power source or the connections as well as from the tools themselves. Power tools must only be used by people who have received appropriate training. Standard work procedures should be established for use of tools such as grinders, core saws, circular saws, chainsaws, brushcutters, oxy-acetylene welders and torches, and electric welders.

Points to be considered include the following:

- Shut down fuel-powered tools when refuelling. Keep naked lights and ignition sources away from the fuel and refuelling area.
- Make sure electrical tools are fitted with suitable earth protection and fuses. Check cables and connections frequently, and make sure leads are tagged with the appropriate inspection dates.
- Pneumatic tools must have a suitable check valve at the manifold outlet. All hoses must have suitable clips or fittings at the connections to prevent the hose from flailing should the connection fail.
- Inspect tools daily for correct operation. If defective, place an out-of-service tag on the tool, withdraw it from service and have it repaired or replaced.
- Take care when laying out cables and hoses to protect them from damage and prevent tripping hazards.
- Do not leave tools where they can fall or be pulled down.
- Keep guards securely in place at all times.
- Use correct and suitable personal protective equipment, particularly eye protection.
- Do not use electrical tools in rain, wet conditions or near flammable liquids and gases.
- Maintain tools in accordance with manufacturer's specifications; have them serviced regularly by qualified service agents.
- Where pneumatic tools of any type are to be used, operators must be well trained and be aware of specific hazards of compressors, compressed air and use of compressed air.
- Maintain and store welding gear, including nozzles, hoses and gas bottles, in accordance with the relevant standards.

Cutting light vehicle tracks and gridlines

The route of vehicle tracks should be chosen carefully, especially in rough or hilly terrain. It is best to traverse the route on foot initially, irrespective of whether the track will be cut by hand, bulldozer, excavator or grader.

When cutting tracks and grid lines by hand:

- maintain all hand tools such as picks, axes and chainsaws in good condition
- use only trained chainsaw operators
- wear appropriate personal protective equipment such as safety footwear, gloves, glasses and ear plugs
- cut protruding stumps flush with the ground. Stumps can cause trips, falls and cuts to those on foot, and can damage vehicle tyres and suspensions
- ensure that large trees are felled only by experienced people.

When cutting tracks and grid lines with earthmoving equipment:

- use only experienced operators with well-maintained equipment
- discuss gradients, slopes and means of working on steep or difficult terrain with the operators before starting work
- keep light vehicles and people on foot well clear of mobile equipment.

Trenches, costeans and pits

Narrow trenches, costeans and pits always present hazards to those sampling the sides or working in the bottom of the excavation. Many people have been buried and died in trenches that have collapsed on top of them.

In general:

- develop standard work procedures for excavating and working in trenches, costeans and pits
- keep clear of bulldozers or excavators while they are operating
- cut back sides of the excavation to a 45° batter or shore them up with suitable supports
- avoid deep narrow trenches
- check sides and excavation surrounds for slips, faults and planes of weakness which can cause collapse, particularly in wet weather
- do not allow people to work alone in a trench or pit
- protect edges of excavations where necessary, so that no one can fall in
- do not use excavator buckets for working platforms
- leave excavations in a safe and stable condition on completion of work.



Working around mobile earthmoving equipment

Only properly licensed and trained personnel should operate earthmoving equipment. Operators of heavy equipment usually have restricted visibility and it is essential that those on foot or in light vehicles remain vigilant and keep clear. Operators must be made aware of their presence and movements.

A formal communications system should be established between the machinery operator and those on foot or in light vehicles.

Use mobile equipment designed for the job

Heavy and earthmoving equipment

Heavy equipment such as bulldozers, excavators and drill rigs are seldom owned by exploration companies but are hired as needed from contractors. The explorer must provide the contractor with full details of the work to be done so that the correct equipment can be hired.

The following points should be considered when employing contractors:

- The equipment must be capable of carrying out the work required and the task must be within the design capacity of the equipment.
- Plant maintenance should be in accordance with the manufacturer's specifications.
- Operators must be fully trained and competent.
- Special instructions may be required for the safety of exploration staff working close to heavy equipment being used by contractors.
- Contractors must provide evidence that their employees have received all appropriate training and are competent.

Refer to Section 4, Contractor relationships, in this guidance note.

Explosives

Explosives must be used and handled only by qualified, experienced and competent people. Other people must leave them alone.

In Queensland the *Explosives Act 1999* covers the manufacture, purchase, transport, storage and use of explosives. Anyone involved in shotfiring during exploration activities must have a licence issued under the *Explosives Act*.

The main requirements are as follows:

- Explosives may be bought only from a licensed dealer by a licensed or authorised person.
- Vehicles used for transporting explosives must comply with standards laid down by the law, and the *Australian Code for Transport of Explosives by Road and Rail*. Correct signage must be carried on the vehicle.
- A licence for carriage of explosives is required, and drivers must be competent.
- Ten kilograms or more of explosives must be stored in licensed magazines.
- A licensed shotfirer must be in control and personally supervise all charging up and blasting operations.
- Only licensed shotfirers may initiate blasts.
- Storage and use of explosives must comply with Australian Standards AS 2187.

A permit to fire shots may be required from the local shire council, particularly if blasting near townships.

Dangerous and hazardous goods, flammable materials

Dangerous goods, flammable liquids and flammable gases are always present on exploration sites, camps and drill sites. Well-established safety precautions must be taken when these substances are stored and used. Often standard work procedures will need to be established.

Typical substances which must be stored and used in accordance with relevant standards and codes include:

- oxygen, acetylene and liquid petroleum gas (LPG)
 - store LPG in accordance with Australian Standard AS 1596
The storage and handling of LP gas
 - separate oxygen cylinders from all flammable materials and gases
 - keep cylinders upright and held in position
 - store cylinders away from heat sources and clear of dry grass, bushes, etc.
 - keep firefighting equipment readily available

- petrol and other flammable liquids
 - store flammable liquids in accordance with Australian Standard AS 1940 *The storage and handling of flammable and combustible liquids*
 - consider bunds for bulk storage of flammable liquids to prevent spillage escaping
 - pay special attention to storage of aircraft fuels
 - use proper containers for storage and transport
 - do not transport petrol and other flammable liquids inside vehicles
 - store petrol and other flammable liquids away from heat sources and clear of dry grass, bushes, etc.
 - keep firefighting equipment readily available
- toxic drilling additives
 - avoid using toxic additives where possible
 - use correct personal protective equipment
 - store chemicals such as caustic soda, soda ash and lime away from the workplace and keep them dry
 - make sure Material Safety Data Sheets and correct personal protective equipment are available
- hydrofluoric acid
 - avoid, if possible, having this substance on an exploration site
 - use it only in analytical laboratories, unless no other alternative is available
 - ensure that it is transported, stored and used only by fully trained people
 - make sure correct first aid treatment is available at all times
 - comply with Worksafe Australia's *Code of practice for hydrofluoric acid*
 - establish standard work procedures that incorporate emergency procedures
- other reagents, acids, alkalis, etc.
 - clearly label all reagents and make sure they are properly and securely stored
 - establish standard work procedures and train operators in correct usage
 - make sure Material Safety Data Sheets and correct personal protective equipment are available

- radioactive probes
 - obtain a licence from the Radiation Health section of the Department of Health in accordance with the *Radiation Safety Act 1999* before use
 - appoint a radiation safety officer
 - establish standard work procedures incorporating emergency procedures
 - ensure activities comply with the Australian Radiation Protection and Nuclear Safety Agency's (ARPANSA) *Code of practice for the safe use of sealed radioactive sources in borehole logging*
 - ensure transport complies with the ARPANSA document *Code of practice for the safe transport of radioactive substances*.

Where no Australian Standard applies, refer to either Worksafe Australia's *Code of practice for the control of workplace hazardous substances* or to the Queensland Division of Workplace Health and Safety's *Advisory standard hazardous substances*.



section 18 FIXED WING AIRCRAFT

All aviation operations in Australia are controlled by the Civil Aviation Safety Authority (CASA), under the *Commonwealth Civil Aviation Act 1988* and Regulations.

Fixed wing aircraft vary from the larger commercial jets to the small engine aeroplane. This guidance note relates to the use of the smaller aircraft for charter operations.

Selection of contractors and aircraft

When selecting contractors and types of aircraft to be used, consider:

- what will the aircraft be used for, e.g. ferrying staff to and from site, transporting equipment, undertaking aeromagnetic surveys, etc.
- seating capacity, average and maximum loads to be carried, range required
- contractor and pilot experience, reliability and record
- liaison between contractor and exploration company so that each other's needs are fully understood
- maintenance, servicing and fuelling arrangements
- aircraft landing requirements
- adequacy of public liability insurance.

Companies should conduct their own review or audit covering safety procedures, training, pilot experience, maintenance, and public liability insurance of charter operators. This review or audit should be carried out by independent external consultants who are recognised within the industry.

Control of aircraft operations

The pilot is in command of operations affecting the aircraft, but total cooperation is needed from all those using it. Important issues to be remembered include:

- **The pilot is the sole arbiter of safety.** There should be no harassment, coercion or encouragement to act against the pilot's judgment.
- It is essential to comply with pilot briefings of passengers concerning in-flight procedures, including emergencies, embarking/disembarking and general safety.
- The pilot is responsible for the loading of any cargo in the aircraft, including overall weight, position of items (balance), and the correct loading and packaging of both general and hazardous cargoes.
- The pilot's decision is final, but should conform with CASA regulations.
- The pilot is to be briefed about passenger numbers, loads to be moved, and destination.

- The company should appoint a competent experienced person to be in charge of ground operations on remote airstrips.
- The pilot, by law, must be notified of the carriage of any dangerous goods (hazardous cargo). Refer to the International Air Transport Association publication, *Dangerous goods regulations*.

Airstrips

Airstrips should conform to CASA's *Civil Aviation Advisory Publication No. 92-1(1) Guidelines for aeroplane landing areas*.

General requirements for airstrips include:

- being constructed, so that they are closed by only the heaviest rains
- daily inspection before any aircraft movements
- periodic maintenance
- inspection of regular use airstrips by external consultants during safety audits.

Audits should consider

- layout, design and fencing
- maintenance, usage levels and wet season access
- radio frequencies, survey diagrams and incident reports
- inspection of infrequently used airstrips by vehicle or on foot before use
- low level flyover of unattended airstrips to check obstructions and startle animals into movement
- formal surveys with a summary location diagram to CAA standards kept at
 - exploration company head office and appropriate campsites
 - air charter operators' offices and in aircraft used regularly
 - Royal Flying Doctor Service operations base.

Night-time operations

Night-flying operations should not be undertaken in remote areas. The significant exception is for an emergency medical evacuation by Royal Flying Doctor Service (RFDS) or aerial ambulance personnel.

Night-time operations by the RFDS or aerial ambulance are only possible on airstrips registered with the RFDS or aerial ambulance as having suitable facilities. The pilot and aircraft should have suitable rating and instrumentation.

Safety procedures

Light aircraft should be boarded some distance from the main passenger terminal, and always from ground level because of the danger of the propeller blades. A fixed wing aircraft which has its engines running should not be approached until the blades stop turning. The pilot will direct passengers to the parts of the aircraft that they are allowed to approach.

Pre-flight briefing and operations plan

Before each flight there should be a two-way briefing between the charter operator (usually the pilot) and the company person responsible for organising the flight. This meeting clarifies the roles and procedures of each person on the flight, the flight plan (destination and distance), confirmation of aircraft and fuel status, search and rescue frequency and location, and the communications frequencies to be used. Anyone with a potentially active role in procedures should be present at the meeting.

Flight plan and passenger list

The pilot should fill in a passenger manifest and leave this with the contract company or company base. For non-routine flights and flights exceeding one hour, way points will be agreed and acknowledged by the company spokesperson. All company charter flights should use GPS navigation aids.

The flight plan for ferry operations can be simply stated. However, the size and location of the area in which aircraft will be operating during reconnaissance operations should be stated concisely. This may be by centre point in Australian Map Grids, latitudes and longitudes and radius, or by specifying corner coordinates of the block to be covered.

The flight plan and a record of the passenger list should be left with the base ground party, on the day board. Estimated time of arrival should be communicated to the flight destination.

A company radio base with a telephone can provide a backup to the search and rescue (SAR) watch facility where communications with CASA may be unreliable (due to poor or doubtful radio reception). The company radio frequency to be used should be made known to all relevant people and a full-time radio operator should be available.

Every flight should complete this notification and be acknowledged by the relevant authority/company base, or else the mission should be abandoned.

The agreed company flight plan should not be changed unless the written records are amended **before** the flight plan is changed, even if it means an unscheduled return. To do so greatly increases the safety risk. Lodging larger than necessary location areas to gain increased perceived freedom of action is most inadvisable.

Pre-flight passenger briefing

The pilot in command should provide passengers who may not have been at the pre-flight planning meeting with the following safety briefing before every take-off:

- entering, exiting or moving around the aircraft
- operating doors and emergency exits
- locating and operating aircraft radios
- locating and using fire extinguishers
- locating first aid and survival kits (water)
- locating and operating emergency locator beacon
- destination and flight path, any way-points, anticipated flight duration and, during the flight, any unscheduled deviations
- search and rescue watch notification and procedures.

For flights over water, the following should be noted:

- wearing and using life jackets
- locating and operating life rafts
- ditching and leaving the aircraft
- locating and operating the marine/water type emergency locator beacon.

While this may be tedious for experienced people, the procedure protects less experienced personnel and is a check list for everyone.

Passengers should:

- wear seatbelts at all times during flight
- keep seatbelts fastened until the pilot tells them to leave the aircraft
- not smoke during take-off, in flight or landing
- not smoke within 15 metres of the aircraft during re-fuelling operations
- not extend part of the body out of the aircraft (e.g. waving from windows)
- not talk to the pilot during take-off, climb, descent, landing or in bad weather.

In-flight communications and acknowledgments

During the flight, communication should include:

- radio checks from ground base to aircraft
- confirmation of deviation from way points with company representative
- notification to the pilot by all people on the aircraft of any potential complications or hazards associated with approach/landing manoeuvres.

Flight debriefing

On completion of a flight a debriefing should be held between the pilot, passengers and company representative to discuss any safety issues or concerns that may have arisen during the flight. If any concerns raised indicate that any aspect of the flight was at risk, a formal incidents report should be made.

Aircraft operations record book

A durable fastbound book giving details of incoming flight times, passengers and nature of any freight should be kept at each remote site. Details of statistics, incidents, etc. collected as part of the formal safety management system should be crosschecked from site sources into an overall operations record book kept in the company office. Charter operators should also keep a record book of departures and ETAs as a backup.

Helicopters introduce new hazards into exploration that are not encountered in general aircraft operations. Their versatility means unusual hazards and risks, which must be controlled by careful selection of contractors and equipment, competency-based training for employees, and strict compliance with rules and operating procedures. Margins for error are small. All operations must be conducted in accordance with the relevant CASA requirements.

While the helicopter pilot is the key person in the safety chain, and must remain in total charge of the aircraft, all those involved in helicopter operations have important roles to play.

Selection of contractors and helicopters

When selecting contractors and types of helicopter to be used, consider:

- what will the helicopter be used for, e.g. ferrying staff to and from site, transporting equipment, slinging drill rigs and gear, undertaking aeromagnetic surveys, etc.
- seating capacity, average and maximum loads to be carried, range required, terrain to be covered
- contractor, pilot and engineer experience, reliability and record
- records of routine helicopter maintenance checks
- liaison between contractor and exploration company so that each other's needs are fully understood
- servicing and fuelling arrangements
- radio and communication requirements.

Control of helicopter operations

The pilot is in command of operations affecting the helicopter, but total cooperation is needed from all those using it. Important issues are as follows:

- **The pilot is the sole arbiter of safety.** There must be no harassment, coercion or encouragement to act against the pilot's judgment.
- Passengers must comply with the pilot's briefings concerning in-flight procedures, including emergencies, embarking and disembarking, and general safety.
- The pilot must be briefed on passenger numbers, loads to be moved and flight path hazards.
- A competent experienced person must be appointed to be in charge of ground and helipad operations.



Helicopters are a valuable aid to exploration

Helipad safety

Helipad requirements vary according to types of helicopter, frequency of landing, terrain, vegetation and type of work to be carried out. Helipad safety must be controlled by a competent experienced person, who must have full authority on the ground. Reference should be made to CASA's Civil Aviation Advisory Publication No. 92-2(1) *Guidelines for the establishment and use of helicopter landing sites*.

Points to be considered include the following:

- Size of helipad must be fully discussed with the contractor and pilot, taking into account the helicopter type and size, and the need for slinging loads.
- Good all-round clearance is required for manoeuvring of helicopter and loads.
- Vegetation must be sufficiently cleared to allow room for tail rotors and for approach and departure. A fully loaded helicopter may not be able to take off vertically. Dense low vegetation may absorb the downdraft and affect lifting ability.
- Touchdown area must be clearly marked, and any markers securely fastened down so they do not blow into rotors.
- Helipad design must suit local prevailing winds.
- Wind speed and direction indicators should be erected at base camp helipads.
- Fuel must be stored at a safe distance from the helipad.
- Helipad must be kept clear of unauthorised persons, equipment and loose or light objects.
- Only an authorised person is to signal the pilot, except in an emergency.
- Everybody must keep clear of the tail rotor at all times. They must not approach the helicopter when the main rotor blades are in motion unless authorised.
- Rotors can flop excessively in gusty winds.

Embarking and disembarking

Embarking and disembarking procedures vary according to the landing site. General rules include the following:

- Wait until the pilot gives permission before approaching or leaving the helicopter.
- Always approach and leave from the front, and remain in the pilot's line of vision and in the 10 to 2 o'clock position.
- Never walk behind or under the tail, even when the rotors are stopped
- Approach and leave in crouched position, holding on to loose clothing and equipment.
- Always secure doors and harnesses when leaving.

- Do not jump on or off the helicopter. If the helicopter is hovering, transfer weight gradually to avoid suddenly upsetting the balance of the machine.
- Firmly fasten hats or safety helmets or carry them in the hand.
- On sloping ground approach and leave from the downhill side, to avoid the main rotor.
- Provide survival kits and communications systems at drop-off points in case the helicopter cannot return.

Loading and unloading

General rules for loading and unloading include:

- keeping landing site clear of loose articles
- carrying tools at waist height, not carrying anything on the shoulders, not throwing articles in or out of the helicopter
- using two people to carry long items and carrying them horizontally
- accurately assessing load weight, including an allowance for reduced lifting capacity at high altitude
- checking goods to be loaded with the pilot, especially batteries, fuel, LPG, etc. Hazardous cargo must be identified and packaging requirements adhered to.

Slinging loads beneath the helicopter is a specialised operation subject to Civil Aviation Order 29.6 issued by CASA. Sling loading may only be carried out if:

- the helicopter has an approved supplementary flight manual detailing how the operations will be carried out
- slinging is in accordance with the manual
- the pilot has been trained and certified and has an endorsed licence for sling loading
- passengers other than flight crew or those essential to slinging are not carried
- all personnel are suitably briefed by the pilot beforehand
- only those authorised by the pilot are to attach and detach slings
- all precautions are taken by the pilot to ensure the safety of people on the ground
- unusual items, especially long items, are properly prepared for slinging.

Signals and communications

Universally accepted hand signals exist for communication between ground and helicopter pilots. These include signals for helicopter movements, landing, slinging, winching loads, and clear to start engines.

Signals should only be given by trained and authorised persons, except in an emergency, but it is essential that all of the exploration crew are familiar with them.

Ground/air/ground radios are increasingly used for direct communication between pilot and ground crews. Procedures for this form of communication should be properly established and used. Do not rely on the helicopter radios as the sole means of communication.

Passengers should not be dropped off at isolated points or unscheduled locations unless they have a survival kit and means of communicating with a base or emergency service, preferably by radio.

Operations

Points to be considered before starting exploration work include:

- keeping copies of work area maps on the helicopter and at the base camp
- leaving food, water and a radio communications system with everyone dropped off at a remote site
- ensuring that people dropped off know where they are before the helicopter leaves
- if people are walking from the landing site, fly the route to be traversed beforehand. People should carry emergency rations, signalling equipment, etc. at all times.

Emergencies

Emergencies can involve incidents with the helicopter itself or using the helicopter for evacuation of injured people. Points to be considered for helicopter emergencies include:

- provision of survival kits containing water, food, tents, life jackets, etc. on the helicopter
- first aid kit, compass, maps, signalling equipment, distress flares
- emergency locator beacon with both impact and manual switches
- firefighting equipment on the helicopter and at the helipad
- provision of survival kits and emergency communication to all persons dropped off at isolated or unscheduled locations.

Factors to be considered before transporting injured or sick people, which may adversely affect the patient, include:

- atmospheric pressure changes, which may cause severe pain to ears, sinuses, etc.
- turbulence and vibration causing further pain or injury to those with fractured bones or internal injuries
- noise causing distress to those with head injuries.

The drilling phase of any exploration program requires the greatest interaction between an exploration company and the contractors. It is essential that the relationship starts on a sound footing and that contracts clearly establish the duties and responsibilities of each party.

The following issues affect the safety of operations and must be made clear to all parties:

- methods of communication between exploration company personnel and the contractor's personnel
- appointment of people to be accountable for safety on the site
- standard of competency-based training required for both principal and contractor personnel
- statements of minimum acceptable safety standards to be applied on the site.
- the need for all equipment to be suitably designed, maintained and operated to allow the work to be done safely and productively
- the need for equipment and systems audits, either jointly or separately, and how any necessary corrective action can be implemented
- the need for good accident and incident reporting procedures.

These issues should be detailed either in the contract or in joint operating procedures.

For greater detail on contractual requirements, refer to Section 4, Contractor relationships.

The subject of exploration drilling safety includes all matters previously mentioned in this *Minerals exploration safety guidance note*, as well as substantial issues related to the actual operation of drill rigs. It is beyond the scope of this guidance note to provide anything but the minimum of guidance on safe drilling operations. Contractors must develop their own detailed standard work procedures.

National competencies

In the past decade industry training advisory bodies have been established to assist with the introduction of national competencies for a broad range of skills in the workplace. These competencies were developed by the resource industries and the drilling industry. It is expected that workers will be given the necessary training to achieve the competencies appropriate to their work in order to improve safety and general skill levels in exploration.

Competencies are available for operation of equipment, blasting, maintenance, general safety and management practices. To fulfil the expectation of those responsible for safety and management in exploration, workers must be:

- trained by an authorised trainer
- able to access training material and operator manuals
- able to obtain national competencies in a reasonable period of time
- encouraged to access a trainer and assessor
- instructed not to undertake tasks without the appropriate authorisation.

Industry associations, the drilling industry training committee and the advisory bodies can all assist with identification of resources to provide training information. Obtaining a competency increases a person's credibility and adds value to the workforce.

Under Queensland mining safety and health legislation all persons must be competent and records kept of training and assessment.

Licensing and training may also be required in accordance with the *Queensland Water Act 2000* for those persons required to drill in certain groundwater situations. Relevant legislation must be checked.

Moving rigs and vehicles

The size and complexity of the vehicle and drill rig fleet will depend on the exploration program being undertaken. It will vary from a single 4WD vehicle fitted with a small auger drill and all its necessary equipment, to large truck-mounted multi-purpose rigs with rod trucks, compressors, pumps and service vehicles.

General principles involved in moving drill rigs:

- Only authorised people should drive or control any vehicle or drill rig.
- Extreme caution is required when moving around power lines, bridges overhanging branches, steep roads, soft shoulders and in wet slippery conditions.
- Bystanders must be well clear when equipment is moved.
- Drill masts must be lowered for rig moves.
- Vehicles must not be left idling on slopes or loose ground.
- All loads must be secure and checked before moving.

Overhead or underground power lines

Overhead power lines are a major hazard for operators of mobile drill rigs and other high support equipment. Electricity regulations and rail safety documents stipulate clearance requirements for lines of particular voltages, and this information should always be included in induction programs. Management of these hazards needs to include:

- thorough site inspection before access to identify the location of power supply
- identification of authorised or recognised crossing points
- knowledge of the overall height of the vehicle or equipment (sticker in cab)
- knowledge of the height of the line above the ground (check with surveyor)
- establishment of new access close to power poles to maximise clearance
- provision of power line warning signs
- confirmation of the electrical hazard management procedures at site induction
- understanding of basic rescue warnings for power contact
- current first aid skills in cardio-pulmonary resuscitation and basic life support
- up-to-date details of electricity supply control office.

Drill operators need to remember that the height of the rig may change as the equipment is driven up slopes, such as at occupational/private rail crossings. Even though the rig clears the warning bars before the crossing, it may still contact the power conductor. Operators should be aware of rural power supply systems using single lines as the single line may be difficult to see, has a long span, and may be lower than expected.

Drill sites

Many accidents around drill sites can be attributed to poor site layout and poor housekeeping. Others can be attributed to inadequate site planning and preparation. Environmental issues may have a major impact on site layout, but these issues should be considered in conjunction with safe operations.

Sites should be assessed jointly by exploration company and drilling contractor representatives well in advance of rig moves to discuss potential problems. This is particularly important for holes with difficult access or collar positions.

Points that must be considered when planning and preparing a drill site include:

- provision of good access for support trucks and service vehicles, particularly if the rig will operate at night
- identification and assessment of potential hazards such as power lines, flood paths, unstable ground and fire before earthworks begin

- identification and clearance of dangerous trees and branches
- the need for special work platforms in steep terrain
- the need for safety barriers to prevent crews from falling off platforms, down steep slopes or into old open-cut mines
- drainage requirements for the site and access tracks
- provision of clear escape routes in case of an emergency.



A tidy drill site improves safety

- checking that equipment cannot snag on overhead branches
- arranging for safe disposal of excess water, drilling fluids, fuels and lubricants
- planning the position of auxiliary equipment such as rod trucks, compressors, pumps, etc. so that they can be accessed safely
- making sure fuels, muds, lubricants, etc. are conveniently and safely stored
- establishing firefighting and emergency equipment
- erecting any necessary barricades to prevent access by the public
- providing adequate weather protection for drill crews
- carrying out a planned audit of the site and drilling equipment before drilling to ensure that all equipment is in a safe condition and site hazards have been controlled.

Housekeeping

Poor housekeeping is a major source of minor accidents around drill sites, such as trips, falls, cuts and sprains. Neat tidy sites are usually safe sites.

Rigging up

Precautions to be taken when rigging up include:

- making sure the site will take the weight of the rig and ancillary equipment before moving on to it
- clearing away debris and loose rocks, and cut tree stumps to ground level
- re-checking for power lines, underground cables, gas pipelines, water pipes, etc.
- making sure that the rig is stable and cannot move. Jacks must be placed on a sound foundation

Good housekeeping involves:

- keeping platforms and working areas clean and safe underfoot
- making sure drilling fluids and water are channelled away from the hole, collar and around the rig. Muddy or slippery walkways, working platforms and ladders cause slips, falls and inefficient work practices
- stacking rods and casing in an orderly manner, preferably on racks, trestles or trucks. Place stops to prevent them rolling off
- keeping tools on tool racks when not being used
- keeping all tools, wrenches, rod clamps clean and free of dirt or grease. Discard worn wrenches and rod clamps
- providing rubbish disposal facilities
- keeping engines free from grease, dirt, oil, spilled fuel and accumulated leaves, twigs and other flammable material
- providing adequate sanitary facilities.

Drilling operations

Only experienced people or those undergoing supervised training should be allowed around operating drill rigs. An operating site is no place for spectators or inexperienced visitors.

Each drilling contractor should develop their own standard work procedures for drilling. The following factors should be considered:

- Only experienced trained people should operate drilling equipment.
- One person must be appointed to take charge of day-to-day operations and be accountable for safety on site.
- Nobody should be allowed on site without adequate personal protective equipment.
- Rig controls should be operated from a stable and convenient position, not from where it is difficult to reach the controls.
- The condition of all winches, ropes, hoisting plugs and clamps should be checked before raising or lowering rods, casing or drill pipes.
- Care should be taken when rods, casing or drill pipes are being raised or lowered. Make sure that the hoist plug or rotation head sub is correctly screwed in before taking the weight.
- Rods or casing must be firmly set in clamps before attempting to break a joint. Hands should be kept clear of hoist cables and plugs when uncoupling rods.
- Retaining tools such as rod safety clamps and rod spanners should be operated carefully to avoid contact with rotating rods.



*Untidy sites
lead to
accidents*

- Never place any part of body between stilsons, tongs or break-out spanners and the mast or drill frame. On larger rigs, keep off the drilling platform when using automatic break-out tools.
- Do not use compressed air to pump core out of inner tubes as this can create a projectile. If pumping is required, use only water or mud, and exercise care.
- Never hand-carry tools up and down ladders or the drill rig mast; use a bag.
- Nobody should be on a mast while the rig is operating.
- Any person working on the mast or on the working platform must have and use a safety belt or harness.
- Maintenance must not be carried out while machinery is moving, and all guards on belts, chains and gears must be replaced after removal for maintenance.
- All high pressure pipes and fittings should be adequate for their purpose and hoses should be suitably restrained in case of breakage.

After recent fatal accidents involving contact with rotating drill rods, several drilling manufacturers and operators have designed means of isolating the driller from the rotating rods. Those devices include Glindemann and Kitching's Safety Rod, in which the drill rod rotates inside a static rod, and KL Drill Rig Services Drill Rod Guard, which consists of a three-piece guard that activates as the drill head descends. As such devices are developed, they should be installed on relevant rigs.

Natural gases encountered during drilling

Drilling associated with coal seams and petroleum will virtually always encounter gases in the strata. Some gases (methane) will be explosive within a certain range while other gases (hydrogen sulphide) will be toxic, even in very low concentrations. Increased carbon dioxide levels may be accompanied by reduced oxygen concentrations and become toxic at higher levels.

If a hazard analysis of the operation identifies a risk, you may need to consider:

- inclusion of gas management in induction (blow-out preventers and extraction/venting procedures)
- a method of gas monitoring and warning
- extension of safety exclusion zones around the drill rig
- recognition and treatment of gas-related illness
- removal or treatment of ignition sources (electrical wiring, exhaust outlets, flame)
- general training for knowledge of gases.

Summary of gases

Name of gas	Properties	Effects on humans	Flammable limits	Detection
Carbon dioxide	SG-1.53 Colourless Slightly pungent smell Soda water taste	Increases respiration Toxic above 5%	Non-flammable	Tube detector Infrared analyser Interferometer Electrochemical sensor Gas chromatograph
Carbon monoxide	SG-0.97 Colourless, odourless, tasteless	Highly insidious poison displacing oxygen from the blood TLV = 30 ppm	12.5–74%	Tube detector Electrochemical sensor Infrared analyser Gas chromatograph
Methane	SG-0.55 Colourless, odourless, tasteless	Non-poisonous but will not support life	5–14%	OFSL Catalytic sensor Infrared analyser Gas chromatograph
Hydrogen sulphide	SG-1.19 Colourless, sweet taste Odour of rotten eggs	Poisons the central nervous system TLV = 10 ppm	4.5–45%	Tube detector Electrochemical sensor
Sulphur dioxide	SG-2.26 Colourless, acidic taste Pungent, suffocating odour	Extremely poisonous, affecting the lungs TLV = 2 ppm	Non-flammable	Tube detector Electrochemical sensor

Radioactive substances

If borehole logging or other industrial activities that use radioactive substances are taking place near where you work, exercise caution before approaching the area. Requirements for radioactive probes are covered in section 17 of this guidance note.

Any accident involving a radioactive substance must be dealt with by a trained radiation safety officer. Important points include:

- proceed with caution to treat any injured person
- stay clear of the area
- wait to be invited to a radiation work area
- follow the instruction of the radiation safety officer.

Compressors, pumps and high pressure equipment

All high pressure equipment, including receivers, pipes, fittings, pumps and hoses, must be suitable for the purpose for which they are used. Compressed air and hydraulic fluid are powerful energy sources and must be treated with respect. As drilling equipment becomes more sophisticated, the use of hydraulic components increases. The increased demand for faster drilling and larger holes means compressors are getting bigger and air pressures higher.

Some points to consider are:

- check and securely fix air hoses before applying pressure
- fit restraints on air hose connections to prevent whipping in the event of a coupling or hose failure
- construct and maintain air receivers and all pressure vessels in accordance with the relevant Australian Standard
- fit high pressure water pump and air compressors with pressure relief valves
- regularly examine all pressure system components for suitability and condition. Substandard components should be changed immediately.

Even so-called non-flammable hydraulic oils can burn easily when sprayed under pressure through a leaking hose or pipe on to hot components such as an engine exhaust.

Fatigue management

Fatigue associated with driving long distances is well advertised and understood by most drivers. It is less well understood in the exploration industry, even though exploration workers have traditionally worked long hours, often coupled with extended rosters and field duties. Australian environmental conditions in association with these extended work hours are not conducive to simple control measures for fatigue management and additional risk factors may need to be considered.

Exploration managers should consider:

- roster length in relation to work hours
- remote locations and associated extensive travel
- after work and break activities
- physical demands and fitness for work
- break length between field roster periods
- education programs for the worker and family to gain a better understanding of fatigue
- alternative travel methods at the end of a roster.

All workers need to be consulted on the most appropriate roster structure. A roster that suits a local workforce may be inappropriate for exploration workers who live long distances from their workplace and are required to travel by road.

Heat and dehydration

Recognition of heat conditions is taught in basic first aid but it is important to prevent the likelihood of heat illness. Although not always possible, organisation of work at cooler times of the day can help eliminate or reduce the incidence of a heat-generated illness. **Heat conditions have killed exploration workers, so control is important.**

Actions that can be taken by individual workers include:

- providing at least 5 litres of cool water per person per eight-hour shift
- controlling the intake of alcohol in the eight hours before start of the shift
- wearing cotton clothing that covers as much skin as possible
- wearing a hat and a shade on a safety helmet
- wearing UV protection sunglasses
- applying sunscreen to exposed skin
- being hydrated before starting work and drinking regularly during work
- drinking some fluids (fruit juice) other than water to help restore salts
- eating normally to replace salts
- not waiting until you are thirsty before you drink—it may be too late
- providing shade during rest breaks and at other times, if the work process allows
- checking urine colour frequently during the day (the lighter the better)
- looking after co-workers to ensure that they are drinking enough fluid.

General

- Radusin, S (ed.) 1987, *Australian bush survival skills and search and rescue manual* (Start Publishing, PO Box 511, Cannington, WA 6107).

Legislation

- *Mining and Quarrying Safety and Health Act 1999* (Qld)
- *Coal Mining Safety and Health Act 1999* (Qld)
- *Explosives Act 1999* (Qld)
- *Petroleum Act 1923* (Qld)
- *Workplace Health and Safety Act 1995* (Qld)
- *Radiation Safety Act 1999* (Qld)
- *Civil Aviation Act 1988* (Cwlth)

Department of Natural Resources and Mines (NR&M) (Qld) guides and guidance notes

- Guidance Note: *Management of safety and health risks associated with hours of work*
- Guidance Note: *Keeping and using the mine record at mining and quarrying operations in Queensland*
- *SafeGuard* (audit criteria for safety and health management system)
- *Radioactive borehole logging* (issued by the Geological Survey of Queensland)
- Guidance Note QGN 06: *Guidance to metalliferous mines and quarries in reporting serious accidents and high potential incidents to an inspector of mines and a district workers' representative*
- Guidance Note QGN 07: *Guidance to coal mines in reporting serious accidents and high potential incidents to an inspector of mines and an industry safety and health representative.*

These and other NR&M guides and guidance notes are available from the local inspector of mines or from the NR&M web site, <www.nrm.qld.gov.au>.

Division of Workplace Health and Safety Standards (Qld)

- Hazardous substances
- Advisory standards
 - first aid
 - manual tasks
 - risk management
 - personal protective equipment

Worksafe Australia and other Commonwealth codes

- *Australian code for transport of explosives by road and rail*
- *Code of practice for hydrofluoric acid*
- *Code of practice for the safe use of sealed radioactive sources in borehole logging*
- *Code of practice for the safe transport of radioactive substances*
- *Control of workplace hazardous substances*

Australian Standards

- AS 2187: *Explosives—storage, transport and use*
- AS 1596: *The storage and handling of LP Gas*
- AS 1940: *The storage and handling of flammable and combustible liquids*

Civil Aviation Safety Authority

- Advisory Publication No. 92–1(1) *Guidelines for aeroplane landing areas*
- Civil Aviation Order Air Service Operations–Helicopter External Sling Load Operations
- International Air Transport Association publication, *Dangerous goods regulation*
- Civil Aviation Advisory Publication No 92–2(1) *Guidelines for the establishment and use of helicopter landing sites*

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