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1.0 MANAGEMENT COMMITMENT & CONTROL

1.1 INTRODUCTION, PURPOSE & SCOPE

This Health and Safety Manual has been developed with employee and contractor participation. It is designed to provide both employees and contractors with practical guidance in health and safety issues. The manual also sets specific standards for the company's Health and Safety Program.

The standards and rules as set forth in this manual are to be followed by all employees and contractors. Wherever possible and applicable, legislative requirements have been incorporated from Alberta and the Yukon, the company's main areas of operation.

Safe work procedures (mostly as contained in Section 5) are guidelines that are based on minimum standards identified in government legislation. Deviation to any of these rules and work procedures shall require the approval of management. An equivalent level of safety must be provided for workers performing the tasks when deviation from written rules and procedures is necessary.

Any requirements for change or modification of this documentation shall be reported to management. Northern Cross (Yukon) Limited (“Northern Cross”) welcomes any suggestion for the ultimate improvement of this manual and its contents. In order to ensure a practical and optimum level of safety for employees and contractors, all personnel who work for Northern Cross must ensure the information contained in this manual fulfils the company's safety needs.

All employees are expected to become familiar with this manual's contents, to review it during safety meetings and training sessions and to refer to it before conducting any critical task.

This manual is also intended to complement the contractors’ Health and Safety Programs as identified in Section 6 or, in the absence of the contractors’ own Safety Program, to provide a contractor with guidance on Northern Cross’s expectations for health and safety.
1.2 POLICY STATEMENT FOR HEALTH, SAFETY & ENVIRONMENT

Northern Cross is committed to protecting the health and safety of our employees and the public associated with and/or affected by the work we undertake. We shall continually strive towards maintaining a leadership role in the promotion of accepted safety philosophies.

The success of our safety program is measured by the enhancement of the well being of our greatest resource – our employees and contract personnel. Consequently, success is contingent upon active participation by all personnel, and by fulfilling our collective responsibilities, which include:

- Senior management will be accountable and responsible for providing adequate resources and leadership in the areas of safety management.
- Managers and supervisors will provide direction to our employees and contractors that include the health and safety of our personnel as paramount.
- All employees will undergo a Northern Cross safety orientation and be in compliance with all policies and procedures.

In particular, managers, supervisors, employees and contractors will:

- Comply with legislated regulations and accepted industry codes and practices;
- Adhere to established company safe procedures, practices and rules;
- Engage in proactive prevention of occupational injury or illnesses through effective hazard management, and minimizing company losses;
- Plan, evaluate and conduct our activities in accordance with sound environmental practices; and
- Promote prompt reporting of accidents or incidents, and implement subsequent remedial programs in a timely and effective manner.

_______________________
President, CEO
January, 2012
1.3 PETROLEUM INDUSTRY GUIDING PRINCIPLES FOR WORKER SAFETY

Petroleum Industry Guiding Principles
For Worker Safety

We, the members of the petroleum industry, have a responsibility
to protect all workers engaged in its activities from personal injury
and health hazards. To meet our responsibility we will operate
under the following guiding principles:

RESPONSIBILITY
The operating company, when acting as prime contractor, is responsible for coordination and general
supervision of all activities at the work site, including activities carried out by contractors, sub-contractors,
service companies and suppliers. While all parties have a responsibility to promote worker safety, the
operating company recognizes its leadership role in promoting worker health and safety on the basis that it
has the greatest power to influence work site situations. It is the responsibility of workers and employers to
refuse to perform unsafe work practices.

PRIORITY
Activities will be conducted on the basis that safety of all personnel is of vital importance, whether those
personnel are employed by an operating company, a contractor, a sub-contractor, a service company or
a supplier.

RECOGNITION
The process of selecting contractors, sub-contractors, service companies and suppliers, and the administration
of contracts, will include recognition and support of good safety performance. Support and recognition based
on good safety performance will also be provided by all employers to their employees.

IMPROVEMENT
The operating company, in cooperation with service companies within the industry, will promote methods and
practices that have potential for improving safety performance.
1.4 WORKPLACE VIOLENCE POLICY

Purpose

It is the goal of Northern Cross to provide a workplace for all employees, contractors, clients and visitors that is free from violence by establishing preventive measures, holding perpetrators of violence accountable and by providing assistance and support to victims. Committing violent acts, whether on duty or off duty, has the potential to impact an employee’s ability to perform their job. Provincial and territorial legislation requires employers to provide their employees with a safe and healthy work environment. It is intended that all useful management tools be employed to accomplish the dual purpose of reducing the effects of violence on victims and providing consequences to those who perpetrate violence.

Definitions

- **Workplace Violence** includes, but is not limited to, intimidation, threats, physical attack, domestic violence or property damage and includes acts of violence committed by company employees, clients, customers, relatives, acquaintances or strangers against company employees in the workplace.
- **Intimidation** is engaging in actions that include, but are not limited to, stalking, behaviour intended to frighten, coerce or induce distress and use of social media to embarrass, harass or demean.
- **Physical Attack** is unwanted or hostile physical contact such as hitting, fighting, pushing, shoving or throwing objects.
- **Domestic Violence** is the use of abusive or violent behaviour, including threats and intimidation, between people who have an ongoing or prior intimate relationship. This could include people who are married, live together or date or who have been married, lived together or dated.
- **Property Damage** is intentional damage to property and includes property owned by the company, employees, visitors or vendors.

Coverage

This policy applies to all full time and part time employees and contractors. This policy applies to the conduct of an employee while functioning in the course and scope of employment as well as off duty violent conduct that has a potential adverse impact on an employee’s ability to perform the assigned duties and responsibilities.

A violation of this policy will be considered unacceptable personal conduct as provided in the Disciplinary Policy. Acts of violence, as defined herein, may be grounds for disciplinary action, up to and including dismissal. An act of off duty
violent conduct may also be grounds for disciplinary action, up to and including dismissal.

**Authorized Exceptions to Policy**

An employee may only have a weapon in their vehicle if it is in compliance with management approval as being required as part of the employee’s job duties (i.e. for flare lighting, protection from wildlife, etc.) and only if they hold the necessary possession permits.

**Retaliation**

This policy prohibits retaliation against any employee who, in good faith, reports a violation of this policy. Every effort will be made to protect the safety and anonymity of anyone who comes forward with concerns about a threat or act of violence.

**Reporting Responsibilities**

All employees are encouraged to be alert to the possibility of violence on the part of employees, former employees, customers and strangers. Employees shall place safety as their highest concern and shall report all acts of violence and threats of violence. All reports of violence will be handled in a confidential manner, with information released only on a need-to-know basis. Management shall be sensitive and responsive to the reporting employees’ fear of reprisal.

**Procedures**

- The Incident/Hazard Reporting procedure (Section 9) will be used when investigating a report of a violation of this policy.
- Employees will be instructed regarding proper response to acts or threats of violence.
- The enforcement policy of the company will be used after the investigation, if warranted.
2.0 RESPONSIBILITY FOR HEALTH & SAFETY

Standard

Employees and contractors at all levels of the organization must be aware of their individual health and safety responsibilities. Responsibilities shall be referred to in new employee indoctrination, during in-house training and during performance reviews by appropriate managers/supervisors. Supervision should not only ensure that employees and contractors are aware of their responsibilities, but should also continuously reinforce performance requirements and motivate employees and contractors to become involved in the health and safety program.

Although specific responsibilities are identified in each element of the health and safety program, the following identifies the more general responsibilities for employees and contractors at all levels within Northern Cross.

2.1 MANAGEMENT

Management shall promote health and safety by:

- Routinely measuring employees and contractors performance to ensure that it meets the standards of the health and safety program;
- Continuously demonstrating management's commitment to health and safety by attending safety meetings, planned worksite inspections/tours, safety training sessions, by writing memos regarding health and safety and by participating in the development and implementation of health and safety issues;
- Encouraging employees' and contractors' participation in health and safety issues;
- Ensuring corrective actions are taken on hazards as well as health and safety concerns in a timely and appropriate manner when reported by employees and contractors through incident/accident reports, hazard reports, safety meetings, etc.;
- Ensuring training needs are identified and met;
- Ensuring the required resources and information are provided to all employees and contractors to maintain a safe and healthy work environment.
2.2 EMPLOYEES

Employees shall cooperate with, and assist, management's health and safety efforts by:

- Becoming familiar and complying with the company's safety requirements and responsibilities and asking questions when requirements are unclear;
- Becoming actively involved in the development and maintenance of the safety program by providing feedback to management on program requirements;
- Following safety requirements and rules as identified in this manual;
- Reporting all hazardous conditions and situations that cannot be immediately fixed to both fellow employees and contractors who may learn from or may be exposed to the hazard. Also reporting any hazards to management so that the hazard may be corrected;
- Refusing to perform work if, on reasonable and probable grounds, he or she believes there exists an imminent danger to him or herself or other person, as identified in the Occupational Health and Safety Act;
- Using the appropriate personal protective and safety equipment for the job;
- Inspecting equipment, tools and vehicles informally on a daily basis and correcting deficiencies as quickly as practical;
- Reporting accidents and near miss incidents as per the Accident Reporting procedure; and
- Knowing the locations of and how to use emergency equipment.

2.3 CONTRACTORS

- Cooperate fully with management to ensure the safety of the workplace.
- Comply with safety regulations, procedures and standards stipulated by regulatory agencies and Northern Cross.
- Fulfill responsibilities as an employer to their own workers and any other sub-contractors under their hire.
- When performing work on any Northern Cross work site, contractors are required to abide by the policies, rules, and procedures that are stipulated within the safety program set forth by Northern Cross.
- Work to obtain a Certificate of Recognition (COR) or equivalent.

2.4 VISITORS

- Report immediately to a company representative upon arrival on Northern Cross’ premises.
- Follow directions and instructions of the company representative, and remain escorted throughout visit.
- Adhere to all applicable legislated requirements and company rules and procedures when on site.
2.5 LEGISLATIVE COMPLIANCE

All employees, contractors and sub-contractors must strive to ensure all municipal, provincial, territorial and federal government legislation applicable to the work is adhered to.

Although it is impossible to cover all parts of applicable legislation in this manual, the following does incorporate legislative requirements wherever possible.

Applicable legislation includes:

- Government of Yukon Occupational Health and Safety Act and Regulations
- Workplace Health and Safety Acts & Regulations in Alberta
- Yukon Utilities Board Acts, Regulations and Ministerial Directives
- Alberta Energy Resources Conservation Board Act and Regulations
- Motor Vehicle Acts
- Transportation of Dangerous Goods Act
- Workers’ Compensation Acts & Regulations
- Environmental Protection Acts & Regulations
- Yukon Oil and Gas Act
- Workplace Hazardous Materials Information System (WHMIS)
- Yukon Waters Act

2.6 WORKPLACE HEALTH & SAFETY ACT

General Safety

Every Employer shall ensure:

- The health and safety of all persons at a worksite and workers engaged in the work of that employer; and
- That all employees are aware of the duties and responsibilities under this Act and Regulations.

Every Worker shall:

- Take reasonable care to protect the health and safety of him/herself and other workers; and
- Cooperate with his/her employer for the purposes of protecting the health and safety of him/herself and other workers.

Accident Reporting

If an accident occurs that has the potential of causing a serious injury:
The Worker shall:

- Immediately notify his/her employer of the accident.

The Employer shall:

- Notify the appropriate provincial and territorial authority of the accident;
- Complete an accident investigation report (found in appendices) and prepare a report;
- Ensure a copy of the report is made available to the applicable agency; and
- Ensure that no person disturbs the scene of a serious accident until the agency has given approval.

Refusal to Perform Unsafe Work

No Worker shall:

- Carry out any work or operate any tool/equipment if, on reasonable grounds, he/she believes there exists, or that it will cause to exist, an imminent danger to that worker or any other worker.

Upon being notified the Employer shall:

- Investigate and take action to eliminate the imminent danger;
- Ensure that no other worker is assigned that work until the imminent danger has been eliminated;
- Not discipline the worker who refused the work.
3.0 EMERGENCY RESPONSE PLAN

3.1 INTRODUCTION

Northern Cross’s Emergency Response Plan has been developed to facilitate an effective response by operations, management and support personnel to an emergency occurrence affecting the company. To ensure a state of emergency preparedness company wide, Northern Cross has developed these emergency procedures to protect the public, employees, contract employees, property and the environment.

Where a site-specific Emergency Response Plan is required to address a hydrogen sulphide (H₂S) hazard, the Emergency Response Plan will serve to support the site-specific emergency response process.

Roles and responsibilities of Northern Cross’s Emergency Response Team members are outlined in Northern Cross’s Corporate Emergency Response Plan and Manual. It is imperative that all company and contract personnel involved in Northern Cross operations review this plan to ensure a complete understanding of their role in response to an emergency.

With development of the Emergency Response Plan, the company is prepared to:

- Ensure immediate, competent responses to, and effective handling of, an emergency occurrence;
- Minimize danger to the public, employees, contractors and the environment;
- Establish and maintain effective communications with all parties in an emergency; and
- Make maximum use of the combined resources of Northern Cross, government agencies and other non-company services.

All personnel directly involved with Northern Cross operations, including both company and contract personnel, shall receive training in how to use the Emergency Response Plan.

Emergency procedures are intended to ensure that responses to emergencies are prompt, organized and effective. It is the responsibility of all employees to be aware of the Emergency Response Procedures. It is the responsibility of rig management to ensure that their employees are familiar with and trained in the emergency response procedures.

In all cases the most important considerations are to preserve life and prevent further injury.
3.2 PROCEDURES

1. Potential emergencies include, but may not be limited to:
   a. Fires and/or Explosions
   b. Injuries
   c. Dangerous Goods Spills
   d. Rescue from Height
   e. Confined Space Emergencies
   f. Natural Disasters
   g. Release of Toxic Gas

2. Rig Managers are responsible for ensuring that employees are familiarized with all of the Emergency Response Procedures.

3. In all emergencies the Rig Manager is responsible for organizing the on-site response. In his absence the Driller or another competent worker shall take charge.

4. The Rig Manager is responsible for ensuring that an up-to-date list of emergency response numbers is posted in the doghouse and in the Rig Manager’s shack at all times.

5. The Rig Manager is further responsible for ensuring that a communications method is available at all times.

6. The Rig Manager is responsible for ensuring that at least one “Safe Area” is identified each time a rig moves to a new location. All workers must be made aware of the location of the Safe Area.

7. Responsibilities for notifying various agencies, government departments, etc. are provided on the attached flow chart.

8. All evidence pertaining to the emergency will be preserved at the location, pending investigation by the company and/or the applicable government agencies.

9. Company employees WILL NOT contact the relatives of injured workers or communicate with the media. These tasks will be performed by management.

10. The Rig Manager shall ensure that emergency drills are conducted by each crew on a regular basis.

11. All drills held are to be recorded in the Tour Book, and a safety meeting is to be held discussing how the drill went (i.e. things to improve on, what worked well, what might have worked better, the type of drill held).
Fires

Procedure:

1. For the purposes of this procedure, “FIRES” have been categorized as “minor” or “serious.” “Minor” fires are those which, in the opinion of the rig crew, can be safely controlled using equipment and personnel on site, and where there are no injuries. In all cases, safety of personnel is the overriding consideration. If in doubt, call in emergency services!

2. In the case of “minor” fires, with no personal injuries:
   a. The person discovering the fire shall:
      • Sound the alarm, by shouting FIRE! FIRE! FIRE!
      • Cut off the source of fuel, if safe to do so,
      • Remove any nearby flammable items,
      • If safe to do so, attempt to contain the fire using firefighting equipment, or isolate the fire – protect surrounding equipment and property while leaving the fire to burn itself out.
   b. On hearing the verbal alarm, the Driller shall immediately cease operations, and sound 2 long, continuous blasts on the air horn. He will then proceed to the safe assembly areas and maintain control.
   c. The Rig Crew shall immediately assemble at the safe assembly area for further instruction.
   d. The Rig Manager shall assess the situation and determine the need for emergency services. If there is any doubt at all as to the seriousness of the fire, emergency services shall be contacted. Otherwise, the Rig Manager shall coordinate the crew in controlling the fire.
   e. Once the situation is under control, the Rig Manager shall contact the Operations Manager and advise him of the nature and location of the situation.
   f. The Safety Manager shall:
      • Contact the prime contractor and advise them of the situation.
      • Contact the appropriate government and regulatory agencies.
      • Proceed to the site and conduct an investigation, (for further information on investigations, refer to the Incident and Accident Procedure in Section 9 of this manual).

3. In case of the “serious” fires:
   a. The person discovering the fire shall:
      • Sound the alarm, by shouting FIRE! FIRE! FIRE!
      • Remove injured persons from the area, provide first aid as appropriate, and remain with the casualty,
      • If no casualties, proceed to the safe assembly area for further instruction.
   b. The Driller, on hearing the verbal alarm, shall:
      • Sound two long, continuous blasts on the air horn,
• Shut down operations,
• Assist with first aid, if required, or
• Proceed to the safe assembly area and maintain control.

c. The Rig Crew shall immediately assemble at the safe assembly area and wait for further instruction.

d. The Rig Manager shall:
• Assess the situation,
• Ensure that all personnel are in a safe location, and that all are accounted for,
• Call emergency services,
• Contact the Operations Manager,
• Maintain control,
• Ensure that the accident site is not disturbed in any way.

e. The Operations Manager shall:
• Contact that appropriate government/regulatory agencies,
• Contact the prime contractor,
• Proceed to the site, to assist in an investigation.

A flow chart is attached which illustrates the responsibilities contained in this procedure. This chart is to be posted in the doghouse, crew change room, and Rig Managers trailer.

Personal Injury

If a serious injury or fatality occurs, the following actions shall be taken:

• Remove the victim from further harm and provide first aid.
• Request local medical services (ambulance and hospital).
• Notify management.
• Notify the local police or RCMP.
• Notify OH&S of all serious injuries and fatalities or of any events that have the potential to cause serious injuries.
• Notify WCB of all fatalities and serious injuries, or injuries which disable or are likely to disable the worker for more than the day of the accident.
• Preserve the scene of the emergency until approval to resume normal operations has been received from Management and the appropriate government agencies.

Rescue from Heights

The procedure for conducting a rescue from the derrick or monkeyboards is contained in the “Working at Heights” Policy in this manual.
Natural Disasters

In addition to on site emergencies that occur, Northern Cross will ensure that workers on site are made aware of typical natural disaster situations that could occur.

Procedure:

Natural disasters may include electrical storms, floods, earthquakes and tornadoes. The emergency response for any of the above will be the same:

1. Ensure the safety of all personnel at the rig. Send someone to ensure the safety of personnel at the camp.
2. Secure the well. Shut down equipment as required.
3. Notify the office of the type of disaster.
4. Evacuate to a place of safety until it is safe to return to the location.

A. Forest Fires

Forest fires are an obvious type of emergency that can impact well servicing activities.

Wildfire Notice

A Fire Notice is for information only and is an advisory that a wildfire is currently burning in your area and presents a risk to your life and property. Know the three stages of evacuation: Alert, Order, All Clear and monitor news sources for evacuation messages.

Evacuation Alert

An Evacuation Alert is issued to advise anyone in the area of the potential for loss of life or property from fire. When an alert is issued, you should be prepared for worsening conditions. You may be required to leave the area with minimal notification of an evacuation order being issued. Monitor news sources and keep your phone free for incoming calls. Every attempt will be made to provide as much advance notice as possible, however due to changeable wind/weather conditions, you may be required to leave with little advance notice.
Evacuation Preparation

- Gather any personal items you may have at the worksite, if time permits. Remember, the most valuable items on a site are its employees;
- Keep track of the location of all field personnel and determine a planned meeting place should an evacuation be called while separated;
- Arrange accommodation for field personnel, if possible, in the event of an evacuation.

Fire Protection around the Well Site

If you work in an area on Evacuation ALERT and if time permits:

- Remove any flammable materials against or adjacent to the equipment;
- Have available a round point shovel and/or grubbing tool to prevent the spread of ground fire; and
- Close all windows and doors to prevent sparks from blowing inside.

Evacuation Order

An Evacuation Order is issued by Alberta Sustainable Resource Development, Yukon Energy, Mines and Resources (EMR) or their counterparts in other jurisdictions having the authority to respond to imminent forest fire danger to the involved area.

These orders are issued in the interest of life and safety. Where applicable, members of the RCMP, Local Fire Departments and Emergency Support Services will be involved in expediting that action through door-to-door contact if time permits, or via the media.

When an evacuation is ordered:

- You must leave the area immediately. It is imperative that you report to the Evacuation Centre indicated. This will allow for effective communications for the evacuation team and will facilitate contact by friends or relatives who may be very concerned;
- If you need transportation to evacuate, advise the individual providing the notice of evacuation;
- Close all doors and windows in the buildings. Leave gates unlocked and clear access roads for fire fighter access;
- Keep a flashlight and portable radio with you at all times; and
- Follow your emergency response plan and obey traffic control. Travel will be only one-way out of your area to allow emergency vehicles access. Re-admittance is not permitted.
Returning to Work

You will be allowed to return to the site when the danger has passed. However, there is a possibility that the fire danger may recur. Continue to monitor news sources.

Evacuations can be chaotic. Fire fighters cannot seriously get to work on the fire problem until life safety issues are under control. People who resist evacuation consume fire fighter's precious time. Once you realize you need to leave, don't waste time and evacuate immediately. Delay can result in roadways being blocked by blinding smoke or fire equipment. You cannot save your fellow employees and possessions if you can't get out. Listen to emergency broadcasts and follow the directions of emergency personnel.

The most important thing you can do is keep calm and be aware that an approaching fire usually will:

- Follow the direction of the wind;
- Travel faster up slopes (i.e. rate of spread doubles for every 20% increase in slope);
- Gain great speed while following uphill canyons, which create natural chimneys;
- Gain great speed when burning through grass and light brush;
- Slow down, but gain in intensity when burning through brush or trees; and
- Once large enough, it can generate its own winds, throwing burning debris ahead of the main fire front, potentially encircling those who are in front of it.

B. Floods

- **In Building:** If a building is in a low lying area, be prepared to move to higher ground during flood watch. Seek shelter.
- **Outside:** Do not try to walk through flash floods.
- **In Vehicle:** Avoid driving through flooded areas. If caught there, watch for road washouts and avoid dips and underpasses.

C. Tornadoes

- **In Building:** Stay inside with doors and windows shut. Stay away from windows, doors and exterior walls. Go to small, interior room or stairwell on lowest floor of building (bathrooms are often best choice). If possible, crouch under heavy furniture. Protect your head with cushion or mattress.
- **Outside:** Seek shelter in building (not truck or mobile home) immediately. If no shelter is available, lie flat in a low dry spot (ravine or ditch) or under a low bridge. Keep alert for flash floods. Protect your head. As a last resort, hang on tightly to the base of a shrub or small tree.
- **In Vehicle:** Do not stay in vehicle or mobile home and do not try to outrun a tornado by driving, especially in populated areas. If possible run to nearby
solid structure (shelter or building). If no solid structure is nearby, lie flat in
dry ditch or ravine outside. Keep alert for flash floods. Protect your head.

D. Storms

Hail

- **In Building:** Stay away from windows and glass doors. Be alert for signs of
  high winds or tornado (especially if hail is large) and follow tornado
  precautions as necessary.
- **Outside:** Seek cover, face away from wind and protect your head. Be alert
  for signs of high winds or tornado (especially if hail is large) and follow
  tornado precautions as necessary.
- **In Vehicle:** Keep face and head away from windows. Be alert for signs of
  high winds or tornado (especially if hail is large) and follow tornado
  precautions as necessary.

Blizzards

During winter storms with heavy snowfall and/or high winds the following actions
are to be taken:

- Monitor the rate of snowfall and wind chill chart to determine if conditions
  permit continuation of operations. Wind chill is a combination of ambient
  temperature and wind speed that provides an indication of the effects of
  current conditions on the body.
- Alert field personnel to stop all outdoor work when the wind chill factor drops
  to a hazardous level or if blowing snow reduces visibility significantly.
- Assemble all field personnel in a heated enclosure to wait out the storm.
- Conduct a head count to ensure all personnel are accounted for.
- If a worker is missing in poor visibility conditions, a search party must be
  organized and sent out only when visibility improves to allow a search to
  proceed safely. Notify local police or search and rescue organizations for
  assistance.
- Secure all materials or objects that may be dislodged in high winds.
- Where conditions permit continuation of operations, considerations must also
  be made for regular breaks to warm-up.
- Properly insulated clothing including boots, gloves/mitts and parkas are
  necessary PPE in winter conditions. All exposed areas have to be covered.
- Adopt the “buddy” system where personnel frequently check each other for
  frostbite and signs of hypothermia.
- Administer first aid for any frostbite or hypothermia and summon medical
  services if required.
- If a serious injury or fatality has occurred, contact relevant company and
  government agencies.
• If driving a vehicle in a blizzard, pull off the road safely with four-way flashers on and wait out the storm.

**Lightning**

• **In Building:** Close windows and doors and keep away from windows, doors and fireplaces. Don’t go out unless it is absolutely necessary. Before storm hits, unplug appliances including radio, television and computers and do not touch electrical items or telephones during the storm.

• **Outside:** Get inside vehicle or building if possible. Avoid water and objects that conduct electricity (i.e. tractors, golf clubs, and metal fences). Do not stay in open spaces or under tall objects (trees, poles). If no shelter is available crouch down, feet close together with head tucked down. If you’re in a group, spread out, keeping people several yards apart.

**Winter Survival**

- Stay in your vehicle. Trying to dig your way out of a ditch or attempting to walk back to town can be fatal. Do not leave your vehicle.
- Call 911 to let them know your location and predicament.
- Do not leave the engine running. If it is extremely cold, idle your engine for a few minutes at a time – but only after ensuring the exhaust system is not damaged and the tail pipe is clear of snow and debris. Carbon monoxide can sneak up on you without warning.
- Put on layers of warm clothing and wrap yourself in a blanket or sleeping bag.
- Ventilate the car by opening a downwind window (the side away from the wind and blowing snow) (approximately ½ inch).
- Use your water sparingly (you should keep 2 large bottles in your kit), but do not let yourself get dehydrated.

### 3.3 FIRE PREVENTION AND PROTECTION

**Prevention**

The best means of fighting fire is to prevent it from starting.

The following three components are required before a fire can start and continue to burn:

1. fuel (in form of vapour or liquid)
2. oxygen (in the atmosphere)
3. heat (temperatures high enough to ignite fuel-air mixture)

Removal of any one of three components will prevent a fire or cause a fire to go out.
To prevent fires, workers should:

- always follow safe work practices when handling flammable or explosive materials
- store oily rags, waste materials, paper, and combustible materials in metal containers regularly
- avoid overloading electrical outlets
- control vegetation around tanks, fire walls, buildings and well sites.

**Classification of Fires**

Following is a list of fire classifications:

- **Class “A”** Fires in ordinary materials such as wood, paper, rags, rubbish, etc.
- **Class “B”** Fires in petroleum products such as grease, oil, and paint.
- **Class “C”** Fires in live electrical equipment such as control panels, electrical wiring, and switches.
- **Class “D”** Fires in combustible metals such as magnesium, titanium, and sodium.

**Fire Extinguishers**

Good Housekeeping is essential in the prevention of fires. Fires can start anywhere and at any time. This is why it is important to know which fire extinguisher to use and how to use it. Always keep fire extinguishers visible and easy to get at. Fire extinguishers have to be properly maintained to do the job. Where temperature is a factor, ensure that care is taken in selecting the right extinguisher.

The most common fire extinguishers on Northern Cross property and in Northern Cross vehicles are cartridge-operated dry-chemical extinguishers. They are rated as either ABC or BC type and can be used on any A, B or C fire. Class D fires require special equipment.

Access to fire-fighting equipment must never be blocked by any material, equipment, or vehicles.

All fire-fighting equipment must be inspected at least monthly to ensure it is in place, accessible, and fully charged.

Discharged fire extinguishers must be immediately replaced with fully-charged units and recharged.
Operation of Extinguisher

<table>
<thead>
<tr>
<th>PROCEDURE DESCRIPTION</th>
<th>HAZARD CAUTION &amp; SAFETY HINTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Class A: These fires consist of wood, paper, rags, rubbish and other ordinary combustible materials.</td>
<td>Recommended Extinguisher: Water from a hose, pump type water can, or pressurized extinguisher, and soda acid extinguishers. Fighting the Fire: Soak the fire completely – even the smoking embers.</td>
</tr>
<tr>
<td>2. Class B: Flammable liquids, oil and grease.</td>
<td>Recommended Extinguisher: ABC units, dry chemical, foam and carbon dioxide extinguisher. Fighting the Fire: Start at the base of the fire and use a swinging motion from left to right, always keeping the fire in front of you.</td>
</tr>
<tr>
<td>3. Class C: Electrical Equipment.</td>
<td>Recommended Extinguisher: Carbon dioxide and dry chemical (ABC Units) extinguishers. Fighting the Fire: Use short bursts on the fire. When the electrical current is shut off on a Class C fire, it can become a Class A fire if the materials around the electrical fire are ignited.</td>
</tr>
</tbody>
</table>

Following is a stepwise procedure for operating fire extinguishers:

- break the seal and remove the hose from its storage position
- remove the pin and depress the cartridge lever to activate the extinguisher
- give the nozzle a quick squeeze to verify the extinguisher is charged
- approach the fire with the wind at your back
- start the flow with the chemical when about three (3) meters from the fire
- direct the stream toward the near edge or base of the fire
- use the full stream – do not throttle the flow of the chemical
- do not aim directly into open-top containers containing burning liquids
- do not turn your back on a fire, even though it appears extinguished: ignition may recur

Care of Extinguisher

According to manufacturer’s recommendations, fire extinguishers must be inspected once a month to ensure operational reliability (e.g., seals must be in
place, the nozzle and hose must be unobstructed, workers must have easy access to the unit).

An annual check should include removal of the cartridge to check if it has been punctured, checking of the dry chemical for moisture or caking, and checking of the hose for obstructions. A record must be kept of all inspections.

3.4 EMERGENCY RESPONSE PLAN

Northern Cross will consult with affected workers in establishing and maintaining the Emergency Response Plans.

All workers must be familiar with and ensure the accuracy of the Site Specific Emergency Response Flowchart for their area and the Corporate Emergency Response Plan.

Workers involved in or coming upon an emergency situation must not take any action that may jeopardize their safety, the safety of others workers, or the public.

The most senior worker at the site will initiate the Emergency Response Plan and contact his or her supervisor at the first available moment to request necessary back up.

Alarm/Air Horn Codes

It is standard practice for calls for help to be sent to the rig crew by sounding an air horn. Northern Cross has adopted a code system which is common to all rigs.

Procedure:

1. The following signals are used to summon a crew member to the rig floor:

   1 short horn: Derrickman
   2 short horn: Motorman
   3 short horn: Lead Floorman
   4 short horn: Second Floorman
   5 short horn: Leasehand

2. The airhorn is also used to let the crew know of an emergency situation:

   1 continuous horn: BOP Emergency. All come to floor.
   2 long blasts: Fire, injury etc. All report to Safe Assembly Area
Communications

- Senior Management will convey any pertinent information concerning emergency situations to interest groups that may be affected. This information will be conveyed in a timely, accurate and consistent manner.

- Senior Management will notify the next of kin in the occurrence of an employee fatality. This information will be conveyed as quickly and professionally as possible.

- Senior Management will activate the Crisis Communication Plan.

Emergency Communications and Transportation

It is critical that rig crews have the ability to contact emergency services and evacuate casualties at all times. In order to ensure that this is the case, every rig must be equipped with some form of mobile communication equipment. The type of equipment present must be capable of providing emergency communications at all times, regardless of prevailing weather conditions or the rig location. In addition, each rig must have at least one vehicle available at all times in case an evacuation is necessary.

Procedure:

1. There shall be at least one operating emergency radio or telephone communication method at each rig at all times.

2. The contact number(s) for emergency services available in the operating area shall be posted at a conspicuous location near the communications equipment. As well, the exact rig location, or directions to the rig, shall be posted nearby. A sample form is attached to this policy. Laminated versions should be used for posting.

3. The Rig Manager is responsible for ensuring that the emergency numbers and rig location information is current at all times.

4. There shall be at least one vehicle, capable of carrying a stretcher, available at all times. This can be the Rig Managers vehicle, the crew vehicle or any other vehicle at the location. The important point is that at least one vehicle be available at all times the rig is operating.

Rig Managers are responsible for ensuring that an emergency vehicle (AND THE IGNITION KEY) is available at all times.
Media Response

- In the event of a crisis, a corporate spokesperson will be designated to issue news releases and co-ordinate ongoing media relations’ activities.

- Employees shall refrain from discussing the event with the media and/or the public.

- In the event of a media inquiry, a Media Inquiry Form will be submitted to the corporate spokesperson.

Post Emergency

- Reporting and notification are to be performed in a sequence that will expedite and facilitate the fastest and most effective response to the situation.

- All emergencies requiring activation of the ERP will be investigated internally, as per the requirements in Section 9 of this manual. In some instances, external agencies may investigate incidents. Company employees are to cooperate fully with the investigators once their credentials have been verified.

- For major or massive emergency situations, do not initiate clean up and work resumption until internal and external investigations are completed.

- For serious accident situations, work resumption may require authorization from a regulatory agency as well as management.

- When clean up is initiated, the individual in charge shall ensure that appropriate PPE is available and worn, and appropriate safety precautions are taken to prevent injury and/or health risks to those involved.

3.5 FIRST AID

First Aid Requirements

An employer must, as required by the Yukon Minimum First Aid Regulations and the Alberta OH&S Code Part 11 First Aid, provide first aid services and maintain first aid equipment and supplies for their workers. Northern Cross has ensured that such first aid services, equipment and supplies are:

- located at or near the work site that they are intended to serve, and
- available and accessible during all working hours, and that the equipment and supplies are
  - maintained in a clean, dry and serviceable condition,
• contained in a material that protects the contents from the environment, and
• clearly identified as first aid equipment and supplies.

In addition, there is an emergency communication system in place to summon first aid and medical services.

A record of all workers who are first aiders will be maintained by Northern Cross on all worksites.

First aid records will be retained for 3 years from the date the incident is recorded.

First Aid Records

The Regulation requires that all injuries must be reported and records for first aid treatment maintained. Written records have to be kept for at least 3 years and include the following information:

• the name of the employee;
• the name and qualifications of the person giving first aid;
• the date and time of the acute illness or injury;
• the date and time the acute illness or injury was reported;
• a description of the acute illness or injury, where it occurred and the cause;
• the first aid provided.

Access to first aid records is restricted to:

• individuals requiring access, use and disclosure of the information for the purpose of:
  ▪ medical treatment,
  ▪ work site inspections,
  ▪ accident and incident investigations, or
• evaluation of health, safety and environmental programs and statistics, and
• the Workers’ Compensation Board for the purposes of work site health, safety and environmental programs and statistics.

First Aid Equipment and Emergency Supplies

It is a regulatory requirement that every worksite be equipped with a minimum level of first aid and other emergency response equipment. It is the policy of this company that emergency equipment at our worksites shall meet or exceed the minimum requirements.
Procedure:

1. The Rig Manager is responsible for ensuring that his rig is equipped with at least one First Aid Kit that meets the Occupational Health and Safety requirements. This kit is to be mounted in the doghouse or in the Rig Manager's trailer. A “First Aid” sign is to be posted on the outside of the building housing the kit.

2. In addition to the first aid kit, each rig is to be equipped with at least one "basket" style of stretcher, with restraining and lowering straps, suitable for evacuating a casualty from the derrick or other location.

3. Each rig shall have at least one clean emergency blanket available, in a protective cover, stored with the stretcher.

4. Clean, full eyewash bottles shall be kept:
   a. In the doghouse
   b. In the mixing shack
   c. In the tool room
   d. Near the pump

3.6 EMERGENCY EXERCISES

- Employees and management are required to participate in Emergency Response exercises as determined by this manual.

- Corporate Emergency Response procedures shall be tested annually utilizing the full support of external emergency services.

- Notification shall be given to affected public that an emergency drill will be taking place.

- Field Emergency Response drills shall be tested on a monthly basis. These drills include but are not limited to procedures for man-down, spill response, vehicle accident and immobilization.

- Training for Emergency Response procedures will occur as soon as possible for a new employee. Continual training will ensure that all procedures are improved upon and employees are proficient in all exercises.

- First Aid exercises shall be updated as required by the regulating agency.
Camp Fire Drill Procedures

The off-shift driller (the driller in camp) is the fire drill leader. He is responsible for:

- knowing who is in camp
- ensuring that everyone is aware of the nearest EXIT relative to their location
- appointing persons to remove fire extinguishers and the first aid kit during fire drills
- conducting fire drills periodically

Fire drills will be conducted in the following manner:

- camp will be immediately evacuated when a fire drill is called
- designated persons will remove fire extinguishers and the camp first aid kit during evacuation
- everyone will meet at the camp light plant building
- the fire drill leader will count heads and shut off the propane supply and generator
3.7 EMERGENCY RESPONSE PROCESS CHART

Emergency Situation

Stop All Work Immediately
(Rig Manager)

Hazard Assessment
(Initiator)

Notify Emergency Response Coordinator who will coordinate Overall Emergency Response Procedures

Establish CEOC
(Operations Manager)

Establish Crisis Communication Plan
(Senior Management)

Contact Media and Handle Inquiries
(Senior Management)

Notify Next-of-Kin For any Fatalities
(Senior Management)

Notify ERCB For Environmental Emergencies
(Senior Management)

Middle Manager Becomes On-Scene Commander Upon arrival at incident site.

Establish REOC and On-Scene Command

Notify Air Monitoring Units Alternate Safety Supervisor Other Wellsite Personnel Medical/Fire Services (Safety Dept.)

Notify Transportation Supervisor Field Office Additional Area Production Personnel Off-Duty Rig Crew Road Block Personnel Evacuation Center Rep. Telephone Coordinator (Emergency Response Coordinator)

Notify School Administrators Residents (Telephone Coordinator)

Notify Field Office RCMP Detachment Disaster Services Alberta HSE, OHS Industry Support Services (Emergency Response Coordinator) (Middle Mgmt.)
4.0 HAZARD IDENTIFICATION & CONTROL

4.1 INSPECTIONS - GENERAL

Inspections assess worksite conditions and processes to ensure company standards are being maintained. Conducting inspections with the checklist (refer to Appendices) on a routine basis ensures the inspector regards the equipment and work process from a safety perspective. Deficiencies that may be routinely missed or ignored are identified in this process. The inspector identifies hazards before they result in accidental loss (i.e. injury, equipment damage, spill, etc.).

4.2 STANDARD

Responsibility:

The Rig Manager should participate in the inspection. The supervisor responsible for the area and one other person will also be involved in the inspection process.

Required Frequency:

A monthly Rig Inspection is required.

Required Format:

The checklist provided in the Appendices shall be completed and a list of deficiencies compiled. Do not concentrate only on physical deficiencies. Review procedures and work habits as well. All noted deficiencies are to be corrected as quickly as practical. Deficiencies that cannot be corrected shall be flagged or another method used to inform others of potential hazard.

Duration:

Inspection of a facility should not last more than two hours.

Report Preparation:

The inspection report does not need to be typed, but shall be neat and legible. A copy of the report shall be maintained for two years in the area office and a copy shall be forwarded to the head office.
Follow up:

The Rig Manager is responsible for ensuring remedial actions are completed in a timely manner. All deficiencies corrected shall be recorded on the inspection checklist. Ongoing issues shall be identified as such on the report, include the status and expected completion date.

Within one month of a completed inspection, the Rig Manager shall resubmit the inspection report to management. The resubmitted report shall include completed remedial actions and the status of incomplete items. Any incomplete items shall be reported on the monthly Health and Safety Report (see Communications section 8.0).

Results of inspections will be discussed at safety meetings.

4.3 **FIRE/EMERGENCY EQUIPMENT INSPECTIONS AND MAINTENANCE**

Responsibility:

The Rig Manager in each area is responsible to ensure all emergency equipment is inspected. This task should be shared among all crew members.

Required Frequency:

All emergency equipment shall be inspected by crew members once per month as required by provincial and territorial OH&S legislation and the National Fire Code. Required maintenance on specific equipment is identified below.

Format:

The Emergency Equipment Checklist (contained in the Appendices) is to be completed and filed each time the equipment is inspected. The checklist is to be used throughout the course of the year. It should be put onto a clipboard and hung at the facility. When the list is complete at the end of the year, it shall be kept on file in the area office for two years. Generally, the monthly inspection is to identify if the piece of equipment is in place and functional, as well as indicate that no maintenance is required at this time (if maintenance is required, see Follow up). Initially, the Emergency Equipment Checklist provided should be filled in to identify the pieces of equipment within a specific facility. After the equipment has been identified on the list, photocopies should be used for each of the inspections.
Follow up:

Any equipment requiring maintenance shall be identified on the checklist. The equipment shall be taken out of service and sent for the required maintenance. If possible the missing equipment should be replaced.

Fire Extinguishers

Monthly:

Check to ensure that the extinguisher is in place, the pin is sealed and the indicator button in the cap is down. If the extinguisher is of the pressurized type, ensure that the pressure gauge indicates a full charge (if the indicator is below the green area, it must be recharged). Extinguishers mounted in vehicles, in buildings or in any other high vibration area should be tipped upside down to break up the powder (this is to be done, at least, every six months).

Annually:

A certified technician must perform inspection, testing and routine maintenance of extinguishers (as per the National Fire Code). This includes:

- Empty and inspect the powder and extinguisher shell;
- Inspect and ensure the hose is unblocked;
- Inspect and weigh the pressure cartridge; and
- Replace gaskets and seals as required.

Every 12 Years:

Hydrotest the shell of the extinguisher.

Fire Blankets

Monthly:

Ensure the blanket is in place and the box is functional (i.e. the blanket can be removed and wrapped around a person in one motion).

First Aid Kits

Monthly:

Ensure the list of contents is checked and replace missing stock (the list should be on the inside cover).
Annually:

Replace dated stock or anything that is old or dirty.

**Stretchers/Rescue Equipment**

Monthly:

Ensure equipment is in its proper place and functional.

**Eyewash and Showers**

Monthly:

Ensure that bottles are full, clean and functional. Test any fixed shower or eyewash systems to ensure they work and that the alarm systems work, if so equipped.

Annually:

Replace solution and date the bottle. Do not use water, especially if unsure that the water is potable.

**Breathing Apparatus**

(See also: Respiratory Protective Equipment Code of Practice, Section 5.3)

Monthly:

Ensure the bottles are full and masks are clean and bagged.

Bi-Annually:

Don apparatus and ensure it is functional. Clean, refill bottle and replace the equipment after testing.

Every 3 Years:

Send unit to a certified inspection and test facility. Fibreglass composite bottles are to be hydrotested.

Every 5 Years:

Metal bottles are to be hydrotested.
4.4 HAZARD REPORTING

Responsibility:

All employees and contractors shall correct any identified hazard immediately, if possible. If it cannot be corrected, inform other workers of the hazard, flag, tag or sign the hazard and report it to their supervisor. It is the responsibility of the supervisors to follow up, as well as to keep employees and contractors informed of the status of a reported hazard.

Reporting:

Generally, hazards can be corrected immediately, especially if they are physical in nature. The reporting and correction of these hazards need not be a formal process. If a hazard is potentially severe in nature and/or may take additional time to correct (i.e. procedural changes, change in design or specification or where additional funds or resources are required) it should be reported in writing. The Hazard Report Form (refer to Appendices) is to be completed and forwarded to the supervisor. A copy of the form should be made and kept by the originator.

Follow up:

When a hazard has been formally reported, supervisors shall inform workers of the corrective action to be taken or the status of a concern on a routine basis (updates shall be provided at safety meetings). This feedback should be provided to the originator of the concern as quickly as possible, even if it is not the desired result or the final solution has not been achieved. All corrective actions taken shall be recorded on the Hazard Report Form or in daily logs when no Hazard Report Form has been used. All hazards with major potential consequence should be discussed in monthly safety meetings. Formally reported hazards shall be included in the monthly Health and Safety Report. Any hazards that have the potential to affect other operating areas shall be shared with those areas through this reporting mechanism.

4.5 CONDUCTING A JOB SAFETY ANALYSIS

Job Safety Analysis is required on all jobs to determine if they are critical. It is often done to improve the safety aspects of a job, however, organizations can also find opportunities to reduce waste, increase productivity, quality and efficiency of an operation and create a safe and healthy work environment (see form in Appendices).

Job Safety Analysis can be used to:

- Update work procedures and practices,
- Create new work procedures and practices,
- Assist in accident investigation,
Train new staff,
Assist supervisors in monitoring work performance,
Assist in modified work assignment, and
Develop recruitment criteria.

Steps involved in a Job Safety Analysis:

- Identify all jobs to determine if they are critical.
- Break jobs down sequentially into individual tasks.
- Analyze tasks for specific hazards.
- Determine control measures to eliminate or minimize the hazards.
- Develop or revise safe work procedures or practices to reflect required changes.
- Implement the control measures in respective activity or job.

It is important to identify the tasks that had either historically been a source of injuries or have a high potential for injury. These critical tasks will have the greatest impact on the safety performance of the company.

Task Inventory

An inventory of all job tasks performed by all Northern Cross employees shall be compiled. When new jobs are created or new tasks added to positions, the Job Inventory will be updated to reflect these changes and a Job Safety Analysis (JSA) performed to evaluate the hazards and risks associated with the tasks. This should also apply to all drilling rig crews and ensure they have a task inventory to cover their activities.

Hazard Classification

Northern Cross uses the following hazard classification tool to assist personnel in classifying hazards according to their severity or impact. Northern Cross will use the following classes of hazards in the assessments and inspections.

**Class A**
A condition or practice likely to cause permanent disability, loss of life or body part or extensive loss of property.

**Class B**
A condition or practice likely to cause serious injury or illness or disruptive property damage.

**Class C**
A condition or practice likely to cause non-disabling injury or illness or non-disruptive property damage.
4.6 RISK ASSESSMENT

Risk assessment is a tool for analyzing the probability of procedure, equipment or facility failure and for calculating the impact of the failure on personnel, the public, the facility or the environment.

A failure that has a high probability of occurrence and that has severe consequences on the environment must be prevented, even at high cost. The cost of a failure is much higher in terms of damage and cost to the company. A low probability, minor impact to the environment constitutes a lower risk.

Steps in Risk Assessment

There are three steps that must be taken to determine the risk and are explained in the charts that follow.

- **Identify the Potential Consequences**
  
The potential consequences of an incident are defined in terms of impact to the company, equipment, the environment and the company's reputation. Specific definitions for each level (catastrophic, critical, marginal and negligible) are established for Northern Cross.

- **Determine the Probability of Occurrence**
  
The probability of occurrence is estimated in a range from frequent, occurring repeatedly, remote and not likely to impossible.

- **Categorize the Risk**
  
The risk is then categorized in terms of high, medium or low risk. Low risk is deemed to be acceptable, medium and high are undesirable or unacceptable, with prompt corrective action required. Once the risk factors have been determined for all company operations, they can be prioritized and action taken in order of priority.
### Estimating Risk

**Figure 4.1 Risk Potential Matrix**

<table>
<thead>
<tr>
<th>POTENTIAL CONSEQUENCE OF THE HAZARD</th>
<th>EXPOSURE AND/OR EXPOSURE FREQUENCY</th>
<th>Likelihood of the Event Happening Again Assuming Nothing is Done to Prevent It</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>High</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Severity Index</strong></td>
<td>People</td>
<td>Asset</td>
</tr>
<tr>
<td>4</td>
<td>Slight Injury</td>
<td>Slight Loss (&lt; $1000)</td>
</tr>
<tr>
<td>3</td>
<td>Minor Injury</td>
<td>Moderate Loss (&lt; $15,000)</td>
</tr>
<tr>
<td>2</td>
<td>Major Injury</td>
<td>Major Loss ($15,000 - $250,000)</td>
</tr>
<tr>
<td>1</td>
<td>Fatality or Permanent Disability</td>
<td>Massive Loss (&gt; $250,000)</td>
</tr>
</tbody>
</table>

- **High Potential Hazards** (CLASS A)
- **Low Potential Hazards** (CLASS C)
- **Medium Potential Hazards** (CLASS B)
5.0 RULES AND WORK PROCEDURES

The following rules and safe work practices are based on industry and legislative standards. Generally, they identify the minimum requirements for conducting a specific task and should be followed under normal conditions. If deviation from these practices is necessary, the management group must be consulted and an equivalent level of safety assured.

The methods by which tasks are performed continually change. If there is a more practical or safer method of performing a task that requires a change in the written procedure, the supervisor should be informed. Procedures will be changed to suit distinct area requirements while maintaining the minimum level of safety identified in applicable legislation and by good industry practice. The intent is to ensure the greatest practical level of safety while performing these tasks. All employees and contractors are encouraged to reference this information as well as participate in the review, development and continuous improvement of these practices.

5.1 HEALTH & SAFETY RULES

Smoking, Lighters and Health Rules

- Smoking is permitted only in designated areas at operating leases.
- Open ignition sources of any type should be kept a distance of 25 metres from a live well or any other operating gas processing equipment. Do not leave a vehicle unattended and running within this distance.
- Lighters are to be of the closed mechanism type (Zippo). Pressurized butane or open striker lighters are not permitted on any operating lease. Do not carry "strike anywhere" matches on an operating lease.

Alcohol & Drugs

- Alcohol and illegal drugs are strictly prohibited. No person shall be allowed to remain at a worksite or operate any piece of equipment while under the influence of illegal drugs or alcohol.
- Caution must be practiced when taking prescription or over-the-counter medications. Ability to perform work safely must be considered. Precautions printed on the label of medications must be followed.

Personal Conduct & Appearance

- Horseplay is strictly forbidden.
- Loose clothing and hair that is longer than shoulder length shall be confined. This is to ensure it does not become entangled in operating machinery or obscure vision.
All employees and contractors shall be clean-shaven (within 24 hours) when working or entering onto an operating lease potentially containing sour gas (hydrogen sulphide). This applies to hydrogen sulphide of any concentration within the production gas. This rule is to ensure the employee can maintain an airtight seal with breathing apparatus as well as to ensure that a seal may be maintained with a resuscitator if rescue is required.

Oil saturated and contaminated clothing shall be removed as quickly as possible so as to prevent a fire or health hazard. This includes fire retardant clothing as it will not protect the wearer if soaked with a flammable or combustible material.

Housekeeping

- Employees and contractors must maintain their vehicles and worksites in a clean and orderly fashion.
- All tools must be properly stored.
- All garbage must be picked up and properly disposed of.
- Equipment and materials must not block access and egress to and from the worksite or create a hazard for other workers.
- Oil soaked materials or rags must be disposed of in covered containers.

Firearms

- Firearms, except for flare guns, are not permitted on any Northern Cross lease unless otherwise approved by management.
- In the event of problem bears in the area, one designated person may be authorized to carry a gun. Training and possession permits are to be current for the designated person.

Security

- Ensure all company property is protected from theft, vandalism, etc. Please remember to lock company vehicles, offices, yards and shops when left unattended for prolonged periods. Leave yard lights on, where applicable, to reduce the potential for loss.
- The company will not be responsible for personal property left at a worksite or in a vehicle.
- Management must approve removal of any company tools, equipment or materials.
- Be sure not to remove any drawings or take pictures of any of the company’s operating facilities without written consent.
Discipline

Employees and contractors are expected to perform their jobs safely and efficiently in accordance with company rules and procedures, as well as government legislation. Depending on the seriousness and intent of employee actions, disciplinary action will generally be taken for infractions of stated requirements as follows:

- First infraction - verbal warning.
- Second infraction - written warning.
- Third infraction - day(s) off without pay and written warning.
- Fourth infraction - termination of employment.

Managers will record all infractions in the employee or contractor’s file.

Depending on the severity of an infraction, management may accelerate the disciplinary process or combine any of the above actions.

5.2 PERSONAL PROTECTIVE EQUIPMENT

Hard Hats:

Will be supplied by the company or contractor and must be worn when on an operating lease or whenever falling materials or a bump hazard exists.

Safety Boots:

Shall be provided by the employee or contractor and must be worn when on an operating lease or wherever a hazard exists for foot injury. Safety boots should be a lace-up type as these are easier to remove should an injury occur and they also provide ankle support. Safety boots shall be chemical resistant and shall meet a CSA Grade 1, green patch standard.

Gloves:

Appropriate gloves shall be worn when handling hot, sharp or splintered material.

Chemical Clothing:

Shall be provided by the company and worn whenever there is a potential of being splashed by caustics, acids or other hazardous substances. Consult the appropriate Material Safety Data Sheet (MSDS) for the required protective equipment. This equipment includes PVC clothing, rubber boots, goggles, face shields, rubber gloves, etc.
Eye Protection:

CSA approved safety glasses with side shields or goggles shall be worn as the job requires and will be provided by the company. Prescription glasses shall be hardex treated. Wear safety glasses whenever chipping, grinding, cutting, etc.

Fire Retardant Clothing:

Shall be provided by the company or contractor and worn whenever the potential exists for a flash fire or whenever on a worksite. Fire retardant clothing must be kept clean to ensure its fire retardant qualities.

Northern Cross's standard for fire retardant clothing includes any outer layer clothing that will not support combustion, including Nomex III and Proban.

Fire retardant clothing shall be worn as the outer layer of clothing. Other clothing worn should be 100% natural fibre material. This includes cotton and wool. Synthetic and nylon materials should be avoided even under fire retardant outerwear.

Fire retardant clothing shall cover full arms and legs.

PVC rainwear is inherently fire retardant and may be worn as an outer layer. Plastic and synthetic rainwear is not permitted.

Hearing Protection:

Shall be provided by the company and worn as the job requires or as posted.

Breathing Apparatus:

Shall be worn as required for a specific hazard and/or as identified in a specific Material Safety Data Sheet (MSDS).

Fall Protection:

All persons working over a height of 3 metres (10 ft.), provided he or she is not on a proper work platform with guardrails, shall wear a full body harness and attached lanyard. Lanyards shall be no more than 1.5 metres (5 ft.) long and the free end shall be securely attached to a structure that is able to withstand any impact it may be exposed to. It is preferable that a shock-absorbing lanyard be used. Full harnesses shall also be worn whenever work is done in a suspended cage or elevated mobile platform. All fall arrest equipment shall be inspected routinely and kept in a clean and usable condition. Any fraying of threads or
straps that affect more than 20% of the total strap width shall be repaired or the harness replaced. Safety belts may be used in situations where a fall is not possible but access is restricted (such as working on a platform without guard rails or on a roof). In such cases, the lanyard must be attached to restrict the worker's access to the edge of the structure.

5.3 RESPIRATORY PROTECTIVE EQUIPMENT CODE OF PRACTICE

Application

OH&S legislation requires appropriate Respiratory Protective Equipment (RPE) be provided by the employer and worn when a worker is, or may be exposed to, an "Immediately Dangerous to Life or Health" (IDLH) atmosphere when oxygen concentration drops below 19.5% or when airborne contaminants exceed the Occupational Exposure Limit (OEL). OELs are identified by substance or chemical in the provincial and territorial Occupational Health and Safety Regulations or the appropriate Material Safety Data Sheet (MSDS). OELs are generally quoted in parts per million (PPM). (See Gas Detection, section 5.6.)

Respiratory Protective Equipment Types

Generally, there are two types of RPE used in the oil and gas industry, supplied air breathing apparatus & half face (filter) respirators.

Filter Respirators:

- Are only able to filter a limited number of airborne contaminants at low concentrations for relatively short periods of time;
- Are usually only used for dusts and organic vapours;
- Before use, employees and contractors must be trained on when to change the filter cartridge, the limitations of the cartridge they are using and a facial seal fit test must be performed and recorded.
- **Filter type respirators ARE NOT TO BE USED IN HYDROGEN SULPHIDE OR OXYGEN DEFICIENT ATMOSPHERES.**

Supplied Air Respirators:

- Are common in two forms, as an SCBA (self-contained breathing apparatus, where the air bottle is worn on the back) and remote SABA (supplied air-breathing apparatus, where air is supplied by a hose). Selection of the appropriate breathing apparatus generally depends on the duration of the job (supplied air is normally used for longer duration jobs).
- Must be worn whenever an Immediately Dangerous to Life or Health (IDLH) atmosphere is to be entered, including oxygen deficient atmospheres (less than 19.5% by volume) or toxic atmospheres (where
the occupational exposure limit is exceeded and a cartridge respirator cannot be used).

- Must meet CSA Z94.4-02 standards, including a 30-minute air supply.
- Be of the type where positive pressure is maintained in the mask and the mask is equipped with a nosepiece during cold weather.
- Supplied air respirators must:
  - Not be used with a hose more than 90 metres (300 ft.)
  - Be continuously attended or be equipped with an audible alarm that warns when the supply bottle reaches 500 psi.
  - Be used with hoses that are a standard 1/4" inside diameter, hydrocarbon and chemical resistant, non-kinking, only used for breathing air and rated for a working pressure of 250 psi.
  - Be equipped with a 5-minute escape bottle for emergency purposes.

**Fit Testing**

There are two easy and generally accepted methods of fit testing - mechanical and qualitative.

- The mechanical method of fit testing is usually reserved for positive pressure, supplied air respirators because the flow of air past the seal of the mask is outward past the seal. This method involves either blocking the inlet valve to the mask and gently inhaling so that the mask is drawn into the face, or blocking the exhalation valve and gently exhaling. Either way, the wearer should be aware of any leakage past the facial seal. This method should be used whenever supplied air RPE or a cartridge-type dust mask is donned.

- The qualitative method is generally required when an organic vapour filter respirator is used (it will not work for dust masks). As part of pre-use training, Isoamyl Acetate Vapour (Banana Oil) is passed under and round the seal of the respirator. If the wearer can smell the banana, the seal and fit are not adequate. This test should be performed when the wearer is making movements that would approximate a normal work situation. All fit tests of this nature should be recorded in the wearer’s training file, quoting the type of mask and cartridge used and the date of the test. A copy of the fit test record can be found in the Appendices.

**Classification of Respiratory Hazards**

- Review the work, the confined space to be entered and the substances normally associated with the space.
- Test and inspect for suspected substances. If possible, reduce or eliminate the airborne contaminants so breathing apparatus is not
required, or is only necessary as additional protection. If unsure of the potential atmosphere, wear breathing apparatus.

- It is the responsibility of site supervision to ensure all potential hazardous substances are identified, discussed with workers and the appropriate RPE is selected and used.
- Consult the appropriate Material Safety Data Sheet (MSDS) for information regarding allowable safe concentrations of airborne contaminants and the appropriate RPE.

Training

- All employees and contractors shall be properly trained in the use, care and limitations of respiratory protective equipment before it is used. Training is provided through external training courses such as H₂S Alive and internal training sessions during shutdowns, etc.
- Training on specific equipment shall also be provided before equipment is used (consult with manufacturer recommended use, care and maintenance guidelines).
- Management is responsible to ensure all employees and contractors are properly trained in the use and care of respiratory protective equipment before it is used at any Northern Cross property or job.

Considerations for the Use and Care of Respiratory Protective Equipment

- Ensure employees and contractors are fully trained in the equipment's use and are aware of potential hazards.
- Ensure workers in the area are aware of potential hazards.
- Always ensure a backup person is present and is able to affect a rescue if required. Ensure backup equipment is also available and in operable condition.
- If a remote supplied air system is being used, always ensure that the backup person is tending the air supply bottle.
- Always check and ensure the breathing apparatus and air supply are in an operable condition before entering into an Immediately Dangerous to Life or Health (IDLH) atmosphere.
- Always check facial seal prior to entering an Immediately Dangerous to Life or Health (IDLH) atmosphere.
- Do not enter a flammable environment, even with breathing apparatus on.
- Always plan the work, ensuring that enough air will remain to allow your safe exit from the Immediately Dangerous to Life or Health (IDLH) atmosphere. Do not work beyond the alarm point (usually 500 psi). Clean the mask, place it in a clean plastic bag and ensure the bottle is refilled when finished.
**Maintenance**

- All respiratory protective equipment shall be kept clean, operational and ready for use at all times with air supplies full.
- Emergency respiratory protective equipment shall be checked at least on a monthly basis to ensure the above is maintained.
- A qualified technician, a minimum of once every three years, shall check respiratory protective equipment even if it has not been used.
- Bottles shall only be refilled with respirable breathing air that is tested and meets CSA Standard Z.180.1-00. This test determines dew point, carbon monoxide, carbon dioxide and total hydrocarbon levels.
- Do not refill bottles with air from a utility air compressor or any other non-approved source.

**Inspect Respiratory Protective Equipment, BEFORE and AFTER Use**

**Mask:**

For cracks or tears, physical damage or distortion, inflexibility of rubber parts, cracked or badly scratched lenses. Check nose cup for condition and presence of inhalation valves, exhalation and inhalation valves for proper installation and function.

**Regulator:**

Inspect for cleanliness, damaged or missing parts. Check the valve positions to ensure bypass and purge valves are closed and that supply valve is open. Inspect gauges for proper operation and calibration. If a new type RPE, also inspect face seal gasket.

**Hoses:**

For cracks, cuts or damage. If the high-pressure steel braid hose is cut to the steel braid, replace it immediately. Ensure the coil inside the mask supply hose (older models) is in proper position to prevent any kinking of the hose. On supplied air respirators, check the egress bottle check valve by disconnecting the supply hose and briefly opening the bottle – air should not escape through the open supply hose. Ensure all connections are of the proper type.

**Filter:**

Check for instalment of improper cartridge - ensure the correct filter cartridge is provided for the substance or chemical to be encountered. Check the expiry date on cartridges.
Bottle:

Check for proper connections and seals. Check the pressure gauge to ensure proper operation and calibration. Check overall condition for dents, deep cuts or abrasions, pressure and hydrotest date.

Cleaning & Disinfecting:

- Persons using RPE are responsible for cleaning, inspecting and ensuring it is ready for the next use.
- Remove and dispose of filter cartridges unless apparatus has only been used a short time and will be used again by same wearer.
- Remove face pieces and clean with soap and water, mild bleach solution or cleaner recommended by manufacturer.
- Dry masks and seal them in a clean plastic bag.

5.4 CONFINED SPACE ENTRY CODE OF PRACTICE

Application

A confined space is defined as an area or space that has one or more of the following characteristics:

- Is enclosed, or partially enclosed, and has restricted access or egress (not normally intended for human occupancy);
- Due to its construction, design, location, atmosphere or substances is, or may become, hazardous to a worker entering into it; or
- Does not have an easy means of escape or rescue for a worker entering into it.

By definition, this does not just mean vessels, tanks, areas, etc. that have traditionally been identified as confined space in the past. Potentially, areas such as a rig’s sub-floor or an excavation could also be considered confined spaces. Do not assume that an area is not a confined space just because it has never been considered one in the past.

Responsibility

It is the responsibility of affected employees to prepare confined spaces according to this procedure for maintenance work or inspection. The worker responsible for the confined space shall complete the work plan and the Confined Space Entry Checklist (refer to Appendices) as well as to ensure all workers involved are aware of the hazards and required precautionary measures. A pre-job safety meeting shall be held prior to the initial entry into any confined space to discuss the requirements and precautions identified in this procedure.
This will be done through completion of the checklist (located in the Appendices) or as identified in the initial inspection of the space.

- Always plan the entry in advance to as great a degree as possible. Identify the potential problems that could occur and the required contingencies and rescue that may be necessary, as well as the plans and equipment that may be required. Identify the products involved and read the applicable Material Safety Data Sheets.
- Confined spaces at the worksite should be identified on the Site Specific Emergency Response Plan (ERP).

**Potential Hazards**

The typical types of hazards that may be encountered and planned for include:

- Toxic vapours may result from contaminants in the space. They can be released over the duration of entry from scale or sludge or be generated from mechanical processes such as welding, grinding, clearing, etc.
- Lack of oxygen causing asphyxiation may result from product or purge gases that displace oxygen from welding gases or from metal oxidization.
- Oxygen enriched atmospheres. Welding equipment or other processes may cause these atmospheres.
- Flammable and combustible hazards. Gases, liquids or other materials introduced into the space such as wood or other building materials cause these hazards.
- Injury from mechanical equipment such as mixers.
- Electrical shock from lighting or tools.
- Contact with chemicals, corrosives, cleaners or processed products.
- Pyrophoric iron or iron sulphide deposits.
- Other physical hazards caused by heat, noise, falling, excessive cold, etc.

**Emergency Equipment & Planning**

Additional equipment that should be considered for confined space entry include:

- A means of communication (i.e. radio, phone, etc.);
- Self-contained breathing apparatus;
- Flashlight;
- Harness and rope; and
- Gas detector.

Emergency planning should include, but not be limited to:

- Ensuring competent and trained personnel are available throughout the duration of the entry to conduct a rescue if required;
Communication methods are available to call for emergency response (i.e. intrinsically safe radios or portable phones); and

Ensuring the stand-by person is fully aware of his duties in an emergency situation and is provided with the appropriate equipment and emergency contact numbers.

**Stand-by Person Qualifications & Training**

A watch person shall, for all entries, be posted outside the door or entryway to the confined space. If entry is made at several points, consider having a watch person at each point. Watch person duties include:

- Remain in continuous communication with the workers inside the space;
- Alert workers to hazards that may exist and evacuate workers should conditions become hazardous;
- Summon emergency response personnel should life-threatening conditions develop. DO NOT enter the space without other personnel in attendance for backup;
- Occasionally or continuously gas test, depending on what was determined in the pre-job safety meeting; and
- Ensure all workers are out of the space at breaks and at the end of the shift. Mark the entrance to the confined space to ensure no further entry.

**Isolation & Decontamination**

- Attempt to de-pressure, empty and purge as much product as possible before opening the confined space;
- Positively isolate the space by installing blinds or blanks, by disconnecting or double blocking and by bleeding valves. All isolations must be made as close to the confined space as possible to eliminate dead spaces in pipes. When the double block and bleed method is used, valves must be locked and tagged;
- All isolations must be checked by both the affected worker and the workers’ direct supervisor;
- All electrical equipment must be locked out and tagged, including mixers, heat tracing, fan motors, etc.;
- Open the vessel only after it has been proven to be de-pressured. Use a gas detector and breathing apparatus if flammable or toxic substances are expected; and
- Clean and decontaminate the space as much as possible from outside. Ensure that vacuum and wash trucks are electrically bonded to the vessel.
Ventilation

- On all process vessels or tanks, consider providing mechanical air movers to ensure a positive ventilation;
- Draw air through space instead of pushing it through;
- Take advantage of natural draft;
- Ensure exhaust from engines or other sources is not being drawn into the space; and
- Electrically bond air movers to the vessel.

Initial Inspection, Gas Testing & Temperature

Throughout the process of preparing a confined space for entry, the potential atmosphere in the space should be tested. Gas testing is sometimes difficult from outside the space when it has first been opened. Depending on the configuration of the space, it may have to be entered to conduct the required gas tests.

- Shut off air movers at least 15 minutes prior to the initial test, allowing any gas released from sludge or scale to be detected.
- Gas testing should be conducted from the manway first, checking for heavier and lighter-than-air substances. Refer to the product's MSDS (Material Safety Data Sheet) to know what to test for as well as a substances effects, relative weights, how to test, etc.
- Initial entry to perform gas tests shall be made with supplied air breathing apparatus and a watch person at the entryway if the potential for an IDLH (Immediately Dangerous to Life or Health) atmosphere exists or if entry will be made into liquid in sour service. Conduct gas tests, always checking for lighter and heavier-than-air gases. Appropriate chemical resistant clothing, gloves, boots, eye protection and face protection should also be worn, depending on the substances involved.

- Allowable gas limits for safe entry:
  - Oxygen 19.5 - 23% by Volume
  - Flammable Gas 10% LEL (lower explosive limit) Maximum
  - Hydrogen Sulphide 10 ppm Maximum
  - Other Toxic Gases As identified by the Material Safety Data Sheet (MSDS)
  - Temperature 30°C Maximum

If these limits cannot be maintained, the space is to be considered Immediately Dangerous to Life or Health (IDLH) (see sub-procedure below).

- Inspect internals for liquids, scale and sludge. Determine what they are and whether or not they may release gases when disturbed. Can these materials be removed from outside the space? What additional precautions need to be taken while these materials are removed?
Inspect for other physical hazards and consider the precautions required to control these (i.e. bumping, tripping, falling, structural integrity of metal, etc.). Erect scaffolding where required. Do not use ladders in a confined space.

Inspect for signs of pyrophoric material (these will spontaneously combust when dry and exposed to oxygen). They are usually found only in sour service vessels. Pyrophoric materials will not pose a hazard if kept wet while removed.

Consider whether continuous monitoring is required or if periodic monitoring will ensure worker safety. When work stops for more than half an hour, the space should be re-checked.

Entry

Considerations for safe entry:

- **DO NOT ENTER A SPACE WHERE A FLAMMABLE ENVIRONMENT EXISTS.**
- Only use electrical equipment that is explosion and vapour proof, low voltage or that is Ground Fault Interrupter (GFI) protected and rated.
- Ensure a safe work permit (see Appendices) has been issued for entry into the space (if applicable) prior to entry.
- If welding or other work that may generate a hazard for workers is to be performed, ensure continuous gas monitoring is conducted.

**IDLH (Immediately Dangerous to Life or Health) Entry**

The following additional considerations should be taken if the confined space cannot be fully decontaminated and/or gas test results cannot be met:

- No more than two workers should enter the space at one time.
- All workers entering the space shall wear breathing apparatus and shall be in full body harnesses with lifelines attached.
- There should be two watch persons to affect a rescue if required.
- Even if breathing apparatus is worn, no one shall enter a flammable atmosphere. The maximum allowable flammable gas concentration shall be 20% LEL (lower explosive limit).

### 5.5 HYDROGEN SULPHIDE

**General**

Hydrogen sulphide (H₂S) is a naturally occurring, highly toxic gas that is colourless and will destroy the ability to smell at higher concentrations. In higher
concentrations, it can paralyze the breathing control centre in the brain and disable the respiratory system with one breath.

**Characteristics/Effects**

- Colourless gas.
- Smells like rotten eggs at between 1 ppm and approximately 100 ppm. The sense of smell is deadened after this concentration;
- Heavier than air, it settles in low areas, excavations, confined space, etc.
- Will readily mix with liquids and then be released when liquids are disturbed;
- Will cause irritation of eyes and throat at approx. 200 ppm;
- Will cause respiratory distress within 2 minutes at 500 ppm;
- Will cause immediate respiratory arrest at 1000 ppm.

**Occupational Exposure Limits (OEL)**

- 10 ppm a person can work for 8 hours without adverse affect.
- 15 ppm a person can work for 15 minutes without adverse affect.
- 20 ppm is the ceiling, not to be exceeded without supplied air breathing apparatus.

On sites where H₂S is expected, all personnel should have a current H2S Alive certificate.

**Rescue**

H₂S sites should have a wind sock in several locations and at the Muster Point.

- When someone has been overcome by H₂S, or this is suspected, **DO NOT RUN INTO THE AREA TO AFFECT A RESCUE**. Proceed in the opposite direction, call for help and backup, don breathing apparatus and then remove the casualty from the area.
- Only after you and the casualty are free of the affected area can you remove the breathing apparatus and apply artificial respiration. When the casualty exhales, avoid breathing in the exhaled H₂S. A casualty who is being revived from H₂S poisoning is often violent; be prepared for this.
- Any person who has been overcome by H₂S shall seek medical attention, no matter what the circumstances, as H₂S can turn into hydrosulphuric acid in the lungs and cause pneumonia.
Work Procedures

- Whenever possible, work with others on a sour lease. This is not always possible, so maintain communication as often as possible via radio when on a sour lease alone;
- Work upwind of the operation as much as possible; and
- As much as possible, avoid enclosed areas, H₂S process buildings, tanks, trenches or any other place where H₂S may settle. Treat these areas as potential confined spaces when on a sour lease.

5.6 GAS DETECTION

Responsibility

- The affected worker is generally responsible for gas testing. The safe preparation of operating areas and equipment for maintenance work should include gas detection as part of this preparation.
- Gas detection equipment must be made available to all operations personnel, be maintained in a usable condition and be calibrated at least every three months. Management is responsible for providing the required equipment as well as training employees and contractors in the proper use and application of equipment.

Three types of gases are commonly tested for in the oil and gas industry, namely: oxygen, flammable gas and toxic gas.

Oxygen

- Testing is usually done when a confined space needs to be entered. The concentration of oxygen in normal breathing air is 20.9% by volume.
- All gases are capable of displacing oxygen in a confined space. Although a gas may not be considered toxic (such as nitrogen) it may be able to effectively displace oxygen to the point where a worker will suffocate.
- Oxygen detection equipment usually depends on a wet catalytic cell that is subject to freezing and should not, therefore, be left in extremely cold environments for prolonged periods of time.
- The normal level of oxygen in breathing air is 20.9% by volume. Allowable limits for oxygen concentration are:

    A maximum of 23% by volume.
    A minimum of 19.5% by volume.

If these limits cannot be maintained, supplied air-breathing apparatus shall be worn.
Reduced oxygen will result in asphyxiations below approximately 15% by volume. Increased oxygen concentration is toxic after a period of time but, more importantly to realize, is the increased fire hazard it produces.

**Flammable Gas**

- Detection is to be performed to identify the presence of a flammable gas prior to the performance of hot work or confined space entry.
- Flammable gas is usually measured in % LEL, which stands for the lower explosive limit of the gas used to calibrate the instrument (usually methane or natural gas). The detector must read 100% LEL (lower explosive limit) when measuring the calibration gas before the mixture will ignite. If a gas other than the calibration gas is being measured, the explosive limit may be reached at a limit lower than 100%. This is why the allowable limits are as low as they are.
- Allowable limits for flammable gas are:
  - A maximum of 20% LEL (lower explosive limit) for any work other than confined space entry and hot work.
  - A maximum of 0% LEL (lower explosive limit) for hot work or confined space entry.
- All flammable substances must be in a gaseous state and mixed with air in order for the gas detector to produce a reading.
- It is important to monitor flammable gas periodically throughout the day as, when combustible liquids heat up, they release gas. This is particularly important if the job involves hot work where heat is generated and may boil gases off of liquids.
- Prior to use of a flammable gas detector, ensure that it has been calibrated (within the past three months) and is operating properly.
- Do not allow the sensor to get wet as this will destroy the cell and the reading will not be accurate.

**Toxic Gas**

- Detection is normally performed prior to workers entering enclosed areas or working on process systems.
- Detection is performed using Colorimetric tubes (Draeger or Gastec are common detector names). The Colorimetric tubes are filled with a catalyst that reacts with the substance being measured and is dependant on the amount of gas being drawn through the tube.
- Most tubes provide a reading in parts per million (PPM). There are 10,000 PPM in 1% by volume. Consult with the applicable material safety data sheet (MSDS) for the allowable level or concentration, known as the Occupational Exposure Limit (OEL).
Testing Methods (Technique)

- The appropriate worker shall perform testing prior to the performance of hot work, confined space entry or any work where workers may be exposed to harmful gases.
- All gas test results shall be recorded on the safe work permit (see Appendices).
- Check the operation of the detector with a known source and concentration of gas. Do not test it on a process gas source or the gas tank of a vehicle as this often throws the detector out of calibration.
- Potential sources of gas in the area should be tested first, such as dead spaces below grade, sewers, sumps, excavations, open sources of hydrocarbon, sample points, drains, etc.
- Always test for heavier and lighter than air gases in air traps. If a small source is located close to the job, attempt to isolate it and monitor it periodically in the event it becomes worse.
- Be sure not to draw water into the detector. If this occurs, the gas detector reading will usually wander uncontrollably. It must receive maintenance and be re-calibrated before being used again.
- Periodically monitor hot work and confined space entry. A general rule is to re-test every 2 - 3 hours.

5.7 SAFE HANDLING OF HYDROCARBONS & CHEMICALS

Liquids in Drums and Small Containers

Generally, flammable and combustible liquids are supplied and dispensed from 200 litre (45 gallon) drums. The following points should be considered when handling, storing and dispensing from these containers:

- Ensure all such chemicals are stored outside (wherever possible), are on a proper loading rack, are properly labelled and properly secured.
- Ensure proper stands and barrel movers are supplied and used for dispensing purposes.
- Wherever a barrel is laid over on its side, it should be fitted with automatic shut off valves.
- Containers used for accepting a substance should be properly WHMIS (Workplace Hazardous Materials Information System) labelled, should be made of metal and should be properly bonded to the drum.
- Do not transport liquids dispensed into small containers in the cabs of vehicles.
- Ensure all containers of chemical and flammable liquids are properly secured when being transported.
Workplace Hazardous Materials Information System (WHMIS)

WHMIS legislation was initially designed to provide all workers with information on the chemicals and substances they handle and may be exposed to. There are three main requirements for WHMIS compliance:

Training

- All persons working at a worksite where chemicals or controlled substances are being handled must be provided with training on legislative requirements and how the company meets these requirements.

Labelling

- All containers of hazardous controlled products must be labelled, either with a supplier's label (where the product is still in the original shipping container) or a workplace label (where product has been decanted into another container).
- Labels are to identify the product by name, hazard classification (i.e. corrosive, toxic, flammable, poisonous, reactive, compressed, etc.) and the required protective equipment for safe handling.
- Whenever any product is put into another container, ensure a Workplace Hazardous Materials Information System (WHMIS) tag or label is affixed to the container.
- Labelling may take the form of colour coding of pipes and vessels. A chart indicating Workplace Hazardous Materials Information System (WHMIS) requirements will also be posted. Even if colour coding is provided, sample points or areas where workers are in contact with the controlled product shall be labelled.

Material Safety Data Sheets (MSDS)

- MSDS provide detailed information specific to the product being handled. Information in the MSDS for a product includes physical, chemical, toxicological and flammability information. The MSDS also includes emergency response procedures, required safe handling techniques and manufacturer information.
- MSDS specific to all the products at the worksite must be made available to all workers and information must be kept current (within three years).
- Operations personnel are responsible for ensuring that their MSDS information is available at worksites and is complete.
- As part of routine pre-job planning and safety, MSDS should be reviewed.
- The location of the MSDS information should be identified in the Site Specific ERP (Emergency Response Plan).
Transportation of Dangerous Goods (TDG)

The purpose of TDG legislation is to ensure all people who may be exposed to, or who must respond to, an emergency are provided with information about the safe handling of hazardous products in transit. There are also three main requirements for TDG legislative compliance.

**Placarding**

- All controlled and designated product loads must be placarded on all four sides of the vehicle. These placards identify the product’s characteristics (i.e. flammable, compressed, poisonous, etc.).

**Manifesting**

- Information indicating the product, shipper, receiver and carrier of the product must accompany the product, with the driver, for each load carried.

**Training**

- All carriers of these products are required to be certified in the requirements and the fulfillment of the legislation.
- All operations personnel and contractors expected to carry dangerous goods on behalf of Northern Cross are to be TDG (Transportation of Dangerous Goods) trained. Management and field supervisors are to ensure compliance with this standard.

**Exemption Permits**

Members of the Small Explorers and Producers Association of Canada are exempt from specific requirements of Transportation of Dangerous Goods (TDG) legislation when the applicable exemption permit is carried with the dangerous goods in transport as follows:

- Permits exempt the carrier from the requirement to placard and the requirement to manifest, except as indicated below. (Parts IV and V of the TDG Regulations).
- The load of dangerous goods cannot exceed 500 kg. in weight. If carried by a bulk carrier, volume of production fluids can exceed 500 kg.
- A copy of the permit must accompany the load.
- Contract companies transporting product, samples, etc. for Northern Cross only may use permits.
Copies of individual specific permits are available with the operators. Each permit specifies conditions that should be reviewed before they are used.

5.8 LOCKOUT AND TAGOUT (LOTO) PROCEDURES

Responsibility

The applicable worker shall lock out and tag all normally energized equipment before work is performed on it or before a worker may be exposed to a hazard created by the equipment. Any subsequent worker shall lock out and tag the equipment before working on it.

Practice

- Only keyed locks shall be used for lockout.
- The appropriate crewmember will install his or her lock on the equipment breaker with a multiple lockout device and a "Do Not Operate" tag. The crewmember's name, the current date and the reason for installing the lock shall be recorded on the tag.
- The crewmember shall then try to start the piece of equipment.
- Each maintenance worker who works on the piece of equipment shall install his or her own lock on the breaker before starting work on that piece of equipment and shall remove it whenever the work is complete or when he or she is not working on the equipment.
- The only person who should remove the original lock is the person who installed it. If that person is not available to remove the lock, the supervisor shall be consulted before the lock is removed.

5.9 EQUIPMENT ISOLATION

Responsibility

Employees are responsible for the positive isolation of process equipment that normally contains hazardous materials before any work is performed on that equipment.

Positive Isolation means:

- Blinding, Plugging or Blanketing
- Double blocking valves with bleed valve open between the block valves

Practice

- Positive isolation shall be made as close as possible to the affected equipment.
All blind or isolation locations shall be flagged or tagged to indicate a blind is in place.

When the double block and bleed method is used, isolation valves must be locked in the closed position and the bleed valve shall be locked in the open position.

Consider thermal expansion between isolations in piping.

Protection should be provided to prevent overpressuring.

Blind locations should be identified on the safe work permit.

Only management, as per the Occupational Health and Safety Act, may grant deviation, in writing, to this standard.

5.10 MATERIAL HANDLING

Hoisting and Rigging Operations

Hoisting can be one of the most hazardous processes, whether hoisting a chemical barrel into the back of a pickup or hoisting a new skid package into place. Most accidents occur because equipment used is not designed for the load to be lifted or because the equipment is damaged. The following factors should be considered when making any mechanical lift:

- Only qualified, trained and, where applicable, certified persons shall operate a mechanical lifting device or rig a load.
- Any hoist over a capacity of 2000 kg. must have all inspections, operations and maintenance recorded in a log book.
- All lifting equipment shall be inspected prior to each use to ensure there is no obvious physical damage.
- Ensure only equipment designed and rated for a lift is used.
- Slings and lifting lines shall not be used if cut or frayed, where the damage exceeds 10% of the total thickness.
- Hooks are not to be spread more than 15% or twisted more than 10 degrees and they must be equipped with safety latches.
- Any load that cannot be held while being lifted shall have a tag line attached and be guided by another worker.
- Never stand under a suspended load, under any circumstance.
- Never ride on a suspended load.
- See Electrical Hazards (section 5.11) for safe clearances from power lines.
- Signs and barricades should be considered to keep other personnel out of the lifting area.
- If a man basket is used, it shall be stamped with a provincial/territorial OH&S approval number, be secured with an additional sling attached above the headache ball and all persons shall be tied in with harness and lanyard.
“INTERNATIONAL HANDS SIGNALS FOR HOISTING”

These signals are to be used in any crane or hoisting procedure where a signal person is required. The appropriate signals can be found in the appendices of this manual and hoisting personnel should become familiar with these signals.

Manual Lifting

Accidents involving manual lifting and back injury account for the vast majority of industrial injuries. When lifting:

- Stay as close to the object to be lifted as possible;
- Bend at the knees and let your legs do the work, not your back;
- Keep your body straight at all times. Do not twist your back with a load. Instead, shuffle your feet and turn your entire body; and
- Use mechanical devices as much as possible to make heavy lifts.

5.11 ELECTRICAL SAFETY & STATIC HAZARDS

Electrical Equipment

- All electrical equipment on an oil and gas lease can be a potential source of ignition;
- Any electrical equipment, regardless if it is battery operated or otherwise, must not be used on a lease unless approved by the lead operator and a gas test is performed. Exceptions to this rule are flashlights or instruments that have an intrinsic safety or explosion proof rating on them (a label affixed to the piece of equipment will indicate the appropriate CSA approval, i.e. Class 1, Div. 11);
- Normal extension cords or electrical equipment should not be used in process areas. All electrical equipment should be inspected to ensure it is in proper working order and condition before use. Check to ensure that insulated housings on portable power tools are not cracked and that cords are not frayed or pulled out; and
- Only qualified electricians are to service or maintain electrical equipment.
Safe Clearances

Although most vehicles are not high enough to contact live overhead power lines, if the line is of a high enough voltage electrical current can arc to the vehicle. The following are the required safe distances in any direction to be maintained from power lines:

- 2 metres  Up to 5,000 volts
- 3 metres  Between 5,000 and 50,000 volts
- 4.5 metres  Between 50,000 and 250,000 volts

Where these safe distances cannot be maintained, the lead operator shall ensure the local power company is informed and is at the jobsite before work commences.

If power lines do make contact with a vehicle, the tires will act as an insulator. Do not attempt to get out of the vehicle as contact with both the truck and the ground will provide a path for the electrical current. If egress from the vehicle is necessary, jump clear of the vehicle.

Static Charge Dissipation

Liquids being transferred or dispensed carry small pieces of solid, electrically conductive material. These particles will become electrically charged and may release this charge to a ground source, such as the inside of a truck tank or a small container causing an arc or a spark. If a flammable mixture is in the container, this spark may cause a fire or explosion.

Metalic braid hoses will not always serve as the bond between a truck tank and a production tank or vessel because:

- There is no guarantee that the braid in the hose is making the proper bond; and
- The electrical current often travels around the outside of the hose (depending on the product and its speed through the hose), and will not allow the current to travel against the flow in the hose, thus allowing the charge to dissipate.

Whenever flammable liquids are transferred from one container to another, always ensure they are bonded to each other and grounded. Ensure that the containers are made of a conductive material such as metal to allow the static charge to dissipate.

Other operations where static electricity dissipation should be considered include steam cleaning, sand blasting, moving belts and handling of powders or dusts.
5.12 COMPRESSED GASES

- Compressed gas cylinders shall be handled, used, transported and stored in the upright position at all times.
- Secure bottles with chain or a non-combustible strap. Do not use rope if possible.
- Caps should be in place at all times except when cylinder is in use.
- De-pressure hoses, regulators and torches when left overnight.
- Do not store compressed flammable gases inside normally classified areas.
- Do not drag, overheat and weld on cylinders or use cylinders as rollers or work supports.
- Always use appropriate regulators and equipment with compressed gases.

5.13 SAFE USE OF LADDERS & SCAFFOLDING

Ladders

Like any other piece of equipment, check to ensure a ladder has been maintained in a safe condition before using it. Check for broken or bent rungs and rails and ensure proper non-slip feet are in place.

The following precautions should be taken when using ladders:

- Always fully extend a step ladder. Do not lean it against something;
- Do not work from the top step of a step ladder or the top three rungs of an extension ladder;
- Extension ladders should be placed one metre away from the vertical for every four metres in height;
- An extension ladder should extend at least one metre above a platform if it is to be used to access the platform;
- An extension ladder should always be secured at the bottom and tied off at the top. If possible, have someone hold the bottom of the ladder until it is secured;
- Ladders should never be painted as this could hide cracks or other damage;
- Do not carry tools up and down ladders. Use a canvas sack and rope to lift tools instead;
- Always face the ladder when ascending and descending; and
- Do not reach from side to side. Move the ladder to the location where it is required.
**Scaffolding**

- Whenever possible and practical, provide scaffolding for workers when the job is involved and will likely last a long time;
- Only qualified and trained personnel shall erect scaffolding. After being erected, scaffolding should be inspected by someone other than the erector using the following criteria to determine if it is safe to use;
  - Scaffolds shall be constructed out of materials designed and identified for this purpose. All materials shall be stamped to identify them as scaffold components.
  - Frame structure shall be set on a stable and flat surface. Where this is not possible, levelling jacks shall be used;
  - Platforms must be supported every 3 metres (10 ft.)
    - Platforms shall:
      - Be of 2" x 10" or equivalent lumber
      - Be at least 24" wide
      - Not extend out from a support point
      - Be secured in place
      - Be equipped with kick plates and guardrails
  - If the height of the scaffold exceeds three times the smallest base dimension, it shall be braced onto a supporting structure at a spacing of 4.6 vertical metres or provided with outriggers to prevent tipping;
  - Rolling scaffolds shall not be moved with a worker on it and shall have its wheels locked in place while in use.

**5.14 VEHICLE OPERATIONS**

**General**

All diesel vehicles shall be equipped with a positive air intake shut off with controls located in the cab.

All company vehicles, or those operated on the company’s behalf, shall be equipped with at least a 20 lb. BC rated dry chemical extinguisher, a first aid kit, flares, a tow strap, booster cables and, in remote areas (more than 50 km. from populated areas), a survival kit.

**Towing**

- Ensure that chain or rope is attached to a secure part of the frame and not to steering components, the bumper or other exterior fixture;
- Do not use combination rope or strap and chain. If the rope or strap breaks, the tension in the rope can act as a sling-shot for the chain end;
Always ensure the ends of the towing line are well attached, not just loosely hooked;
Avoid jerking the vehicle as this puts extreme strain on the vehicle and the towing line; and
Do not place yourself in the line of tension or line of fire of the towing line as, should the towing line break or become detached, you may be struck.

**Powered Mobile Equipment**

Operators of powered mobile equipment (quads and/or ski doos) must have sufficient education, training, and experience. A worker must not operate powered mobile equipment unless the worker:

1. Is trained to safely operate the equipment
2. Has demonstrated competency in operating the equipment to a designated competent worker
3. Is familiar with the equipment’s operating instructions
4. Is authorized by the employer to operate the equipment.

An operator of powered mobile equipment must report any conditions affecting the safe operation of the equipment, operate the equipment safely, maintain full control of the equipment at all times, use the seat belts and other safety equipment, ensure that passengers in the powered mobile equipment use the seat belts and other safety equipment, keep the powered mobile equipment free of objects that could interfere with the operation or create hazards.

Before operating any powered mobile equipment the operator must complete an inspection of the equipment and the surrounding area to ensure that the equipment is in a safe operating condition and that no worker, including the operator, is endangered when the equipment is started up. A checklist will be used for pre-use inspections.

Powered mobile equipment will be inspected/re-certified by a competent worker for defects and conditions that are hazardous or may create a hazard, in accordance with manufacturer’s specifications. The equipment must be maintained according to the manufacturer's instructions. A record of the inspections and maintenance carried out will be kept at the work site and readily available to a worker who operated the equipment.

A worker must not operate powered mobile equipment (forklift, all terrain vehicles and tank trucks) unless competently trained, demonstrates competency in operating the vehicle by a competent worker, is familiar with the operating instructions and is authorized by the company to operate the equipment. A person must not leave the controls unattended unless the equipment is secured against unintentional movement by an effective method of immobilizing the
equipment, and unless a suspended or elevated part of the equipment is either landed, secured in a safe location, or both.

Workers will not smoke within 7.5 metres of a vehicle while it is being refueled or refuel a vehicle when there is a source of ignition within 7.5 metres of that vehicle.

Power mobile equipment weighing 700 kilograms or more must be equipped with a rollover protective structure that is either supplied by the manufacturer or certified by a professional engineer as being suited to that equipment, or safe work procedures will be instituted to eliminate the possibility of a rollover. Equipment fitted with a rollover protective structure manufactured on or after July 1, 2009 must have seat belts for the operator and passengers that comply with SAE Standard J386 (2006), or SAE Information Report J2292 (2006) and that is designed to prevent the worker from being thrown from the vehicle or equipment while the vehicle or equipment is in motion. No person shall use or operate a machine that is equipped with a restraining device unless the person is wearing the restraining device.

Powered mobile equipment shall be equipped with a roof, protective screen, or cab to protect the operator when there is a risk of objects falling from above, and/or if an object being handled by the equipment could shift and impact the operator.

When powered mobile equipment is left unattended, action must be taken to keep unauthorized people from moving the equipment, and to prevent the equipment from inadvertently moving. The brakes should be set and the wheels blocked when on sloping ground. Elevated parts must be lowered to the ground.

If an inspection indicates that powered mobile equipment is hazardous or potentially hazardous, the health and safety of a worker who may be exposed to the hazard will be protected immediately, the powered mobile equipment will not be operated until the defect is repaired or the condition is corrected, and the defect will be repaired or the unsafe condition corrected as soon as reasonably practicable. An out-of-service tag will be affixed to the equipment until it is repaired.

5.15 TOOL & POWER EQUIPMENT SAFETY

Safe Use of Tools

- Always choose the right tool for the job;
- Inspect the tool for any obvious physical damage or frayed cords. Ensure guards are in place. Ensure power tools have been equipped with appropriately rated blades, wheels, bits, etc.;
Defective or broken tools should be removed from service, repaired or replaced. Do not leave a broken tool for the next person;

The striking surface of tools must be kept free of burrs and cracks;

Always secure yourself, keeping your hands and body out of the path of the tool's movement;

Pneumatic tool hoses shall be secured with whip checks;

Wear appropriate eye, face, hand and hearing protection;

Guards shall not be removed from any tool;

Fixed shop tools shall be equipped with a face shield and a sign requiring the shield’s use; and

Bench grinders must be equipped with a tool rest set above the centre line and within 3 mm of the wheel. The wheel surface shall be routinely cleaned to ensure it is kept flat. Do not use the side of a grinding stone, as it is not designed for this stress.

5.16 HOT WORK

Hot Work

Hot work generally refers to work that is performed within close proximity to live process equipment and involves a source of ignition. The source of ignition can be found in the form of an open flame or a piece of unclassified electrical equipment such as a flashlight or camera flash. The following factors should be considered when performing hot work:

- Assess the job or work. Does it have to be performed in the process unit or can it be performed in a safe area?
- Perform a flammable gas test (see Gas Testing, Section 5.6). Record test results on the Safe Work Permit (see Appendices).
- Identify potential sources of gas and attempt to isolate them from the job. Cover drains and sewers and shut in other sources of hydrocarbon where possible.

Welding

- Ensure all welding equipment is inspected prior to use. Inspect for visible damage, check hoses and connections and ensure there are flashback arrestors on either the torch or bottle end of hose connections;
- Ensure proper personal protective equipment is worn;
- Do not wear contact lenses where the potential for flash injury to the eye exists. Contacts will intensify the damage;
- Clear or sun safety glasses provide adequate protection from stray light. Ensure others are wearing them;
- Ensure adequate fire fighting equipment is at the site of the welding process. Two portable extinguishers are generally sufficient;
Process equipment or vessels to be welded must be adequately purged and emptied of all hydrocarbons. A gas tester will not detect heavier hydrocarbons when they are at ambient temperature. When these hydrocarbons are heated in processes such as welding, they give off flammable vapours;

Ensure all process equipment is positively isolated;

Ensure welding bottles are never taken into a confined space and that the torch is removed from the space at the end of each work shift;

Ensure adequate ventilation is provided for welders, especially in confined spaces;

Ensure paint, coatings, grease, etc. are removed from the piece to be welded;

Ensure ground cables for electric welders are as close to the operation as possible and in a safe location;

Lighters and matches must never be used for lighting welding torches. A striker must be used;

Never clean oxygen fittings with grease or other hydrocarbons as this can result in an explosion within the fittings, bottle, etc.; and

De-pressure hoses and fittings when job is finished for the day.

5.17 LOADING/UNLOADING TANK TRUNKS AND VACUUM TRUCKS

Truck Loading/Unloading

The hazards generally associated with truck loading are the potential for fire, explosion and exposure to toxic fumes. The following factors should be considered for truck loading and unloading operations:

Load lines and stations should be:

- Identified with the appropriate Transportation of Dangerous Goods (TDG) and Workplace Hazardous Materials Information System (WHMIS) signage;
- Provided with ground cables attached back to structural steel and wheel chocks with a sign requiring their use;
- Provided with a container to catch spills and drips at the point of connection;
- Provided with line caps and chains;
- Provided with an automatic shut off valve in the event of fire, as well as a portable fire extinguisher within 50 ft;
- Hot work should not be performed within 30 metres of a hydrocarbon loading operation. Do not smoke within this distance. Shut off the engine;
- Diesel equipment must be equipped with automatic intake air shut-offs;
- Loading and unloading operations shall not be conducted during electrical storms;
Attach a bonding cable before load line is attached and do not remove it until the load line is detached;
Install wheel chocks before loading operation is started; and
Ensure appropriate Transportation of Dangerous Goods (TDG) placarding is in place.

Sour Product Loading

- All persons handling or transporting sour products shall hold a current H₂S Alive ticket;
- Supplied air breathing apparatus shall be worn whenever the truck operator can potentially be exposed to H₂S (when venting, gauging tanks, connecting or disconnecting, etc.). Gas tests shall be conducted for H₂S before breathing apparatus is removed; and
- Whenever there is a potential that a product to be transported contains H₂S, Northern Cross or its contract representative must provide prior notice to the carrier.

Also see sections regarding Respiratory Protective Equipment (Section 5.3) and Hydrogen Sulphide handling (Section 5.5).

Vacuum Truck Operations

- Vacuum trucks shall not enter into any operating area or onto any lease until the proper authorization/permit has been issued. Vacuum truck operators are not to operate any process valves or connect to process equipment without approval.
- Truck operators should always attempt to work upwind of the product to be vacuumed;
- Ensure the vehicle is bonded and grounded as required. If fibreglass wands are used to vacuum out a tank, ensure the metal hose connection is bonded to the tank;
- A vent hose routed away from the work area and preferably downwind should always be used when handling potentially toxic or flammable product;
- Truck operators shall not leave the truck while it is in operation;
- Ensure that an MSDS is provided to the truck operator for the product being hauled;
- Vacuum truck tanks should be unloaded using gravity or proper pumping procedures only. Do not pressurize the tank; and
- Iron sulphide is produced by a corrosive reaction between sour products and the internals of production equipment. It is a black or dark brown scale or powder that, when dry, can spontaneously ignite and burn in air. Whenever iron sulphide is suspected, keep the material wet and dispose of it as hazardous waste.
5.18 SAFE-WORK PERMITS

Application

Safe work permits are intended to be a checklist for both the worker (issuer) and the maintenance personnel (receiver) and are designed to:

- Identify potential hazards;
- Ensure the required steps are taken to prepare equipment for maintenance activities; and
- Ensure all required safety precautions are taken before a job starts.

Requirement

Permits should be issued when non-routine maintenance work is to be performed that may create a hazard to workers. Permits are not required for routine operation related work or work performed by employees. A safe work permit can be found in the Appendices of this manual.

Responsibilities

Issuer

- Prepare process equipment for maintenance;
- Eliminate or control any known hazards;
- Identify required safe work procedures and special personal protective equipment;
- Review the permit and scope of work with the permit receiver; and
- Periodically visit the worksite to ensure the job conditions and scope of work have not changed.

Receiver

- Review the scope of work, permit conditions, safe work procedures and precautions with the other workers performing the job;
- Ensure all workers abide by the conditions and procedures stated on the permit;
- Ensure only the work identified on the permit is performed in the specified locations;
- Evaluate the adequacy and supply of specified safety equipment;
- Post the permit in a conspicuous location at the worksite;
- Stop the work immediately if the conditions of the job become hazardous and inform the permit issuer;
- Ensure the jobsite is cleaned up after the work is complete, sign off and return the permit to the issuer.
Permit Types

Cold Work - when non-routine work involves the opening of process equipment where there will be no ignition source present.

Hot Work - when work requires the use of any ignition source within a process area and/or where an explosive air/gas mixture may be present. This permit is completed to ensure that a gas test is performed before the ignition source is introduced into the area.

Confined Space - see Confined Space Entry Procedure (Section 5.4).

Permit Life

A safe work permit is not valid for more than one normal work shift (maximum 12 hours). If the work is not complete at the end of that shift and has to be continued, the permit can be extended for another 12-hour period. Renewal of the permit requires all conditions be reviewed and gas tests performed again and recorded. Under no circumstance will confined space entry permits extend beyond the initial time period. If the work is finished for the day, the permit should be returned to the issuer and signed off. The job’s status shall be indicated on the permit.

Permit Distribution

When the permit has been completed and reviewed by both the issuer and the receiver, the original stays in the book with the issuer and the copy stays with the receiver at the jobsite. The receiver’s copy is to be signed off and returned to the issuer when the job is completed or at the end of the shift. The original is to be kept on file for 2 years.

Gas Testing

Gas tests must be performed whenever a hot work or confined space entry permit is issued. For hot work, a flammable gas test is required. Oxygen, flammable gas and H₂S (if applicable) must be checked prior to confined space entry on each day permits are issued. The scope of the job will dictate how often gas tests should be re-done or the need for continuous monitoring. The general rule is to re-test every two hours. The initial gas test shall be recorded on the front of the permit before it is issued with subsequent tests being recorded on the back of the permit.
Allowable Gas Limits

- **Flammable Gas**
  - 0% LEL (lower explosive limit) hot work
  - 20% LEL (lower explosive limit) cold work

- **Oxygen**
  - 19.5% by volume minimum
  - 23% by volume maximum
  - Detectors are usually calibrated to 20.9% by volume

- **Hydrogen Sulphide**
  - Occupational Exposure Limit (OEL) is 10 ppm based on an 8 hour exposure
  - 15 ppm for 15 minutes short term exposure limit (STEL)
  - 20 ppm is the maximum for any period of time

- **Toxic (Other)**
  - Consult the Material Safety Data Sheet (MSDS) to determine the appropriate OEL

**NOTE:**

No person shall work in an atmosphere that:

1) Has a toxic atmosphere above the occupational exposure limit without wearing the appropriate breathing apparatus; or
2) Is explosive or flammable.

**General Rules**

- Permits shall be issued specific to:
  - The type of work being performed;
  - The location(s) and equipment to be worked on; and
  - The time and date of issue.

Similar jobs to be conducted on the same day in different locations within the issuer's area of responsibility can be covered on the same permit provided the description of work and all locations are identified on the permit.

- Identify the type of work to be performed. If the work involves both hot work and confined space entry, check off both areas.
- All permits will be prepared completely free of misunderstanding in meaning and intent. The issuer and receiver will review the scope of work and permit conditions together.
Provide workers with applicable Material Safety Data Sheet (MSDS) information for the products they may be exposed to during the course of work.

5.19 WILDLIFE SAFETY

5.19.1 Bears

Grizzly Bear vs. Black Bear

When working in Bear Country it is crucial to know what types of bears you may be dealing with. In many areas throughout Alberta, British Columbia and the general northwest portions of North America, you may come into contact with either Grizzly ("Grizzlies") or Black bears ("Blacks"). Grizzlies are common in the Eagle Plains area of the Yukon.

It is important to know the distinct differences and similarities between these two types of bears. They react differently to situations and your ability to distinguish them from each other may have an impact on how the bear will react and what the outcome of the encounter may be.

In this section, we will discuss several characteristics of Grizzly and Black bears including their physical appearance, colour variations, temperament and physical capabilities and species characteristics. We will also try to put to rest some myths associated with bears and their behaviour. In subsequent sections we will discuss bear ecology and evolution, diet and locations; what to look for when working in bear country, recommendations on how to avoid encounters and what to do in the case of a close contact with a bear.

Physical Appearance

The easiest way to distinguish the difference between a Black and a Grizzly is the physical appearance. Grizzlies are generally much larger than Blacks. The common name Grizzly is derived from the term *grizzled*. This refers to hair that is either flecked with grey at the ends or is a mixture of grey and darker colours. Many, but not all Grizzlies show this grizzling as a flecking of white on the ends of the dark hairs on their coats. A Black almost never has it.¹
“Grizzled flecking” that derives the name of the Grizzly Bear.

There are several other physical characteristics that help to distinguish between the bears. One of the most noticeable differences is the Grizzly shows a distinctive hump between their front shoulders. This is a large muscle mass covered by relatively long hairs, giving further evidence for the name Grizzly. This large muscle mass is also tangible evidence for the bears digging habits. Although this is consistently a defining characteristic for species determination, in certain situations, a Black can also have this characteristic. When digging with their head below the level of the rest of their bodies, the muscle mass between the shoulders seems to appear as a hump.

Other features include the facial profile. Grizzly bears typically have a more slender snout and concave profile from their eyes to the end of their snout. A Black has more of a convex profile than that of a grizzly. The snout seems to be more pronounced and have a light-colored area just behind their noses and extending around the snout. Grizzlies may also have this light colored area, but it is not as distinct.
Grizzlies have lighter-colored claws than those of a Black. They are also substantially longer (over twice as long). However, if you are close enough to tell the difference in length and colour of a bear’s claws, chances are you’re in big trouble.

One distinct characteristic of a Black is they sometimes have a distinct white patch on their chest. This is never found on a Grizzly.

Distinct white patch across chest is found only on Black Bears.

Colour Variations

The name “Black Bear” is somewhat misleading. Although a great number of Blacks are actually jet black in colour, a great number are also found in variations. Colours such as blonde, light brown, cinnamon, chocolate brown, even white have also been identified. The white variations are not albinos (although some albinos have been discovered), but a sub-species (*Ursus americanus kermodiie*) native and almost exclusive to the Princess Royal Islands in B.C.
Because of the possibility of “grizzling” being superimposed on basic coat colour, the colour patterns of grizzlies are many. Grizzlies may be pale – almost luminous blonde, or reddish blonde or light brown, or medium to dark brown or even black. Colour combinations are common. Fortunately black is probably the least common coat colour, but it occurs frequently enough in areas where Blacks and Grizzlies exist that no one should assume that a black-bear is, in fact, a Black Bear.¹

Temperament

In this section we will attempt to give an account of bear behaviour and give an indication of what might be your best course of action. It must be stressed however that THESE ARE SUGGESTIONS ONLY. Bears are not robots, and each individual has its own unique personality and experiences.

We will explore some characteristics common to both Grizzlies and Blacks as far as learning and instincts are concerned. We will also explore the differences in aggression between Grizzlies and Blacks.

When you see a bear, you want to know not only whether it is a Grizzly or a Black, but also whether it is a female with young. Fortunately, cubs are usually no farther than 100 yards away from their mother. However, bears have been known to separate from their cubs up to several hundred yards. A mother separated in this way still has her protective instincts and will attack if she feels her cubs are being threatened. If a Grizzly is seen at a distance, it may take up to an hour to determine whether she has cubs or not, due to cubs resting or hiding under a bluff or long grass.

The variability of bear behaviour, even in situations that are superficially similar, can be illustrated by considering the case in which a person at close range
suddenly confronts a Grizzly bear mother with young cubs. She does not invariably charge the person, although there is a certain possibility of her doing so. A decision is quickly made by the bear. Once may say that little thought may be involved, but previous factors and experiences most certainly are involved in the process. Instincts regarding defence of young interact with instincts related to survival and avoidance of danger. The personality of the bear comes into play.

Bears are curious. This curiosity around people will usually lead the bear to people’s food and/or garbage. Once the bear becomes habituated, it may eventually lead to the death of the bear. Even though curiosity is part of the essence of a bear, it may not be a good trait around people.

Grizzly bears seem to be significantly more wary of people and human environments that are Black bears. Blacks appear to habituate faster to people than do Grizzlies, though no scientific evidence has been done to establish this as fact.

Black bears to be their rule except during the breeding season when adult males may fight more often with one another.

Aggression is important not only among adult male bears during breeding season, but is periodically important throughout the lives of all bears. Predation is a form of aggression that is practiced by both Grizzlies and Blacks as the opportunity arises.

**Grizzly Bear Aggression**

When in congregations, Grizzlies form a hierarchy of dominance. The most dominant and aggressive is consistently the largest male in the area. An observer may be quick to disagree with this statement. The largest males always seem to be walking slow and lumbering calmly throughout the others. Do not let this calm façade fool you. Battle scars and experience tell different stories. Following the dominant male are adult females with cubs. Sub-adult males and smaller adult males and females round out the hierarchy.

Aggression among adult males reaches a peak during the breeding season (Late Summer). During this period adult males, in contrast to their usual behaviour become extremely aggressive.

Because adult bears have the power and weapons to kill one another, all successful bears readily communicate with a language of aggression and submission. Threat and appeasement signals have evolved because they reduce the incident of actual combat and the danger of injury to both parties.
The following chart describes some of these signals:

<table>
<thead>
<tr>
<th>Behaviour Component</th>
<th>Dominant Male (%)</th>
<th>Subordinate Male (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Locomotion</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approach</td>
<td>93</td>
<td>7</td>
</tr>
<tr>
<td>Charge</td>
<td>85</td>
<td>15</td>
</tr>
<tr>
<td>Run or Walk Away</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Back Up</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Stiff-Legged Walk</td>
<td>56</td>
<td>44</td>
</tr>
<tr>
<td><strong>Contact</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bite</td>
<td>77</td>
<td>23</td>
</tr>
<tr>
<td>Swipe</td>
<td>81</td>
<td>19</td>
</tr>
<tr>
<td><strong>Body Orientation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lateral</td>
<td>71</td>
<td>29</td>
</tr>
<tr>
<td>Sitting</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>Lying Down</td>
<td>29</td>
<td>71</td>
</tr>
<tr>
<td>Higher Elevation</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td><strong>Head Orientation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Down</td>
<td>69</td>
<td>31</td>
</tr>
<tr>
<td>Dropped</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Facing Away</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Neck Stretch</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td><strong>Mouth</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shut</td>
<td>76</td>
<td>24</td>
</tr>
<tr>
<td>Open</td>
<td>36</td>
<td>64</td>
</tr>
<tr>
<td>Showing Canines</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Muzzle Twist</td>
<td>87</td>
<td>13</td>
</tr>
<tr>
<td>Jawing</td>
<td>61</td>
<td>39</td>
</tr>
<tr>
<td><strong>Ears</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Back</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td><strong>Vocalization</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Huffing</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Woofing</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Growling</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Roaring</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Bawling</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

What does an understanding of behaviour among Grizzlies tell us about human safety around these bears? In bear-bear interactions the frequency of contact and injury is low. Most components of aggressive behaviour relate to bluff and threat. In bear-person interactions, when a bear is trying to move a person away, as when the bear’s personal space is being violated, bluff and threat are also typically used. Contact occurs infrequently in Grizzly-human encounters, just as it does in bear-bear encounters.

Bears like any other carnivore, seem ready to chase anything that runs. In bear-bear encounters, few bears that stand their ground initially are physically attacked. This information combined with the finding that many persons have been injured while trying to run from Grizzlies, further reinforces the idea of standing one’s ground if you are hiking and are confronted by an aggressive Grizzly bear.
While Grizzlies don’t communicate with people the same way they communicate with other bears, some actions that people may take can be readily recognised by a Grizzly in certain contexts:

- A direct stare with eye contact is an aggressive or dominance signal.
- A loud, sharp shout or other loud noise is a dominance signal.

**IF** a person has decided to try to intimidate a Grizzly, then the above may be appropriate actions. Personally, I prefer to not intimidate Grizzlies.

- Conversely, by not staring and not making noise, you may be able to calm down an agitated female with cubs.

Again, the above are suggestions only. The best way to deal with bear encounters are on a case-by-case basis. The knowledge that you gained from the chart on the previous page should be applied as to whether the bear you have come upon is dominant or subordinate. Once you have established this, you can better decide on your course of action.

**Black Bear Aggression**

Black bear interactions have many of the same traits as those of Grizzlies. All bears follow the dominant-subordinate structure when interacting. Aggression is a means used by individual bears to help them gain resources such as food or mates. Submissive behaviour allows a bear to signal another that the dominant can have the resource in dispute, at least for the moment.

Black bears will congregate in a manner very similar to that of Grizzlies. When food is abundant, concentrated and prolonged in availability, as at a dump, they will come together and tolerate mutual spacing ranging from five feet to one hundred feet or more. As with Grizzlies, when the resources are more dispersed but still somewhat concentrated, a separation of typically one hundred yards or more is normally maintained by mutual avoidance.
As with Grizzlies, Blacks show certain patterned signals to communicate with each other. Some of these patterns are outlined in the chart below:

<table>
<thead>
<tr>
<th>Behaviour Component</th>
<th>Female with Young (%)</th>
<th>Adult Male (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical Actions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Entering Dump (No Fear)</td>
<td>33</td>
<td>66</td>
</tr>
<tr>
<td>Slow Approach</td>
<td>59</td>
<td>41</td>
</tr>
<tr>
<td>Head Down, Arched Back</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Standing Broad Side</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Standing Stiff Legged</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Mouth Open</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Jaw Snapping</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Paw Swat or Cock</td>
<td>76</td>
<td>24</td>
</tr>
<tr>
<td>False Charge</td>
<td>89</td>
<td>11</td>
</tr>
<tr>
<td>Chase</td>
<td>87</td>
<td>13</td>
</tr>
<tr>
<td>Head to Head</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Charge with Contact</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Inflicting Injury</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td><strong>Vocalization</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Huffing</td>
<td>100</td>
<td>0</td>
</tr>
<tr>
<td>Snorting</td>
<td>97</td>
<td>3</td>
</tr>
<tr>
<td>Gurgling</td>
<td>74</td>
<td>26</td>
</tr>
<tr>
<td>Loud Growling</td>
<td>0</td>
<td>100</td>
</tr>
</tbody>
</table>

In a manner similar to Grizzlies, the head, ears and mouth assume many different positions that appear to be recognised as signals by other bears. While most of the signals used by Blacks are similar to those of Grizzlies, two differences stand out: Black bears either cock a forearm, as if to swat the ground, or actually do this quite often. This behaviour is seldom observed in Grizzlies. The other difference is that Grizzlies typically growl loudly when fighting. Black bears do not.

Most Black bear-inflicted injuries are minor. But it must be stressed that Black bears may become predators on man, although rarely, and in other cases may inflict serious injury. Anyone interested in safety around bears should remember that the power to injure or even kill is always there.

**Capabilities and Characteristics**

Adult males are longer and heavier than their female counterparts. The males grow every year of their life, while the females reach their peak size and stop growing in early adulthood. Other than by their size, male and female bears are hard to distinguish from one another if there are no cubs around.

The size range of a Grizzly ranges from 250 – 350 kilograms, although some of the larger male bears can weigh up to and more than 500 kilograms. Black bears are somewhat smaller than Grizzlies; ranging from 135 to 200 kilograms.
A bear’s lips, unlike those of other animals such as the wolf or bobcat, are free from the gums and can be manipulated with amazing dexterity. This adaptation and a long manipulative tongue greatly assist the bear when it feasts on tiny blueberries or even tinier ants. The ears are rounded and the eyes small. The tail is very small and inconspicuous.

Both Grizzly and Black bears have feet that are well furred, on which it walks like a human being with the entire bottom portion of the foot touching the ground. Each foot has five curved claws, which it cannot sheathe. These are very strong and are used for digging and tearing out roots, stumps, and old logs when searching for food.

The eyesight of the bear is relatively poor, but its senses of hearing and smell are well developed. A startled animal will usually attempt to get downwind from an intruder and make identification by smell. Under favourable conditions bears can detect carrion, which they scavenge, at considerable distances.

Both Grizzlies and Blacks may appear awkward as they shuffle along, but can move with amazing speed when necessary. For short distances, they can run up to 55 km/hr. They are good swimmers and frequently cross rivers and small lakes.

Climbing is second nature to Black bears. Young animals take to trees when frightened. They climb with a series of quick bounds, grasping the tree with their forepaws and pushing with their hind legs. When descending they travel backwards, frequently dropping from heights up to 4.5 metres.

Grizzlies aren’t as adept at climbing, due to their massive size and weight. Cubs are capable of climbing high into trees however when startled. Grizzlies have been known to climb up trees when in pursuit. It is recommended that if you choose to climb a tree to evade a Grizzly, you choose a tree in which you can climb at least 33 feet. That’s the highest that a Grizzly has climbed to pull someone down.³

Bears are strong…very strong. Trying to physically subdue an enraged adult Black or Grizzly is like wrestling with a tank. Occasionally, you may find a vulnerable spot and stop the bear but, generally, you are better off trying to avoid or outwit it.¹

When male Grizzlies, each weighing more than 400 pounds, fight for dominance they are able to grab one another in their jaws, plant their feet and lift the opponent completely off the ground and throw it in the air, or down a riverbank.
Myths

1. Bears can’t run downhill.

False….Bears can run up to 55 km/hr uphill, downhill, across a hill, whatever. This is their terrain. Even the fact that they run downhill slower than uphill doesn’t mean they won’t catch you if you run. **They run faster…. period.**

2. Bear bells will keep away bears.

False….Bears are curious animals. The sound of bells may not have the desired effect on bears; in fact it may attract them. It is a good idea to carry a sound maker with you in the bush, but carry a small foghorn instead. A few short blasts every few miles, and continual talking and/or singing will work much more effectively than relying on a bell.

3. If I carry Bear Repellent, I’m safe.

False….Even when humans are sprayed by pepper spray (which is the same as bear spray) they can continue functioning if they are preoccupied with what they are doing. **If a bear wants to get at you, bear spray may not stop him.**

4. Bears can’t climb trees.

False…As was mentioned earlier, climbing trees is second nature to Black bears and even Grizzly cubs may do it to escape danger when threatened. Mature bears are less likely to climb a tree, but they are capable. A full-grown Grizzly bear can still climb over 30’ up a tree.

5. When a bear attacks, play dead.

True….sort of. **IF A GRIZZLY BEAR IS ATTACKING YOU, PLAY DEAD.** Most of the time they do not intend to consume you. If they are content that the danger has passed, they will leave. Remain motionless for a period after the bear has left to ensure that it is gone.

**IF A BLACK BEAR IS ATTACKING YOU, DO NOT PLAY DEAD.** A Black bear is more likely to continue to attack and consume you if you play dead. Fight off a Black bear with whatever you can find. Attack the eyes, ears and especially the nose. These are the sensitive spots on a bear. It won’t be fun, but it may save your life.
6. Bears are stupid animals.

False….The fact that bears often return to the same spot when a food source is found is evidence of learning. I have seen bears outwit bear traps and still take the bait. When Officers are attempting to trap a bear, it is often a requirement not to have a vehicle with emergency equipment (light-bar) on it, because they recognize that as danger and will not come into the open.

Northern Cross Yukon will provide a Bear Kit at sites where bears may be a problem containing:
1. Information about bears
2. Fog horn
3. Flare pistol

5.19.2 Caribou

The caribou is a medium-sized member of the deer family. They are cloven-hoofed cud-chewing animals. Unlike other members of the deer family, both male and female caribou carry antlers. The caribou is well adapted to its environment. Its short, stocky body conserves heat, its long legs help it move through snow, and its long dense winter coat provides effective insulation, even during periods of low temperature and high wind. The muzzle and tail are short and well haired.

There are three types, or subspecies, of caribou in North America:
   a) Peary caribou - a small white caribou that spends the entire year on the treeless tundra of the Canadian high Arctic.

   b) Barren-ground caribou – these are the most plentiful and the one forming the large herds that each year migrate between the tundra and the trees.

   c) Woodland, or mountain, caribou – they do not form vast herds or make extensive migrations. Rather, they spend most of the year in smaller groups that move between the boreal forest and open mountain habitats.

Both barren-ground and woodland caribou are found in the Yukon.
Caribou Conservation

Wildlife tourism is important in many parts of Canada occupied by caribou. In the north, vast herds of migrating caribou present a wildlife spectacle unequalled on this continent and, as an attraction to naturalists, photographers, and licensed hunters, could contribute to a tourist industry.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has assessed the Northern Mountain population of woodland caribou, which occurs in the Yukon Territory, the Northwest Territories and British Columbia, as being of special concern. A species of special concern is one that may become threatened or endangered because of a combination of biological characteristics and identified threats.

One major threat that caribou face is vehicle collisions. It is the most direct and significant threat to caribou in areas where roads intersect their habitat.

Caribou Safety Guidelines

• Do not disturb, hunt, trap, feed or harass wildlife within the project footprint.

• If caribou are encountered along the access route, they should be given the right-of-way and should be left undisturbed.

• Relay sightings of wildlife by radio to all vehicles to reduce collision occurrences.

• Slow down and yield to caribou along Dempster Highway between Eagle Plains Lodge and egress points off the Dempster Highway to avoid caribou mortality.

• All incidents with wildlife shall be reported to the District Conservation Officer in Dawson City at 867-993-5492.

• Should caribou be encountered within the vicinity of the project area, the District Conservation Officer shall be contacted immediately. The District Conservation Officer shall have the authority to require that all project activities stop until further notice.

• Employees and contractors should exercise caution and travel at reduced speeds when caribou are sighted or known to be in the project area.
5.19.3 Wolves

Description

Wolves inhabit the entire Yukon except for the icefield ranges of Kluane National Park. The total Yukon population is estimated between 4000 and 4500 wolves. Wolf distribution is closely linked to the ranges of their main prey: moose, caribou, and Dall’s sheep.

Most adult male Yukon wolves weigh in between 38 and 52 kg but some can reach 65 kg. Females are lighter, averaging about 7 kg less than males. A wolf’s long legs and narrow body design allow it to travel great distances in search of prey, with minimal energy loss. During winter, the wide front foot acts like a snowshoe, improving the wolf’s mobility. Yukon wolves range in colour from nearly pure white to jet black. About half are a mixture of grey and white with some tan colouring on the ears and shoulder.

A wolf population is composed of separate family units known as packs as well as lone wolves that exist among the pack territories by avoiding contact with the constituted pack. Packs defend their home range from other packs. The average pack size in the Yukon is seven to nine wolves.

Behaviour

Normally wolves are secretive and will run away when they encounter people, but they can become habituated and may approach camping areas and people.

Feeding wildlife is illegal. When wolves become habituated to unnatural food sources they can lose their fear of humans. A wild animal that has become conditioned this way can be a danger to itself and to the general public.
What to do if a wolf approaches

If a wolf appears and acts unafraid or aggressive, take the following action as soon as you notice the animal:

- Do not allow the wolf to approach any closer than 100 metres.
- Raise your arms and wave them in the air to make yourself appear larger.
- When in a group, act in unison to send a clear message to the wolves they are not welcome.
- Back away slowly, do not turn your back on the wolf.
- Make noise, throw sticks, rocks and sand at the wolf.
- If you see a wolf acting aggressively, call the District Conservation Officer in Dawson City at 867-993-5492.

5.20 WORKING ALONE

Working Alone - What is it?

“To Work Alone” means to work alone at a worksite in circumstances where assistance is not readily available in the event of an injury, illness or emergency.

What is “readily available”?

Must assess three factors:

1. Awareness - will other people capable of helping be aware of the need?
2. Willingness - can you expect others will actually provide assistance?
3. Timelines - can assistance be provided in a reasonable time?

Responsibilities

Management

- Participate in on-site Hazard Assessments with the crew supervisor.
- Establish an effective means of communication between the employee and persons capable of responding to the employee's needs.
- Ensure that proper check-in procedures and infrastructure is in place and effectively maintained.
• Implement training procedures for employees of the company.

• Ensure compliance of Working Alone standards through established disciplinary protocols.

• Ensure the Working Alone Program is effective through periodic site visits, recommendations to crew supervisors and as a part of internal and/or external audits.

**Supervisors and Employees**

• Ensure they are aware of risks associated with Working Alone and be able to recognize and mitigate these risks effectively.

• Ensure contact list is up-to-date.

• Follow all established procedures, standards and industry practices regarding Working Alone.

• Communicate any unsafe emergency equipment.

• Complete necessary vehicle, equipment and worksite checks.

**Safe Work**

• Prior to each task that involves a potential working alone environment, the employee must first review the written safe work procedures that are listed in the Safety Manuals prior to carrying out that work.

• Ensure an effective means of communication is available; this means a radio, telephone or other electronic device.

• If not practicable, visit the employee or establish a system for routine contact.

**5.21 GROUND DISTURBANCE**

**Purpose:** To outline the mandatory requirements necessary to ensure worker safety and to avoid contact with pipelines and underground utilities during ground disturbance activities.

**Note:** Extreme caution must be used at all times during Ground Disturbance activities.
Procedures

Northern Cross will designate a selected individual (employee or contractor) deemed to have sufficient experience and training (ie. Ground Disturbance Level 2) to competently serve as a Designated Supervisor.

The Designated Supervisor and all personnel conducting the work will have appropriate training as outlined in this Code of Practice.

The Designated Supervisors will be responsible to ensure that work is conducted in a safe manner and in accordance with applicable legislation.

Ground Disturbance is ground breaking activity such as excavating, digging, trenching, plowing, drilling, tunneling, auguring, backfilling, blasting, stripping topsoil, leveling, removing peat, quarrying, clearing, grading or pounding posts.

For the purposes of this Code of Practice a “Ground Disturbance” shall be defined as any excavation or construction activity (other than hydrovac, hand sampling and hand exposure) that involves the use of powered mechanical equipment and results in the penetration of the ground, to any depth.

For further clarification, the following examples are considered to be ground disturbance:

- Hand sampling by auger or shovel to a depth greater than 30 cm
- Removal of ground cover over a pipeline to any depth (such as stripping topsoil, spill soil cleanup, etc)

The following examples are not considered to be ground disturbance:

- Hand sampling by auger or shovel to a depth less than 30 cm
- Removal of spill fluid by vacuum truck as long as no soil cover is removed
- Hydrovac and hand exposure are acceptable methods of exposing known or suspected lines prior to ground disturbance being conducted, however these lines should be identified as part of the ground disturbance investigation.

Line Hit: Regulations state that a line hit is defined as any contact made with an underground facility that results in any of the following: puncture or crack in the facility, scratch, gouge, flattening, or dent of the surface OR damage to the protective coating.

Pre-Job Safety Meeting: A pre-job safety meeting must be held daily to cover all the job safety and procedural aspects of the job. This must be conducted with all persons in attendance who are directly responsible for the safe conduct and job...
itself. The following topics should be discussed and meeting minutes (with signed attendance list) recorded and retained on file.

   a) Review of potential hazards, safe work procedures, permit requirements, etc.
   b) Review of site plans, survey drawings, pipeline base map, land titles, duly signed copy of Crossing Agreement, One Call information, if applicable, etc.
   c) Review of utilities, right-of-way, irrigation crossings, pipeline crossing signage, line lists.
   d) Complete a Ground Disturbance Checklist.
   e) Before commencing any mechanical excavation within 5 meters of an underground facility, the facility must be located and exposed by hand or hydrovac.
   f) Mechanical excavation equipment must not be used to dig within 60 cm of an exposed pipeline without the direct supervision of the owner. A spotter should be in place for all work within the proximity of a facility.
   g) Cutting back and shoring of excavations to prevent cave-ins.
   h) Care must be taken not to damage facilities with shovels when hand exposing (no picks).
   i) All workers have the right and the responsibility to refuse to carry out any work or procedures they feel are unsafe.
   j) Personal protective equipment requirements (steel toed boots, hard hats, eye protection, hearing protection, etc.)
   k) All incidents, injuries, and near misses are to be reported.
   l) Review of site specific emergency response plan.

**Pipeline and/or buried Facility Indicators**

- Look for warning signs where pipelines cross roads or water courses.
- Look for wells, tanks, or valves that may indicate the presence of pipelines.
- Look for ground settling from previous work.
- Talk to nearby landowners and residents.
- Look for vegetation appearing “different” from its surrounding, ie. Greener, taller, shorter, or more brown than the surrounding vegetation.

Pre-job/tailgate meetings identify work phases, changes to work procedures, changes to job scope and communicate to new members or members not present, the scope and hazards of the project.

**Search Area and Controlled Area**

A **Search Area** is the area within 30 meters of where a ground disturbance will take place. All pipelines and utilities that pass within 30 meters of the work area must be located. All facilities which pass within a 5 meter radius of the ground
disturbance area should be highlighted on the drawing with a colored marker to ensure their encroachment into the work area is readily noted.

A pipeline **controlled area** is the land bordering it for 30 meters along each side.

**If you are working within a pipeline right-of-way, you must:**
- Get written approval from the pipeline owner before you dig.
- Call the pipeline owner at least two full working days before you dig so the pipeline can be located and marked before you dig.
- Expose the pipeline by hand or hydrovac before digging with machinery within 5 meters of the pipeline. The 5 meters can be reduced through a written agreement with the pipeline owner.
- Any time mechanical excavation is used, the line should be hand exposed a minimum of 60 cm on each side unless direct on-site supervision of the owner of the pipeline.
- Call the pipeline owner at least one full day before you cover any exposed pipeline.

**If you hit a pipeline, STOP WORK and NOTIFY THE NORTHERN CROSS SUPERVISOR/REPRESENTATIVE AND REGULATORY AGENCY IMMEDIATELY!**

If contact is made the ground disturbance work must be immediately terminated. The company must immediately notify the owner of the facility, let them know the location of the contact, and the kind of damage that resulted. If the facility is a PIPELINE, the company **must immediately notify** the required agencies and regulatory bodies of the location where the contact occurred, and the kind of damage that resulted. Upon notification the government agencies require a written record. The company must conduct an incident investigation into the causes and make recommendations for prevention of the causes (use Incident Reporting Form).

**Backfill Inspections**

The owner of the pipeline must perform a backfill inspection before backfill commences. Where an owner inspects the pipeline for damage, a written record must be made and retained in the project file, for the life of the pipeline.

It is common practice to take pictures of the disturbance and attach them to the back of the backfill records. Where an owner of the facility to be backfilled has been notified but will not come to the site for the backfill inspection, the supervisor should document the following:
- notification to the owner, including time, date, name
- date and time of inspection
- photos (no digital), and written comments on the condition of the line
• witness by a third party, if possible

A copy of the inspection report should be forwarded to the owner of the facility.

Training

Designated Supervisors must receive formalized and specific training on the provisions of this code of practice and related procedures. Ground Disturbance activities will only be conducted with the on-site supervision of a Designated Supervisor. All personnel supervising ground disturbance work on the company’s behalf must receive formalized and specific training which includes the following:

• Defining Ground Disturbance
• Company Ground Disturbance Code of Practice/Critical Procedures
• Regulations for Undertaking a Ground Disturbance
• Distance Defining Search/Controlled Areas
• Facility Existence Sources
• Ground Disturbance/Safe Work Permits, Licenses and Approvals
• Notification to Underground Facility Owner
• Crossing Agreements
• Regulations
• Maps and Plot Plans
• Line Locating Explanation
• Exposure Processes and Marking
• Permits and Pre-job Meetings
• Emergency Response Plans
• Back Fill Inspections
• Environmental Awareness

5.22 AIRCRAFT SAFETY

Outside the aircraft

• Keep clear of the helipad or tarmac until the aircraft has landed and come to a complete stop
• Approach or depart the aircraft only on signal or command of the pilot or ground crew
• Approach or depart from a helicopter from the front or side quadrants to avoid the tail rotor and overhead rotor. Under NO circumstances should you walk under the tail rotor or tail boom. The rotor on some helicopters comes down low in the front so they should be approached from the sides
• Approach or depart an aeroplane from the rear quadrants or either side to avoid the propellers. Under no circumstances should you walk under the wings or approach from the front of the aeroplane while the propellers are turning
• Do not walk uphill when leaving or downhill when approaching a helicopter. If you must approach from uphill or leave in an uphill direction, the helicopter should be shut down and the rotor blades stopped.

• Bend over when approaching or departing a helicopter. Beware of the large main rotor.

• Keep a firm grip on all hand-carried articles when walking to and from the aircraft.

• Provide the pilot with a passenger manifest before boarding the aircraft. Declare any magnetic or hazardous materials.

• Use only the steps provided. Take care not to damage the floats when getting in and out of offshore aircraft. Walk only on designated areas of wings.

• No person should disembark or board a helicopter if the skids are not on the ground.

Inside the aircraft

• The pilot is in complete charge of the aircraft and its passengers-follow his instructions. The pilot should provide you with a complete briefing, including usage of life vests, where required.

• Do not distract the pilot with unnecessary conversations or actions.

• Never throw anything out of a helicopter. Possible damage to the rotor system can result.

• Aisles and doors should be kept clear for emergency exit

• During refuelling operations, passengers should not be in the aircraft, unless otherwise directed by pilot.

• Hearing protection should be worn during small aircraft flights. Hearing protection should be worn even when boarding, disembarking, or refuelling.

• No passenger should be allowed to ride in any helicopter while it is performing long line operations or while an external line or hook is attached.

• Never carry blasting caps and blasting agents (dynamite) in the helicopter at the same time. When carrying any hazardous substance, be sure it is in a proper container and marked according to Federal and Provincial regulations.

• All luggage and cargo should be securely tied down before takeoff.

Field Use of Helicopters

• When selecting a landing zone (LZ), choose one that is as flat as possible and has adequate clearance in all directions. Trees and brush should be cleared if necessary to provide adequate clearance, if the permit allows brush cutting. If not, find another LZ.

• The person designated to hook or unhook the loads should have radio communications with the pilot and inform him of the type, size and destination of the load.
• Helicopters generate extremely high static electricity charges; lines should be allowed to touch the ground and dissipated the charge before being handled. Tag lines should be a length that will not be drawn up into the rotor blades.
• No person should ride the hook, sling, or net for any reason other than a life or limb emergency situation. Suitable emergency litters may be necessary for long line evacuation of an injured person.

5.23 LOAD SECUREMENT

Northern Cross requires all loads to comply with Department Of Transportation regulations.

The Rig manager will ensure that the Bed Trucks are adequate for the loads that will be moved. When a bed truck picks up a load the bottom end should only be approximately 2 – 3 inches off the ground.

SCR Building and Top Drive Buildings contain sensitive equipment and care must be taken when Bed Trucks are handling them. All heavy loads such as pump houses with pumps in them should be assist lifted to prevent damage from being dropped.

The Rig manager will ensure that all loads are secured at the correct points on each load. (ie: Secure derrick in a manner that will not cause it to bend or incur any other damage).

Requirements for Securement Devices

Cargo securement standards require that all devices and systems used to secure cargo to or within a vehicle must be capable of meeting the performance criteria. All vehicle structures, systems, parts and components used to secure cargo must be in proper working order when in use. This means that they cannot be damaged or weakened so as to affect their performance. The cargo securement standards reference manufacturing standards for certain types of tiedowns including steel strapping, chain, synthetic webbing, wire rope, and cordage. Changes in the references do not necessarily mean the older securement devices need to be replaced.

Proper Use of Tiedowns

Each tiedowns must be attached and secured so that it doesn’t come loose, unfastened, opened or released while the vehicle is moving. All tiedowns and other components of a cargo securement system must be located inside any rub rails whenever practical. Also, edge protection must be used whenever a tiedown would be subject to wear or cutting at the point where it touches an article of cargo. The edge protection must resist wear, cutting and crushing.
Use of Unmarked Tiedowns

Cargo Securement Standards do not prohibit the use of unmarked tiedown devices. However, in view of the potential safety hazards of carriers not properly identifying unmarked tiedowns, they are considered to have a working load limit equal to the default rating for that type of tiedown specified in the following tables:

**Section 1 – Chain**

<table>
<thead>
<tr>
<th>Size</th>
<th>Working Load Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 mm (1/4 inch)</td>
<td>580 kilograms (1,300 pounds)</td>
</tr>
<tr>
<td>8 mm (5/16 inch)</td>
<td>860 kilograms (1,900 pounds)</td>
</tr>
<tr>
<td>10 mm (3/8 inch)</td>
<td>1,200 kilograms (2,650 pounds)</td>
</tr>
<tr>
<td>11 mm (7/16 inch)</td>
<td>1,680 kilograms (3,700 pounds)</td>
</tr>
<tr>
<td>13 mm (1/2 inch)</td>
<td>2,030 kilograms (4,500 pounds)</td>
</tr>
<tr>
<td>16 mm (5/8 inch)</td>
<td>3,130 kilograms (6,900 pounds)</td>
</tr>
</tbody>
</table>

**Section 2 - Synthetic Webbing**

<table>
<thead>
<tr>
<th>Width</th>
<th>Working Load Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 mm (1-3/4 inch)</td>
<td>790 kilograms (1,750 pounds)</td>
</tr>
<tr>
<td>50 mm (2 inch)</td>
<td>910 kilograms (2,000 pounds)</td>
</tr>
<tr>
<td>75 mm (3 inch)</td>
<td>1,360 kilograms (3,000 pounds)</td>
</tr>
<tr>
<td>100 mm (4 inch)</td>
<td>1,810 kilograms (4,000 pounds)</td>
</tr>
</tbody>
</table>

**Section 3 - Wire Rope (6 x 37, Fiber Core)**

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Working Load Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 mm (1/4 inch)</td>
<td>640 kilograms (1,400 pounds)</td>
</tr>
<tr>
<td>8 mm (5/16 inch)</td>
<td>950 kilograms (2,100 pounds)</td>
</tr>
<tr>
<td>10 mm (3/8 inch)</td>
<td>1,360 kilograms (3,000 pounds)</td>
</tr>
<tr>
<td>11 mm (7/16 inch)</td>
<td>1,860 kilograms (4,100 pounds)</td>
</tr>
<tr>
<td>13 mm (1/2 inch)</td>
<td>2,400 kilograms (5,300 pounds)</td>
</tr>
<tr>
<td>16 mm (5/8 inch)</td>
<td>3,770 kilograms (8,300 pounds)</td>
</tr>
<tr>
<td>20 mm (3/4 inch)</td>
<td>4,940 kilograms (10,900 pounds)</td>
</tr>
<tr>
<td>22 mm (7/8 inch)</td>
<td>7,300 kilograms (16,100 pounds)</td>
</tr>
<tr>
<td>25 mm (1 inch)</td>
<td>9,480 kilograms (20,900 pounds)</td>
</tr>
</tbody>
</table>

**Section 5 - Synthetic Fiber Rope**

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Working Load Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 mm (3/8 inch)</td>
<td>185 kilograms (410 pounds)</td>
</tr>
<tr>
<td>11 mm (7/16 inch)</td>
<td>240 kilograms (530 pounds)</td>
</tr>
<tr>
<td>13 mm (1/2 inch)</td>
<td>285 kilograms (630 pounds)</td>
</tr>
</tbody>
</table>
5.24 WINTER OPERATIONS

Cold weather does present additional hazards during winter operations. With proper awareness and good planning, injuries can be minimized.

Hazards involved during winter operations around a service rig include:

a. Slips and falls due to snow and ice
b. Wind chill factors, hypothermia
c. Boiler, steam and steam line burns
d. H2S exposure
e. Fire
f. Pinch points
g. Electrical shock
h. Working around sumps, pits and tanks
i. Chemical exposure

The following personal protective equipment is recommended for winter operations.

a. Standard work wear and personal protective equipment
b. Fire retardant work wear
c. Warm clothing (hard hat liner)
d. Hearing protection
e. Eye protection
f. Insulated safety work boots

Procedures

The general procedures for winter operations are as follows:

1. A pre-job safety and procedural meeting of all personnel must be held after rig up and periodically throughout the winter.
2. Wind chill will reduce the time in which exposed flesh will freeze.
3. The use of alcohol or drugs in a cold environment is a hazard as it causes dilation of blood vessels, relaxation of the senses and increased need for sleep with the onset of hypothermia.
4. Warm clothing, especially layers of light wool or heavy cotton under a waterproof garment provides extremely effective protection against the cold.
5. Pant legs must be kept over top of work boots to protect from steam and chemical burns.
6. Extremities (fingers, toes) are the first body parts to freeze in cold weather.
7. Change clothes immediately if they become wet.
8. Tight clothing will cut off circulation to the area affected. Proper fitting clothes are a must to prevent hypothermia.
9. Steam and steam lines are a burn hazard and can create slipping hazards on the floor and stairs.
10. Steam hoses and connection must be well maintained.
11. Never attempt to clean work boots with a steam hose. Severe burns to the feet and legs can result.
12. Do not leave steam hoses unattended.
13. Insulated steam lines where they might present a risk to contact to workers.
14. Do not engage controls or equipment when visibility is obscured by steam or snow.
15. Ensure the rig floor is free from ice and has non-skid material in place to prevent slipping.
16. Stay clear of the top of the pipe when running in the hole, ice plugs in drill pipe can become projectiles when thawed.
17. Drill pipe that has been laid down may contain ice plugs. A steam hose directed in one end will remove this hazard.
18. Use the buddy system to (periodically) check other workers for facial frostbite.

**Boiler Operations**

1. At least one person at the work site must hold a valid “Special Oilfield Boiler Certificate.”
2. Ensure all workers that operate the boiler are properly trained.
3. A slow warm up is recommended when firing up a cold boiler to reduce stress on the boiler.
4. Repair leaks only after de-pressuring the boiler or line.
5. Check the operation of the boiler automatic shut downs.
6. The water gauge glass must always be guarded to prevent accidental breakage.
7. Ensure boiler blowdown and pop valve lines are clearly identified. These lines can be baffled or diverted to a safe area.
8. Water pump shafts must be guarded.
9. Wear protective clothing when handling treatment chemicals.
10. Ensure that electrical equipment is well maintained and all covers are in place.
11. Never store flammable material in the boiler house.
12. A fire extinguisher must be in the boiler house.
13. The boiler house must be clean and tidy.
14. Yearly inspection of boilers is a requirement.
15. Blowdown lines should be plumbed into a deflector or barrel to prevent an uncontrolled release of steam and hot water.
16. WHMIS labels and MSDS data sheets must be present for all chemicals on location.

5.25 **NORTHERN CAMPS**

Depending on the speed of the operation and the duration of use, construction camps may be quite large and will be required to supply infrastructure similar to that of a small community.

Good access will be required both to the project and to existing transportation and supply routes.

It is important to utilize suitable sites to limit environmental effects. Site activities will initially include preparation and installation of site infrastructure; including water supply and sewage disposal and eventual reclamation and re-vegetation of the site.

Smaller secondary camps will be required for activities such as surveying or clearing. These camps will occupy smaller areas and for a shorter period of time. The facilities are mobile and offer a smaller number temporary quarters and facilities for workers.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Permit Name</th>
<th>Regulatory Agency</th>
<th>Legislation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use of water or deposit of waste</td>
<td>Water Licence</td>
<td>Yukon Water Board</td>
<td><em>Waters Act, Waters Regulation</em></td>
</tr>
<tr>
<td>Work within right-of-way</td>
<td>Work in right-of-way permit</td>
<td>Department of Highways and Public Works, Transportation Maintenance Branch</td>
<td><em>Highways Act, Highways Regulation</em></td>
</tr>
<tr>
<td>Access on highway right-of-way</td>
<td>Access Permit</td>
<td>Department of Highways and Public Works, Transportation Maintenance Branch</td>
<td><em>Highways Act, Highways Regulation</em></td>
</tr>
<tr>
<td>Erect a sign within highway right-of-way</td>
<td>Sign Permit</td>
<td>Department of Highways and Public Works, Transportation Maintenance Branch</td>
<td><em>Highways Act, Highways Regulation</em></td>
</tr>
<tr>
<td>Electrical work</td>
<td>Electrical Permit</td>
<td>Department of Community Services, Building Safety</td>
<td><em>Electrical Protection Act</em></td>
</tr>
<tr>
<td>Activity</td>
<td>Permit Name</td>
<td>Regulatory Agency</td>
<td>Legislation</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-------------------------------------------------</td>
<td>--------------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
</tr>
<tr>
<td>Building outside municipality,</td>
<td>Building Permit, Plumbing Permit</td>
<td>Department of Community Services, Building Safety</td>
<td>Building Standards Act</td>
</tr>
<tr>
<td>plumbing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas piping</td>
<td>Gas Installation Permit</td>
<td>Department of Community Services, Building Safety</td>
<td>Gas Burning Devices Act</td>
</tr>
<tr>
<td>Gas burning</td>
<td>Gas Burning Devices Permit</td>
<td>Department of Community Services, Building Safety</td>
<td>Gas Burning Devices Act</td>
</tr>
<tr>
<td>Solid Waste Disposal</td>
<td>Solid Waste Disposal Permit</td>
<td>Department of Environment, Environmental Programs</td>
<td>Environment Act, Solid Waste Regulation</td>
</tr>
<tr>
<td>Air emissions</td>
<td>Air Emissions Permit</td>
<td>Department of Environment, Environmental Programs</td>
<td>Environment Act, Air Emissions Regulation</td>
</tr>
<tr>
<td>Camp sanitation</td>
<td>Compliance with regulations respecting the</td>
<td>Department of Health and Social Services, Environmental Health Services</td>
<td>Yukon Public Health and Safety Act, Regulations Respecting the Sanitation of Camps in Yukon</td>
</tr>
<tr>
<td></td>
<td>sanitation of camps in Yukon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public Health</td>
<td>Compliance with regulations respecting public</td>
<td>Department of Health and Social Services, Environmental Health Services</td>
<td>Yukon Public Health and Safety Act, Regulations Respecting Public Health</td>
</tr>
<tr>
<td></td>
<td>health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>On-site sewage disposal system</td>
<td>Permit to install a sewage disposal system</td>
<td>Department of Health and Social Services, Environmental Health Services</td>
<td>Public Health and Safety Act, Sewage Disposal System Regulations</td>
</tr>
<tr>
<td>Operating a food premises</td>
<td>Permit to Operate a Food Premises</td>
<td>Department of Health and Social Services, Environmental Health Services</td>
<td>Public Health and Safety Act, Eating and Drinking Places Regulation</td>
</tr>
<tr>
<td>Activity</td>
<td>Permit Name</td>
<td>Regulatory Agency</td>
<td>Legislation</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Compliance with standards, codes, safety practices and qualifications of workers and supervisors</td>
<td>Compliance with standards, codes, safety practices and qualification of workers and supervisors</td>
<td>Yukon Workers' Compensation Health and Safety Board</td>
<td>Occupational Health and Safety Act, General Safety Regulations, Occupational Health Regulations, Minimum First Aid Regulations, Blasting Regulations, Radiation Protection Regulations, Commercial Diving Regulations</td>
</tr>
<tr>
<td>Registration with Yukon Workers' Compensation Health and Safety Board</td>
<td>Registration with Yukon Workers' Compensation Health and Safety Board</td>
<td>Yukon Workers' Compensation Health and Safety Board</td>
<td>Occupational Health and Safety Act</td>
</tr>
<tr>
<td>Activities in a Habitat Protection area (HPA)</td>
<td>Permission for activity (if within HPA)</td>
<td>Department of Environment, Conservation Officer Services</td>
<td>Wildlife Act, Wildlife Regulations</td>
</tr>
<tr>
<td>Land use, geotech, new road access</td>
<td>Land Use Permit</td>
<td>Department of Energy, Mines and Resources, Lands Branch</td>
<td>Territorial Lands (Yukon) Act, Land Use Regulations</td>
</tr>
<tr>
<td>Storage and handling of petroleum products</td>
<td>Storage tank Systems Permit</td>
<td>Department of Environment, Environmental Programs</td>
<td>Environment Act, Storage Tank Regulation</td>
</tr>
<tr>
<td>Timber Cutting</td>
<td>Commercial Timber Permit or permit identified as priority harvest</td>
<td>Department of Energy, Mines and Resources, Forest Management Branch</td>
<td>Territorial Lands (Yukon) Act, Timber Regulation</td>
</tr>
<tr>
<td>Burning</td>
<td>Burning Permit</td>
<td>Department of Community Services, Protective Services</td>
<td>Forest Protection Act</td>
</tr>
<tr>
<td>Activity on First Nation Settlement Land</td>
<td>Authorization by affected First Nation</td>
<td>First Nation Land Department</td>
<td>Authority under First Nation Final Agreement or law passed by First Nation on whose settlement land activity is located</td>
</tr>
</tbody>
</table>
5.26 COLD WEATHER SURVIVAL

There are four basic essentials for cold weather survival:

- **Heat** - enough warmth to maintain body temperature, melt snow or cook if necessary and make smoke signals.
- **Shelter** - protection from cold, wind, rain, and snow. Stay Dry!
- **Water** - To sustain life.
- **Will to live** - Chances are you will spend only one or two nights or maybe only a few hours before help arrives. Check yourself frequently for signs of cold injury.

**Frostbite**

Frostbite is frozen flesh. Signs of frostbite are loss of sensation and cold, pale, waxy skin. Frostbite can progress to deep frostbite. It usually involves an entire hand or foot and affects the tissues deeper down. You may see white, waxy skin that turns greyish blue, and feels cold and hard to touch.

**Hypothermia**

The most hazardous effect of cold weather is hypothermia. Hypothermia is a condition where the body's temperature drops below 35°C. Hypothermia may progress from mild to severe if not recognised. This can cause a worker to become disoriented, less alert, and less attentive to the job. It can also result in death. Hypothermia may be brought on by lack of adequate clothing, wet windy environments, falling into cold water, or any situation in which the body cannot maintain its core temperature.

Unfortunately, workers affected by hypothermia may be unaware of their condition and may even resist help. If a worker is suspected to be suffering from hypothermia, aid should be administered even if refused.

The symptoms and effects of hypothermia occur in the following order:

1. Shivering
2. Slowing of the heart and breathing
3. Lack of coordination
4. Lack of organ function, unusual behaviour, shivering stops
5. Stopping of the heart (death)
Wind Chill Factor Comparisons

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>8 k.p.h.</th>
<th>16 k.p.h.</th>
<th>24 k.p.h.</th>
<th>32 k.p.h.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>light flag moves</td>
<td>light flag fully extended</td>
<td>raises newspaper sheet</td>
<td>blowing and drifting snow</td>
</tr>
<tr>
<td>-1.1</td>
<td>-2.8</td>
<td>-8.9</td>
<td>-12.8</td>
<td>-15.6</td>
</tr>
<tr>
<td>-6.7</td>
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<td>-65.0</td>
<td>-71.1</td>
</tr>
</tbody>
</table>

Danger - Exposed flesh may freeze within one minute
Great Danger -- Exposed flesh may freeze within 30 seconds

- Wear layered high visibility clothing. Three layers are most effective.
  - Inner layer absorbs body moisture and keeps it away from the skin. Long underwear of wool or chlorofibre (non-flammable). Socks should be of wool, nylon blend or chlorofibre material.
  - Second layer is insulation. Wool, synthetic insulation or waterfowl down are appropriate. Should be flame retardant if outer layer is removed.
  - Outer layer protects from wind, moisture and dirt. This layer must be removable to prevent over-heating and should be flame retardant.
- Since most of the body's heat loss is from the head and neck area, keep those areas covered to conserve body heat.
- Fire retardant hard hat liners and high collar outer wear should be worn in winter months.
- Mittens, gloves and boots should have insulated liners that are removable so they can be dried daily.
- An extra pair of dry gloves and socks should be kept with you.
- Sunglasses may be necessary to protect the eyes from snow-glare.
Travelling during extreme conditions

- Plan your trip. Tell someone your plans, route, destination and time of arrival. Arrange to check in occasionally during your trip so that you will be missed if something happens.

- Dress or pack according to the weather conditions- even if you don’t plan on getting out of your vehicle.

- Keep your vehicle well maintained and with as full a tank of gas as practical.

- Do not try to drive until the vehicle windows have been cleared of snow, ice, and condensation so you have full visibility. Also, clear your roof, hood, headlights and tail lights so you can see and be seen while driving.

- When travelling on the Dempster Highway in the Yukon during winter, it is advisable to have two drivers or use global positioning system (GPS) technology.

- If stranded, stay with the vehicle.

- If stranded, beware of carbon monoxide poisoning resulting from insufficient ventilation of the passenger compartment. Open your downwind window to ventilate-especially when using a portable heater in the passenger compartment. Keep your exhaust system leak free to prevent asphyxiation. Try to keep the tailpipe clear of snow.

- Plan ahead. Depending upon communication resources and the potential for quick rescue, equipment that may be helpful if you become stranded include:
  - High Energy Foods (Candy bars and peanut butter crackers)
  - A gallon of water for each passenger
  - Blanket/sleeping bag
  - Gasoline antifreeze
  - Plastic garbage bag
  - Bumper jack, tire wrench and spare tire
  - 15m nylon cord
  - Windshield cleaner
  - Tools (adjustable wrench, pliers, screwdriver, pocket knife)
  - Windshield scraper
  - Sunglasses
  - Portable Heater
  - Booster Cables
  - High Visibility spare clothes
  - Tow rope/chain
  - Fire extinguisher
  - 1m 14ga wire for dipping a rag into the gas tank
  - Shovel, sand, tire chains
  - Spare fan belt
  - Flares
  - First aid kit
  - Flashlight and batteries
  - Reflectors
  - Plastic whistle
Working during extreme conditions

- Use the buddy system
- Watch co-workers for signs and symptoms of hypothermia
- When possible, schedule work to avoid the most extreme weather conditions
- Stay sheltered from the wind (see wind chill factor comparisons above)
- Have heated rest areas nearby. Take regular rest breaks that allow enough time to warm up.
- Be cautious of loose or bulky clothing becoming caught in moving or rotating equipment or machinery.
- Keep clothing dry. Brush off snow before going indoors so it doesn’t melt on clothing.
- If heavy perspiration has taken place, avoid over-cooling when removing outer layers. Drink liquids to prevent dehydration.
- Maintain core body temperature by consuming warm liquids and a diet high in fat and carbohydrates.

5.27 WINTER ROAD SAFETY PROCEDURES

Use of the Winter Road System prior to an official opening or during a closure is not approved as there is no inspection or maintenance provided. The road surface can deteriorate rapidly as it is subject to changes in weather. There are also unexpected delays that may occur in this remote, isolated area. Please be prepared for extended trips.

When using the Winter Road System there is always the possibility of being stranded. Unless you are absolutely sure of your location remain with your vehicle, make a camp nearby and start a fire. This will be your first step in preventing hypothermia, which is the exposure to cool air or water. Wet or damp clothing, wind and exhaustion accelerate this condition. Avoid overexertion. The following are suggestions of supplies that should accompany every vehicle on the Winter Road System:

**Clothing**

1. Winter boots, pants & socks
2. Parka or snowmobile suit
3. Two piece underwear
4. Mitts, toque or cap

**Food**

1. Chocolate or Granola Bars
2. Freeze dried food
3. Nuts and raisins
4. Sugar and salt
5. Tea bags, soup, hot chocolate
6. K rations
7. Hot pac meals
8. Water purification tablets

Fuel

Carry enough fuel to reach your final destination, as there are no service stops provided.

Survival Equipment

Always carry any personal medication with you.

1. Blankets, pillow, sleeping bag
2. First aid kit, map
3. Flashlight, flares
4. Cutlery, multi-tool with knife
5. Hatchet, axe, saw, rope, wire
6. Mirror, newspaper, watch
7. Matches (water proof)
8. Small metal can, plastic jug
9. Sun glasses, survival booklet
10. Toilet paper, paper towels

Vehicle Equipment

1. Extra belts, fuel filter
2. Booster cables, ice scraper, brush
3. Methyl hydrate, anti-freeze
4. Shovel, extension cord
5. Snow tires, jack, satellite phone
6. Tools, come-along, fire extinguisher
7. Tow chain or nylon rope
8. Candles, supplementary heat source

Rules

1. DO NOT park your semi-trailers, loaded or unloaded on the ice as it encourages others to do the same and the constant weight could create an ice failure.

2. The recommended ice road speed limit of 15km/hr must be strictly followed. Exceeding the speed limit causes ice pop-outs, cracking, wave action and complete ice failures.
3. Stagger your loads, approximately one kilometre apart when traveling across an ice road.

4. Prior to departing you should notify a person at your destination of your estimated time of arrival.

5. Road blockages, sudden storms, ground drifting and whiteout conditions preventing travel and road maintenance can occur in sub-zero temperatures.

6. Passing or meeting vehicles should be done with great care due to swirling snow reducing visibility.

7. It is recommended that freight haul commence as soon as a section opens. Extreme changes in temperature have been evident in previous winter road seasons and the number of days a section remains open have been reduced. Please take this into account when scheduling your trip or loads as immediate, early or permanent road closures could be a possibility.

8. Please drive with caution at all times when traveling on the winter road system as the driving surface is very slippery and stopping distances are increased for all traffic.

9. All traffic should drive close to the centre of all ice roads, not by the snow storage banks.

10. Travel is not recommended for temperatures of -5°C or milder. Night travel is recommended for improved visibility of approaching traffic.

11. Travel during mild temperatures is hazardous and will deteriorate road conditions further. Water on an ice road could erode the travel surface and reduce ice thickness. Continues mild weather will deteriorate the stability of the ice and change its texture to grey, crystallized and honeycomb with no load bearing capacity. Travel is not approved if there is water on any ice road. Travel is not recommended on any land road that is water covered as any breakdown or accident can have the potential to be a life-threatening situation.

12. Travel is not approved when the winter road is not open for temporary closures during the season and permanent closures prior to and at the end of the season as the road user cannot safely arrange for assistance. There are also safety, construction and environmental concerns if a vehicle is stranded on the road during the summer.
5.28 ACCESS ROAD SAFETY

Northern Cross construction supervisors will make sure the access roads to all well sites, camp site or other work sites are clearly marked with clear and concise information.

Where the Municipal road ends and the access road begins, a sign will be erected indicating the Company name, the name of the road, the name of the location(s), the radio channel to be monitored, kilometre 0 and the distance to the worksite. The sign will indicate that only Authorized Personnel are allowed on the road as well as the maximum speed allowed.

Additionally:
- Distance markers will be placed every kilometre and will be visible in all directions.
- 2-way radios must be used in all vehicles using the Northern Cross access road.
- Drivers must call out their location every kilometre when the road is busy or every five (5) kilometres when the traffic is light.
- Loaded vehicles (i.e. vehicles going to the site) have priority and empty vehicles leaving the site must pull over to let the loaded vehicle pass.
- Pull-out areas will be constructed at least every five (5) kilometres and clearly marked.
- Maximum speed on the ice or snow road is thirty kilometres per hour (30 KMP) or as marked on the access road sign.
- Unauthorized vehicles will not be allowed on the access road at any time.
- If matting is used for the access road other conditions may apply and will be clearly explained on the access sign.
6.0 CONTRACTOR SELECTION & REQUIREMENTS

6.1 CONSIDERATIONS FOR SELECTING CONTRACTORS

Application

This section is intended to be used for the selection of contractors and to make them aware of Northern Cross's safety expectations. This section should be copied and provided for all new and perspective contractors.

Contractors should be selected based upon their past related experience, the training and competency of their employees, the resources they are able to bring to the worksite and their past loss experience.

The Contractor Evaluation Sheet, located in the Appendices, should be completed and followed up to ensure that each new contract company hired to provide a service to Northern Cross has the required safety initiatives in place and that their loss record is acceptable. This evaluation should be completed before any new contractor is selected. The Northern Cross representative should consider the safety requirements as a priority, equal to the cost of the quote submitted by the contractor.

Contract Lease & Wellsite Supervisor Selection

Before selection of a new contract lease or wellsite supervisor, the following should be considered:

- At least five years experience in the position of supervisor directly related to the position and job responsibilities he or she is to be hired for;
- Training and current certification in the following:
  - Second Line Supervisors Well Control
  - First Aid & CPR Standard Level
  - Workplace Hazardous Materials Information System (WHMIS) & Transportation of Dangerous Goods (TDG)
  - H₂S Alive or Rescue
  - Safety Training for Wellsite Supervisors
  - Regulatory awareness
  - The Canadian Oil and Gas Industry Industry Recommended Practice (IRP) #7 - Standards for Wellsite Supervision of Drilling, Completion and Workovers
6.2 **CONTRACTORS RESPONSIBILITY**

Contractors hired to provide services for Northern Cross shall:

- Comply with all applicable provincial, territorial and federal legislation governing the work being performed for Northern Cross.
- Comply with all of Northern Cross's Safety Program Standards (Section 6.4).
- Supply proof of coverage from the applicable provincial/territorial Workers’ Compensation Board and Certificate of Insurance.
- Be required to act as “Employer” on Northern Cross's behalf as identified in the Yukon Government’s Occupational Health & Safety (OH&S) Act Duties in Respect of Health and Safety; or as the "Prime Contractor" in Alberta's OH&S Act Sections 3.
- These legislative obligations require that all employees and subcontractors are aware of and comply with the acts and their associated regulations in addition to all of Northern Cross's safety requirements.
- Prime contractors shall possess ultimate authority for the implementation of required safety programs. Compliance to these requirements will be occasionally audited by Northern Cross to ensure compliance.

6.3 **GENERAL SAFETY REQUIREMENTS FOR CONTRACTORS**

- The contractor shall comply with all federal, provincial, territorial and municipal government laws and regulations, as well as the Northern Cross safety program requirements.
- It shall be the contractor's responsibility to become fully acquainted with applicable safety and health laws and regulations prior to commencing work.
- The contractor and any sub-contractor or agent shall inform Northern Cross of any notices, warnings or orders issued by any government agencies relative to the contracted work. In addition, the contractor shall immediately report governmental inspections, and the results of these inspections, to the owner's representative. Where advance notice is given of an inspection, the contractor shall report it to the site representative.
- The contractor shall take all necessary precautions to keep the worksite free from recognized hazards that are likely to cause injury, death, illness or damage to property or equipment.
- The contractor shall adhere to all legally mandated and industry accepted practices of safety and workmanship, and to site safety standards or job work rules. This will enable the contractor to avoid injury to workers and others, as well as damage to equipment, materials and property.
- Northern Cross may suspend work at any time or terminate the contract for a pattern of frequent failure to adhere to safety laws and regulations, or to the owner's established on-site safety procedures.
- Northern Cross may deny access to the site by the contractor and its
employees if, in Northern Cross’s sole judgement, such action is justified on the basis of safety.

- The contractor shall allow the owner or its representative to enter the worksite to audit for compliance within the terms of the contract, including all addenda.
- The contractor agrees to maintain current records covering safety training for employees working on the project for the duration of the contract and agrees to make these records available to Northern Cross for review, if requested.
- The contractor will retain, on site, a competent supervisor or lead hand, all satisfactory to the owner. The supervisor shall represent the contractor and directions given to him shall be as binding as if given to the contractor.
- The contractor will supply to the owner, and maintain current, a list of all supervisory personnel.
- The contractor will ensure that all workers are competent to perform their assigned tasks.
- Contractors will supply proof of coverage from the applicable provincial/territorial Workers' Compensation Board and Certificate of Insurance.
- The contractor will state days of the week and the hours per day during which the work shall be performed.
- The contractor must be aware of, and be completely familiar with, Northern Cross’s Emergency Response Plan and be ready to react to an emergency situation.
- The contractor will cause the least possible inconvenience to the public and private individuals in the vicinity of the work and will render them all reasonable assistance wherever so required. The contractor shall avoid excessive noise, dust, speeding, road damage, pollutants and noxious smells.
- The contractor will not permit any materials, stones or rubbish to be deposited or remain upon any private grounds without first obtaining the owner's consent, nor will he permit any unnecessary obstruction anywhere. The contractor will provide and maintain all necessary signs, signals, crosswalks and bridges for the safety, convenience and protection of the public.
- The contractor agrees to indemnify the owner against all penalties incurred by reason of non-observance of any provisions, regulations or orders.
- Before proceeding with any work on the existing facilities, the contractor shall obtain the approval of the designated site representative.
- It shall be the contractor's responsibility to ensure that safe working conditions prevail at all times work is in progress.
- Notwithstanding the foregoing, the owner reserves the right to have the owner's appointed representative suspend work at any time, whether it be
because of the presence of a hazard or to check the possibility of the presence of a hazard.

- Reports of all accidents shall be submitted in writing within twenty-four hours and shall include the following:
  - Name of facility.
  - Location.
  - Date of accident.
  - Name and address of contractor.
  - Name and address of person injured.
  - Job description of person injured.
  - Description of accident.
  - Description of device or equipment damaged or involved in accident.
  - Action taken.
  - Name and title (if any) of person submitting report.
  - Remarks.
  - Basic and underlying causes.

- The contractor shall provide all labour, equipment, supplies and supervision required for completion of the work and all else, including safety equipment, personal protective equipment and first aid services and supplies necessary for, or incidental to, the proper execution of the work unless specifically noted otherwise.

- The contractor is required to cooperate fully with Northern Cross, other contractors and sub-contractors performing other work in or near the worksite. The contractor must coordinate their work plans with the other contractors to prevent interference with the operations, to share information and to ensure that conflicting activities do not create hazards.

- The contractor must obey a stop work order immediately and take such remedial action as is considered necessary to eliminate or reduce the hazard to an acceptable level. Neither the giving nor carrying out of such orders shall entitle the contractor to extra payment.

- The contractor shall ensure that safe, efficient, careful, qualified, skilled and competent workers, using only safe, suitable and approved tools, material, equipment and procedures perform the work.

Hazard Recognition & Control

Routine, planned inspections shall be performed on a schedule appropriate to the activity level (minimum monthly). Both supervisors and workers shall be involved in worksite inspections. A checklist shall be used that is appropriate to the activity at the worksite. Deficiencies must be recorded and followed up on in an appropriate and timely manner.

Hazards and employee concerns shall be reported immediately, corrected appropriately and quickly.
Supervisors shall routinely observe, commend or correct workers work habits and compliance to minimum safety standards.

**Rules and Work Procedures**

Written rules and work procedures shall be provided for contract employees as guidance for performing critical tasks. Procedures shall incorporate applicable legislative requirements. Contract employees shall be familiar with these requirements and where to access information.

Emergency response procedures applicable to possible emergency situations shall also be written and adequately communicated to contract employees.

**Safety Meetings**

Routine safety meetings shall be held (at an adequate and realistic frequency and where the number of contract employees warrants) to discuss employee concerns, recent accident and incident reports and topics relevant to the work at hand. Minutes shall be maintained and follow up actions shall be completed to an adequate and timely level.

**Training**

All new contract employees shall be safety orientated to the worksite, its hazards, work processes, emergency response and loss-reporting procedures before he/she starts work. A written record shall be maintained of the orientation.

A minimum level of training and certification shall be maintained by contract employees and shall consist of the following:

- Workplace Hazardous Materials Information System (WHMIS) - mandatory for all
- First Aid - and as required by provincial/territorial Occupational Health & Safety (OH&S) First Aid Regulations
- H₂S Alive – when applicable

**Incident & Accident Reporting**

All accidents and near miss incidents shall be reported immediately to Northern Cross. If the contractors report format is to be used, it does not need to be duplicated onto a Northern Cross Incident/Hazard Investigation Report.

All such losses are to be investigated to determine immediate and underlying causes. Corrective action designed to prevent a recurrence shall be implemented on a timely and appropriate basis.
Northern Cross will occasionally audit contractors to ensure compliance to these requirements. These requirements are based on the Petroleum Industry's Basic Safety Program. For more information regarding the development of such a program, contact ENFORM in Calgary.
7.0 TRAINING

7.1 INDOCTRINATION

Responsibility

Before a new or transferred field employee/contract employee begins work, a competent worker (assigned by management) will review the more important details of the New Employee Indoctrination Checklist with the new worker (refer to appendices).

Process

The new worker will also be provided a copy of the indoctrination booklet and have access to the Safety Manual in order to refer to its contents throughout his/her indoctrination period. A new Employee Indoctrination Checklist is intended to assist the indoctrinator in this process; to ensure no important details are missed and to ensure consistency from indoctrination to indoctrination. The Indoctrination Checklist shall be signed by both the new worker and the indoctrinator and will be maintained on the new employees’ file.

The new employee shall remain under the constant supervision of a competent employee until management believes that the new employee is competent enough to perform the job.

Follow-Up

Approximately two weeks after the initial indoctrination, the indoctrinator shall go back and review some of the more important details of the indoctrination. This ensures that the new employee understands the requirements of the safety program and is provided the opportunity to ask questions.

7.2 ON-THE-JOB TRAINING

Responsibility

Management is responsible for ensuring employees, contract employees and contractors are trained to safely perform their job duties.

Process

Required competency levels by position or job level shall be identified prior to being promoted from one job level to the next. The employees and/or contractors’ ability to perform the required tasks of the position should be reviewed.
### 7.3 EXTERNAL TRAINING STANDARD

#### Responsibility

Management shall ensure that all employees or contract employees are trained in the required minimum standard as identified below.

#### Requirement

<table>
<thead>
<tr>
<th>Prior to commencing work</th>
<th>Workplace Hazardous Materials Information System (WHMIS) Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Transportation of Dangerous Goods (TDG) Certification</td>
</tr>
<tr>
<td></td>
<td>First Aid &amp; CPR</td>
</tr>
<tr>
<td>Within the first three (3) years</td>
<td>WHMIS Certification</td>
</tr>
<tr>
<td></td>
<td>TDG Certification</td>
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<tr>
<td></td>
<td>First Aid &amp; CPR</td>
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<td>H₂S Alive</td>
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<td></td>
<td>Defensive Driving</td>
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<tr>
<td></td>
<td>Fire Extinguisher Training</td>
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<tr>
<td>Before supervising a well workover</td>
<td>Well Service Blowout Preventer (BOP) Ticket</td>
</tr>
</tbody>
</table>
8.0 COMMUNICATIONS

8.1 SAFETY MEETINGS

General

Safety meetings provide the opportunity for effective sharing of information specific to the safety of the job between employees, contractors and management. Safety meetings increase employee awareness of company safety initiatives, legislative requirements, new procedures, accidental loss information or any other concerns. Safety meetings should be organized in such a manner that employees and contractors obtain value from them. It is generally better for employees and contractors to attend fewer, well planned and conducted, interesting and informative meetings than several repetitive and mediocre meetings.

Responsibility

- Employees are expected to attend and participate in all safety meetings to ensure optimum effectiveness.
- Employees and employees should be involved in both the planning and the making of presentations at meetings. This involvement ensures buy-in and ownership in the process. Employee involvement also ensures that the subject matter is practical, current, timely and interesting.
- Contractors should also be encouraged to attend Northern Cross field safety meetings as they can also benefit from the topics discussed.
- The Rig Manager has the ultimate responsibility to ensure that meetings are conducted as per this standard.

Planning/Organizing

Normally, general safety meetings will be held every month. This will vary depending on the number of employees and contractors in the area, the level of activity and the employees and contractors available to attend.

Safety meetings will generally follow the example of the Safety Meeting Agenda provided in the Appendices of this manual. An agenda shall be prepared and distributed at least one week before the meeting.

Safety meetings shall be planned by management in advance, preferably at the beginning of each year. This planning can and should be delegated to the workers on a rotational basis. The person responsible for coordinating the meeting should either make a presentation to the group or organize a speaker to make the presentation. The key topic of discussion does not have to be a traditional safety one as long as its theme involves education on operation and safety.
A time frame of a two-hour maximum should be used for planning the meeting. Most people only have an effective attention span of this duration no matter how interesting the subject matter.

**Conducting the Meeting**

Any and all concerns shall be recorded and addressed by the appropriate personnel. Feedback shall be provided no later than the next meeting, even if the feedback is a status report. The meeting coordinator must make every attempt to maintain the schedule as identified on the agenda as follows:

- Review of old business/concerns 30 minutes
- New business/problems & concerns 15 minutes
- Review of Accidents/Incidents/Hazards reported 15 minutes
- Key topic 60 minutes

Minutes shall be recorded on the Safety Meeting Minutes Form provided in the appendices of this manual. Items of concern shall be continuously and sequentially numbered (from meeting to meeting the item numbers shall start where the last meeting minutes finished off). Sequentially numbering items in this manner ensures that no item is forgotten and prompts speedy follow up action. The meeting coordinator should not attempt to keep meeting minutes. This task should be delegated prior to the meeting.

As a presenter, try to make the meeting as interesting as possible:

- Try not to read information to the group. Know your topic ahead of time and speak on it;
- Use audio-visual modes of presenting the information such as overheads, videos, etc.;
- Try to involve the group as much as possible by asking questions or asking for input if the concept you are presenting is new/different; and
- Keep the presentation as short as possible, sticking to the pertinent facts as much as possible.

**Follow-Up**

When the meeting is finished, the minutes should be typed and distributed within one week of the meeting. A copy of the minutes should be filed in the operating area and one copy forwarded to management. Any outstanding concerns should be scheduled for follow up and completion by a specific person and date. The Rig Manager is responsible for ensuring that the follow up action occurs when and as specified. These follow up actions should be recorded in the minutes.
8.2 CRITICAL PRE-JOB SAFETY MEETINGS

Responsibility

The senior Northern Cross representative on site is responsible for conducting the pre-job safety meetings as deemed necessary.

All persons involved with the job shall attend the pre-job safety meeting.

Process

Pre-job safety meetings shall be conducted prior to the start of activities that are not performed on a routine basis and which are, by their nature, more hazardous such as:

- Drilling operations (i.e. acidizing, completions, etc.);
- Plant turn around activities;
- Projects involving confined space entries;
- When new contractors will be performing tasks in an operating area;
- Pre-job meetings are intended to be used to review job procedures and the scope of work. This review ensures consistency in understanding among all those involved;
- Applicable procedures as contained in this manual should be reviewed as well as the Safe Work Permit terms and conditions;
- The meeting should also provide workers with the opportunity to ask questions about the job; and
- Formal minutes need not be kept although the date, time, topic and those in attendance should be recorded in an operations log.

8.3 MONTHLY SAFETY REPORTING

Responsibility

Supervisors are responsible for completing, filing and forwarding the Monthly Safety Report to management within one week of each month end as per the following format.

Process

The Monthly Safety Report Form provided in the Appendices of this manual is to be completed in the field before the end of the first week of each new month. The form need only be hand written but must be legible.
Follow-Up

It is the responsibility of management to respond to those concerns identified on the monthly report that require management follow up as identified here or as identified in Section 4, Hazard Recognition & Control.
9.0 INCIDENT/HAZARD INVESTIGATION REPORTING

9.1 INTRODUCTION

Reporting and investigating all losses and near-losses serves as a measurement and learning tool. It is difficult to correct hazardous conditions and/or practices if a loss is not reported.

Northern Cross is committed to identifying the causes of a loss and controlling or eliminating hazards to prevent a recurrence of the loss without fault finding, to utilize this system as a learning experience and to ultimately create a safe and healthy working environment for all its employees and contractors.

9.2 RESPONSIBILITIES

All employees and contractors are responsible for:

- Ensuring all accidents and applicable incidents are verbally reported immediately.
- Completing a preliminary accident or incident report, giving a detailed description of loss or near loss (see Incident/Accident Investigation Report in Appendices).
- Ensuring the applicable report is given to management before the end of the next working day. This information is the key to preventing further occurrences.

Management is responsible for:

- Collecting statements (description of events) from all persons involved;
- Determining whether a full investigation is required;
- Coordinating and ensuring an investigation is completed in a timely manner, if an investigation is required;
- Ensuring remedial action has been completed by the specified date;
- Reviewing all reports to ensure correctness and completeness;
- Completion of the management control section, assigning responsibility for remedial action and follow-up;
- Distributing reports to applicable head office personnel; and
- Preparing an accident/incident bulletin when such occurrences are considered high severity potential and ensuring such bulletins are distributed to applicable personnel/departments.

9.3 APPLICATION

All accidental losses and near misses must be reported on a Northern Cross Incident/Accident Report form on or before the next working day. Any employee
or contractor involved in the accident may be required to complete a report form and assist in the investigation if one is deemed necessary.

"Accident" is defined as "an undesired event that results in harm to people, damage to property or loss to process." This definition concentrates on harm, damage and loss and may be further expanded to include:

- Personal injury requiring medical aid (where professional medical personnel or facilities are required);
- Damage to property such as vehicle, fire, explosion, environmental, security, etc. related accidents where such damage resulted; or
- Loss of process where product was lost through spills, releases, contamination, theft, process upset, etc.

All of the following types of loss or near loss must be reported:

**Injuries**

All injuries, excluding first aid (see First Aid Reporting, Section 9.9) sustained by any person while working on a Northern Cross property or when conducting business on Northern Cross’s behalf.

All exposures to a potentially harmful substance exceeding the occupational exposure limit where adverse affects are likely to be experienced by the individual involved.

**Fires/Explosions**

All unplanned fires or explosions, regardless of severity.

**Vehicle**

All vehicle related damage, regardless of severity occurring to Northern Cross property, or when operating a vehicle while conducting company business.

**Property Damage**

Physical damage to equipment or property, regardless of severity, such as buildings, tankage, boilers, pumps, compressors, pipes, lands, etc.

**Spills**

All significant volumes of a designated substance which may, or does, result in damage to the environment and any spills that exceed Northern Cross property boundaries.
Releases

All significant releases of a designated substance (excluding those occurring under normal operating conditions) or releases required to be reported by licensing agreements.

Loss/Theft

Any loss or removal of company property without authorization.

Bomb Threats

All bomb threats must be immediately reported verbally (see emergency action plans) followed by an accident report.

Business Interruption

When emergency shutdown or process upset causes substantial loss of production or product.

Near Miss

When a loss was narrowly avoided, but potential existed for severe injury or damage.

9.4 COMPLETING REPORTS

- When an accident has occurred, ensure that procedures contained in the emergency action plan are followed, that all required emergency response contacts have been made, that all injuries have been attended to and all process and equipment has been secured.
- Do not allow any person to tamper with or adjust equipment, process or the accident site.
- It may be necessary to request a statement from all personnel involved when a serious accident has occurred (this may be accomplished by having people complete an accident report form).
- Rope off or barricade the site of a serious accident and proceed with taking photographs, measurements, drawings, etc. of the accident scene as required.
- At no time should an accident investigator endanger his/her own life/safety or that of any other persons.

Preliminary Report

When a loss has occurred, a preliminary assessment of loss potential must be completed. The questions should be asked:
if the conditions had been slightly different; or
if no corrective action is taken;…

... what is the potential for severe injury, liability or serious damage if a similar accident should recur?

FACT: 20% OF ALL ACCIDENTS/INCIDENTS THAT OCCUR HAVE A HIGH POTENTIAL FOR LOSS, THUS 80% OF OUR INVESTIGATION TIME SHOULD BE SPENT ON THESE HIGH POTENTIAL LOSSES. 80% OF ALL ACCIDENTS/INCIDENTS REQUIRE LITTLE (20%) OF OUR INVESTIGATION TIME.

High potential losses cannot be thoroughly investigated by the following working day, therefore a preliminary report must be completed. This procedure MUST be completed before the end of the next working day. Do not hold this report back due to lack of detail or inability to determine direct or basic causes.

A preliminary report is usually nothing more than a detailed description of the occurrence and immediate action taken to prevent a recurrence. The knowledge of what happened and immediate corrective action taken may be enough information to prevent a similar loss in another location within the company. After this information has been shared with management and other pertinent areas, the required time can be taken to thoroughly investigate the loss.

Report Preparation

Identify whether this is a preliminary report or a final report (if no investigation will follow) by checking the appropriate box.
If the accident was caused by a contractor's actions, the contractor and company shall be named.
Identify the exact location of the loss occurrence (LSD, road, address plan, block, etc.)
Date and time of loss.
The report should be completed by the affected person or his/her immediate supervisor, however there are no limitations to who may report an accident;
Persons involved, injured or witness to loss should be named, with company/position and their role in the accident;
Ambient weather at the time of loss should be very specific as it helps to paint a picture for those investigating and reviewing the accident - Identify light conditions, visibility, ambient temperature, wind speed and direction and if it was raining, snowing, etc. at the time of the accident.
Accident/Incident Type - more than one type may be identified.

When an injury has occurred, identify whether the casualty required:
first aid - when casualty is treated outside of medical facility (i.e. hospital, clinic, doctors office).

Medical aid - when casualty must be treated (not just diagnosed) at a medical facility.

ESTIMATED COST: A preliminary report does not require this section to be completed although, if possible, include an estimated cost of all losses incurred. Costing can be changed to represent a more accurate figure when an investigation is completed.

True replacement costs at current market value shall be included for all equipment/materials damaged or destroyed, all clean-up costs, labour costs, the cost of lost product and all persons’ time involved in the investigation shall be considered. None of these costs should ever by considered routine maintenance or the regular costs of doing business.

DETAILED DESCRIPTION OF LOSS is the most critical part of any accident/incident report. It must draw an accurate picture of the events leading up to and during the accident. It must be the WHAT happened, to WHOM, WHEN, WHERE and HOW of the accident. All details should be listed in chronological order.

If a serious loss has occurred where more than one person was witness to the loss, it is important to collect written statements from all persons involved. This will assist the investigator in compiling and relaying the accident details in the description of loss.

The emergency response, if required, should also be reviewed in this section. Both successes and problems encountered during the response should be reviewed so that improvements may be made in the future. Interim preventive measures should also be identified here.

For an accident to occur there must be damage done. The failure to limit the damage is due to substandard practices or conditions existing. These are the immediate or direct causes of the accident.

Direct/Immediate Causes

Direct causes are the symptoms of the real problem or cause. They can be identified easily because they can be seen, felt or experienced. Some typical examples of immediate causes include:

Substandard Practices:

- operating equipment without authority
• failure to warn  
• failure to secure  
• operating at improper speed  
• making safeguards inoperable  
• using defective equipment  
• failing to use personal protective equipment  
• improper loading  
• improper lifting  
• improper position for task  
• servicing equipment in operation  
• horseplay  
• under influence of drugs

**Substandard Conditions:**

• inadequate guards or barricades  
• inadequate or improper protective equipment  
• defective tools, equipment, materials  
• congested or restricted action  
• inadequate warning system  
• fire and/or explosion hazards  
• poor housekeeping  
• hazardous environment  
• noise exposure  
• extreme temperature  
• inadequate or excessive illumination  
• inadequate ventilation

These substandard conditions/practices identify what is wrong. Now we have to ask why this condition or practice exists.

**Indirect/Basic Causes**

Identify why an immediate cause exists by determining the personal and job factors that may have contributed to the loss. Some common basic causes include:

**Personal Factors:**

• inadequate physical capability  
• lack of knowledge  
• lack of skill  
• stress  
• improper motivation
Job Factors:

- inadequate leadership or supervision
- inadequate engineering/purchasing standards
- inadequate tools and equipment
- inadequate maintenance
- inadequate work standards/procedures
- wear and tear
- abuse or measure

Even after the basic causes have been identified, we need to ask why do these situations exist and what can be done to eliminate or control them in a practical manner?

9.5 INVESTIGATION

As stated earlier, the potential for subsequent loss will determine the time and effort spent on the investigation. After most accidents have occurred, the direct and underlying causes and the preventive action are obvious, eliminating the need for an extensive investigation.

Prior to conducting an investigation some basic principles must be understood:

- Accidents and other problems are seldom, if ever, the result of a single cause. This must be remembered throughout the investigation as several causes should, and will, be identified.
- In any group of occurrences, a relatively small number of causes will tend to give rise to the largest proportion of results. Even though several causes may be identified in the investigation, usually only a few are critical and require the most attention.

Lessons Learned/Preventive Action

Identify practical solutions that will control or eliminate the critical immediate and basic causes.

Management Control

Management shall ensure the report is complete, that all details are clear, that all questions are answered and that all causes and preventive actions have been identified. He/she must then determine what practical action can be taken to prevent or control the consequences of a similar accident (it is rarely determined that no action is required).
9.6 FOLLOW-UP

The management must assign responsibility for implementation of required preventive action and management controls. An expected completion date shall be assigned and management is responsible for ensuring that actions are completed by the specified date.

9.7 DISTRIBUTION

Original copies of preliminary accident reports should be kept in an active file in the originating area/department until an investigation is complete. Copies of the preliminary and final reports should be forwarded to management.

The reports shall be kept on file in the originating area.

9.8 ACCIDENT/INCIDENT BULLETINS

When a serious or potentially serious accident or incident has occurred, all applicable areas should be informed. This information sharing allows all areas (and in some cases, other companies) to learn from mistakes made or hazards encountered. Steps taken to prevent a recurrence should also be shared through this process.

Bulletins are usually prepared after an investigation has been completed although, if a preliminary report indicates that the occurrence was critical or that the same situation exists in other areas and interim preventive measures are required immediately, a bulletin may be issued at this time.

Accident bulletin formats are nothing more than a brief description of the loss or near loss (WITHOUT NAMES), the critical immediate and basic causes, preventive action taken and lessons learned.

Management is responsible for completion of bulletins when necessary.

9.9 FIRST AID REPORTING

The provincially legislated, First Aid Regulations state that:

"Injuries sustained at work, no matter how minor they may seem, must be reported."

It is imperative that all injuries be reported, not just because of legislation. If an apparently minor injury develops into something major, a written report will ensure that Workers' Compensation will be paid to the injured worker. Reporting minor injuries will help management identify potential hazards and/or injury
trends. This information may then be used to establish controls designed to reduce injuries.

The log book inside each first aid kit is to be completed whenever an injury is sustained by a person conducting business on Northern Cross's behalf, except when the injury is reported on an Accident Report form.

9.10 WCB REPORTING

Responsibility

Management is responsible for completing the required "Employer" reports for the applicable provincial Workers Compensation Board (WCB) as identified below. Management is also responsible to ensure employees and contractors complete the required "Worker" report form. All employees or contract employees must complete the required WCB report forms when an injury sustained requires medical aid (when a doctor is visited regarding an occupational injury or illness).

Application

When a worker sustains an injury while at a Northern Cross facility that requires medical attention, the required reports must be completed, even if no time is lost. Attending physicians are required to ask if an injury was sustained at work and will fill out the WCB forms. WCB will contact the employer if the doctor's form is completed and the Employer and Worker forms are not. An injury becomes recordable if one full, normally scheduled day shift is missed from work due to an injury or occupational illness. If the claim is valid, compensation may be paid to the injured worker for time and wages lost and any out of pocket expenses incurred due to the injury.

Process

Applicable WCB forms shall be completed by each party:

- The injured worker;
- The worker's employer; and
- The attending doctor.

The Employer and Worker forms shall be sent into the nearest WCB office as soon as possible after the injury is sustained.
10.0 ENVIRONMENT

10.1 ENVIRONMENTAL GUIDING PRINCIPLES

- All services will conduct hazard identifications, waste management reporting and environmental site assessments in an environmentally responsible manner.
- All employees, management and contractors will acknowledge and follow Northern Cross’s Corporate Environmental Policy and practices.
- Personnel will ensure that sound environmental management procedures are employed in our operations to protect people, wildlife, air, water, plants and soil.
- Training and resources will be provided to ensure that company personnel can understand and meet their responsibilities in protecting the environment.
- Environmental procedures will be reviewed and updated on an annual basis or whenever otherwise required by changes in procedure, equipment, legislation, etc., to ensure that they are appropriate and effective.
- Will be prevented using a “cradle to grave” or “at the source” solution. Improvement in this area will be continual.
- Adverse environmental impacts caused by company operations will be addressed in an efficient and timely manner.
- Waste generation will be minimized by following the four R’s of waste management: Reduce, Reuse, Recycle, and Recover.
- The best practical environmental option will be continually sought, generally using the best available techniques not entailing excessive costs.
- We will promote efficient use of resources in our operations, toward the goal of energy conservation.
- Northern Cross will recognize, support and encourage technological innovation, research and achievement for improvement of environmental performance.

Corporate Goals and Priorities

Northern Cross’s management will review the environmental policy and procedures annually to ensure its continuing suitability, adequacy and effectiveness. The management review process will ensure that the necessary information is collected to allow management to carry out this evaluation.

The management review will address the possible need for changes to policy, objectives and other elements of the environmental aspects, changing circumstances and the commitment to continual improvement.
Responsibility

Management is responsible for the overall direction and application of environmental management principles and will ensure that these policies, directives and instructions are communicated effectively to all employees and contractors. Management will establish programs and systems to document environmental performance. Management will also ensure that training and support are provided to all staff so that they can maintain and upgrade their technical skills.

Project managers are responsible for coordinating and communicating management direction to all employees in order to support the company’s environmental directives. The project managers will also monitor the environmental performance of internal projects undertaken within Northern Cross’s operations. This position can be delegated among current personnel as management sees fit.

All employees are responsible for adhering to this policy and maintaining best efforts to implement the principles outlined above in their everyday operations. Employees are also responsible for reporting to management the possible areas of improvement in environmental performance.

10.2 ENVIRONMENTAL PRACTICES AND PROCEDURES

This section addresses environmental management strategies for operations within Northern Cross. Environmental concerns will be managed using the following:

- Workplace Hazardous Material Information System (WHMIS)
- Environmental Assessments
- Waste Management Program
- Waste Classification and G-58 Manifesting
- Spill Response Program

Workplace Hazardous Materials Information System (WHMIS)

WHMIS is a Canada-wide information system that reinforces a worker’s right to know about the health hazards of controlled products used in the workplace. This system also provides information on protective measures. Controlled products are divided into six hazard classes, some of which are subdivided into divisions.

WHMIS practices are designed to maintain compliance with these regulations and include:

- Labelling Systems
Material Safety Data Sheets (MSDS), readily available on site
Training for all employees.

Northern Cross will establish a standardized method of product identification on site.

Environmental Assessments

Internal environmental assessments will support the goals of environmental protection and sustainable development. They are a means to determine the existing environmental concerns at a site or facility. They integrate environmental protection with economic decision-making at the earliest stages of planning an activity.

The purpose of these assessments is to predict the environmental, social, cultural and economic consequences of a proposed activity and to assess plans to mitigate any adverse impacts resulting from such activity.

The detail required for assessments will vary depending on a number of factors including magnitude, frequency, duration, ecological content, reversibility, public concern, etc. Management will specify the degree of environmental assessment required for any activities.

Waste Management Program

The purpose of this section is to describe waste minimization philosophies and to promote an active participation in waste minimization by all personnel involved with Northern Cross.

Waste minimization is a continuous improvement practice. It is an ongoing process involving the 4 R’s, and includes the full-cycle assessment of environmental effects and the associated economic and technical feasibility of the various management options.

Northern Cross will promote waste minimization within their operations and will ensure effective management strategies are employed to minimize and effectively handle waste in a diligent manner.

The 4 R’s represent the minimization strategies that may be employed to reduce wastes requiring disposal. Reduction offers Northern Cross the greatest options for waste minimization and can usually be applied at the source. The ultimate way to manage waste is not to produce it in the first place. Reuse can also be applied on-site. Recycling and/or recovery programs will be implemented to reduce the amount of paper and aluminum product waste that is produced by Northern Cross.
Reduction

Waste reduction involves reducing the amount of waste at its source by modifying operating practices and policies, or changing processes that contribute to waste production. It is usually associated with low capital cost. Reduction also includes altering input material or end products. Other waste reduction options include:

- Design considerations
- Inventory management
- Improved operations
- Equipment modifications
- Process changes
- Spill and leak elimination
- Optimal raw material use.

Reuse

Reuse is the second Waste Management technique that can be explored. Reuse means reusing a product for its original or a new purpose rather than throwing it away. The longer you reuse a product the longer it is kept out of a landfill.

Significant cost savings can be obtained by installing closed loop systems so that solvents and other materials can be reused in plant processes. The most important thing to remember about reuse is to separate the waste materials to keep them clean. This greatly enhances their ability to be reused or their acceptability as a raw material.

Recycle

Recycling is the third alternative. This involves the reclaiming of a specific product from the waste stream and processing it into new materials and products. Recycling is different than reuse in that it is not the product itself being reused, but the raw materials within a product.

Recycling can be carried out on site or off site. Northern Cross or others can use the waste materials. Just as in reuse, it is important to keep the recyclable material uncontaminated, which minimizes processing requirements.

Recover

The final “R” is recover. Wastes generated by Northern Cross may contain “recoverable substances” that could be recovered and then recycled or reused on site or by others.
Recover also means gaining the useful materials or energy from a product by chemical or thermal means. This is also called “resource recovery”. It includes using a waste material as a fuel, commonly called “refuse derived fuel”. Composting is also a form of resource recovery.

**Spill Prevention and Management**

An environmental incident (i.e. spill) is a situation where material is released into the environment (air, soil, water), sanitary sewers or storm water in a manner that is not approved by government authorities or, if unregulated, has the potential to cause an adverse effect on human health or the environment.

Good design and production practices will be followed to ensure that corrosion control and leakage prevention are implemented. Processed chemicals will be stored in secure containers. All spills will be contained, cleaned up and the area will be rehabilitated as soon as possible. Contaminated soils and ground water will be rectified as soon as possible.

All environmental incidents are internally reportable. However, not all spills are reported externally. This will vary by substance, the amount released and jurisdiction.

**Spill Procedures**

Be prepared to control small spills. SAFETY COMES FIRST. Do not attempt to control a spill unless you are sure it can be done without endangering yourself or others. Call Emergency Services and evacuate the area if there is potential for fire, explosion or other hazard, or if the spill appears likely to migrate offsite. However, if stopping the source of the release can safely contain the spill, do so as quickly as possible. Control of the spill may require:

- Pick up the spilled container and place it in a safe location while cleaning up the spill.
- If the spill occurs from a drum or tank, attempt to control the source by closing the valve, setting the drum upright or plugging the hole if applicable.
- If the spill occurs from tipped equipment, attempt to right the equipment as quickly as possible.
- Use protective gloves (nitrile) and a face shield, if applicable, while attempting to control a spill.

Once the spill is controlled, contain it, if it is safe to do so, so that the smallest possible area is impacted. It is most important that a spill be contained so that it does not exit Northern Cross property. This can be done through absorbent booms and/or granulated absorbent (cellulose).
Northern Cross will place spill response kits near areas where potential spills are likely, but outside the area likely to be impacted by a spill. The basic kit may consist of two 350 litre, open-top, over pack drums on mobile bases.

After eliminating any ignition sources, a spill may be contained by absorbing it or by placing a physical barrier in its path. Usually it is not necessary to physically contact a spilled material or waste product to prevent it from spreading. If the spill is small (less than 20 litres), use granulated absorbent to soak it up and then properly dispose of the absorbent. If the spill is larger, use a combination of granulated absorbent and containment booms, as applicable, to prevent it from spreading.

Spill Response Kit Contents

- One drum filled approximately 2/3 full of granular absorbent, two short square-end spark-resistant shovels and two dustpans.
- The second drum will contain approximately 12m of absorbent socks, two pairs of rubber boots, nitrile gloves and two face shields, as well a copy of the inventory.
- Both drums must be labelled “Spill Containment Kit”.
- Remove and store separately the metal tops of the drums. Commercially available plastic tops will be placed on the drums for quick removal while providing protection from the elements.

Mini-Spill Response Kit Contents

- One 20 litre metal bucket filled approximately 2/3 full of granular absorbent.
- One short square-end spark-resistant shovel and a dustpan.
- A second 20 litre metal bucket containing two pairs of rubber boots and nitrile gloves, and two face shields, as well as a copy of contents.
- Both cans must be labelled “Mini-Spill Response Kit”.

For any service site spill, contact the client site representative and the project manager as soon as possible. If the spill is on a public right-of-way and local authorities respond, follow their directions and provide any assistance they request. If the spill is on third-party private property and the property owner wants to direct a cleanup of their site, let them do so and offer any assistance you can.

Reporting Requirements

Northern Cross employees will report all spills to management who, in turn, will report spills to the owner or client and proper regulatory agencies:
Oil and gas well and facility lease spills of unrefined product or produced water, as well as all off-lease spills, are reportable to the oil and gas regulatory agencies.

Refined product and chemical spills by Northern Cross employees or contractors in wellsites, public land, etc. are reportable to the operator and environmental authorities.

Transportation spills classified under Federal, Provincial and Territorial Transportation of Dangerous Goods (TDG) Act(s) are reportable to the local, provincial/territorial and federal authorities. (Reportable amounts vary by jurisdiction and should be confirmed with local regulatory agencies).

Any amount of a toxic material spilled in a river, lake, waterway, storm sewer or sanitary sewer, or any amount that has the possibility to cause an adverse effect on the environment must be reported in all provinces. **If any doubt exists – report it!**

Spill that threaten the environment may require the use of:

- Northern Cross’s Emergency Response Plan.
- Utilization of Oil Spill Clean Up and Recovery (OSCAR) Units.
- Utilization of Oil Spill Co-Operatives equipment units, as required.

**Emergency Spill Response**

- Protect human life
- Contain spill
- Contact supervisor
- Establish further clean-up procedures.

**Secondary Containment**

Containers for hazardous waste are to be stored on an impervious slab, with a proper dyke and designed to contain the contents of at least 110% of the volume of the largest container or 25% of the total volume of all containers. Other approved storage devices such as four-barrel spill pallets may be used where appropriate. When these containers are to be stored outside for periods exceeding three (3) months, a shelter or roof must be provided.

Recommended construction for this pad (assuming that the majority of these containers will be metal drums) is:

- A flat surface surrounded by a dyke with entrance and exits allowed by a gently inclining ramp, or
An inclined pad such that the front of the pad is at ground level with the rear of the pad depressed sufficiently to collect the contents of the volume of the planned capacity of the holding area, or

A pad surrounded by grated channels capable of holding the volume of the planned capacity.

An indoor hazardous storage area will:

- Provide for separate, designated areas for certain categories of hazardous materials to prevent the accidental mixing of incompatible chemicals.
- Provide for suitable separation distances or a barrier between hazardous chemicals and ignition sources.
- Have forced air ventilation.
- Have adequate lighting and signs.
- Be equipped with suitable emergency equipment.
- Be staffed with employees trained to respond to emergencies related to the hazardous materials stored therein.
- Have a full and complete inventory of all substances posted at locations accessible to fire and Emergency Response personnel, and incorporated into the ERP along with appropriate Emergency Response procedures for given chemicals.
11.0 DRILLING OPERATIONS

11.1 RESPONSIBILITIES

Direct responsibility for the safety of personnel on drilling rigs engaged with, or on behalf of, Northern Cross shall be with the drilling contractor. Generally, Northern Cross’s “legal” responsibility is to ensure operations are conducted in accordance with all relevant regulatory criteria to ensure, as far as is reasonably practical, that the drilling contractor performs the work in a safe manner and that contractor employees are aware of their responsibilities and duties under relevant regulations.

Personnel Certification

Current certification documents for the following shall be on site:

| First Line Blowout Preventer (BOP) Ticket | Drillers |
| Second Line Blowout Preventer (BOP) Ticket | Tool Pushes/Drillers (sour wells) |
| First Aid & CPR | Tool Pushes, Drillers and one other worker per crew |
| H₂S Alive | All personnel working on sour wells |
| Workplace Hazardous Materials Information System (WHMIS) | All personnel |
| Transportation of Dangerous Goods (TDG) | All personnel who offer, prepare or handle dangerous goods for shipment |
| Regulatory Awareness | All personnel |
| Other certificates as required by provincial/federal regulations |

11.2 RIG INSPECTIONS

Since equipment and facilities do wear out, loss exposures are created by the day-to-day activities of any operation. At some point the wear and tear make the risk of accidents too high. Inspections are needed to detect these exposures before loss. Inspections also provide feedback for the adequacy of existing equipment, process and level of training.

Objective

The objective of Northern Cross inspections is to:

- Identify potential hazards, substandard actions and substandard conditions;
- Identify equipment deficiencies;
Identify problems with standards set by management (insufficient standards, inefficient standards, inadequate standards or lack of standards);

Assess the impact of change, identify any problems in remedial actions, problems due to procedural changes, new equipment, upgraded designs and generally provide feedback to facilitate engineering for applicable modification;

Evaluate the effectiveness of the safety program. Planned inspections give managers the opportunity to get a first-hand look at how their safety program is progressing and help identify any problems in the program;

Serve as a proactive mechanism to reduce the impact and frequency of downgrading events; and

Demonstrate management’s commitment to health and safety.

Inspection Duties

No one individual or group has exclusive responsibility for conducting an inspection. Workers, supervisors and maintenance personnel, as part of their normal job duties, should conduct continuous, ongoing inspections.

Continual inspections (often referred to as “informal inspections”) involve noting an apparent or potential hazard, substandard condition or action and, if possible, immediately correcting it or writing an incident report to initiate corrective action. Informal inspections shall be one of the daily duties of each rig worker.

Formal or planned inspections refer to inspections conducted by management personnel or their designates on a regularly scheduled basis. These inspections allow managers to monitor compliance to regulations and Northern Cross safety policies. Planned inspections require the writing and distribution of an inspection report. The daily walk around is an example of this type of inspection.

Management may, from time to time, contract a third party to conduct planned inspections in order to provide a fresh and unbiased view of rig safety.

Schedule for Inspections

The following schedule shall be followed for inspections.

Pre-Startup

The toolpush or rig manager and Northern Cross’s site representative shall inspect the rig prior to:
Raising or lowering the derrick;
Pressure testing or well testing;
Drilling out surface, intermediate casing or packers; and
24 hours prior to drilling into the critical zone if the well is classed as a sour well.

**Daily**

Rig personnel and the site representative shall conduct daily, informal inspections.

The rig manager or toolpush and Northern Cross’s site representative shall inspect the rig daily and complete a “Daily Walk Around Report”. This shall be done in conjunction with the daily BOP function test. A signed notation that this inspection was done shall be recorded daily in the tour book. Each Monday morning, the completed Daily Walk Around Reports shall be sent to the head office.

11.3 **CLASSIFICATION OF HAZARDS**

It is accepted industry practice to classify hazards or deficiencies as follows:

**Class “A” Hazard**

A condition or practice with the potential for permanent disability, loss of life or body part and/or extensive loss of structure, equipment, material or environment.

Serious deficiencies shall also be treated as Class “A” hazards.

A serious deficiency exists when any contravention of regulations occurs after the initial drill out which could:

- Contribute to an operational failure of any Blowout Preventer (BOP) equipment;
- Restrict the crew’s capability of detecting a kick, shutting in the well and/or circulating out a kick; or
- Otherwise impair the crew’s ability to maintain control of the well.

Where possible, Class “A” hazards shall be corrected within 24 hours.

**Class “B” Hazard**

Potential or serious injury or illness (resulting in temporary disability) or property damage that is disruptive but less severe than Class “A”.

Class “B” hazards shall be corrected within 7 days.
**Class “C” Hazard**

A condition or practice with potential for minor (non-disabling) injury or illness, or non-disruptive property damage.

Class “C” hazards shall be corrected as soon as reasonably practical. A date for correction shall be assigned to the deficiency.

**Note:** The comprehensive inspection checklist supplied in the Appendices is included as a guideline for supervisory personnel.

### 11.4 INSPECTION, TESTING AND DRILLS

Northern Cross is committed to ensure safe and efficient drilling practices in order to control pollution and environmental damage above, at and below the surface during drilling operations. Inspection and testing of equipment and conducting drills on a regular basis are part of this commitment.

**Responsibilities**

The Northern Cross site representative shall confirm the equipment used on a well has been properly inspected, shop serviced and tested and that drills are conducted.

The drilling contractor shall maintain a schedule for inspecting and testing of equipment, conducting drills and keeping adequate records that are readily available to Northern Cross or government representatives.

### 11.4.1 Miscellaneous Equipment

**Fire Extinguishers**

A complete inventory of fire extinguishing equipment shall be compiled for each facility. All fire extinguishing equipment shall be inspected by rig personnel monthly and shall be serviced annually by a technical service company. Monthly inspections shall be recorded on the extinguisher tag. All fire extinguishing equipment shall be tagged as to the date of service and who serviced the unit.

**Casing Wear Tests**

Casing shall be pressure tested every 30 days to a pressure not greater than 50% of the weakest section of the casing or to the working pressure of the blowout preventers, whichever is less (provincially legislated).
**Diesel Engine Air Shut-offs**

All diesel engines with air intakes within 25 metres of the well shall be equipped with air intake shut-off valves or an equivalent system.

Prior to drilling out the cement shoe of the surface casing, the air shut-offs shall be tested and the results recorded. Tests shall be repeated every seven days thereafter.

**Boilers**

Rig boilers shall undergo annual inspections by a competent person. Inspection certificates shall be posted.

Rig boiler pressure safety valves shall be checked on a regular basis.

**Blowout Preventers, Flexible Bleed-Off and Kill Hoses**

11.4.2 Shop Service and Testing

**Documentation**

The service person or company shall complete a form stating the date of service and testing. The contractor shall keep a copy of the completed inspection report on file. A certificate indicating the date of service and testing shall be available at the rig.

**Frequency**

Shop service and testing shall be conducted:

- At least every three years;
- Any time the equipment is subject to uncontrolled flow of reservoir fluids; or
- After a serious kick or well control operation of extended duration.

11.4.3 Minimum Blowout Preventer (BOP) Requirements

- All repairs or replacements shall be equivalent to or better than original.
- Complete disassembly of the preventer, both mechanical and hydraulic, is required.
- Visual inspection of sealing surfaces shall be performed and repairs made as required.
- Measurement of critical wear areas and comparison with original specifications shall be performed.
- All elastomer seals shall be replaced.
- All repairs and parts replaced shall be recorded.
  - Pressure test after reassembly;
  - Two 15 minute pressure tests are required (a low pressure test of 1400 kPa and a high pressure test equal to the working pressure of the BOP);
  - Test all hydraulics for both open and close; and
  - Any weld repairs shall be hardness tested.

11.4.4 Minimum Hose Requirements

The following servicing shall be performed:

- A visual inspection, both internal and external,
- End connections shall be repaired or replaced as required,
- After inspection and reassembly, the hose shall be shop tested:
  - Pressure test after reassembly; and
  - Pressure test rated pressure for 10 minutes; and
- An identification number, manufacturer name and date of last recertification shall be permanently affixed to the hose assembly.

11.4.5 Field Pressure Testing

Annular preventers, ram preventers, kelly cocks, stabbing valves, inside BOP, kill line valves, choke line valves, blowdown manifold, standpipe and standpipe valves, casing, etc. shall be pressure tested.

Tests are required prior to drilling out surface, intermediate or production casing and sequences of drill stem tests. Test results shall be recorded in the tour book. Tests on the annular shall be conducted with pipe in the hole.

Low and high pressure tests shall be conducted on the casing, preventers and manifold for a duration of 10 minutes. All test records shall show the preventer tested, the test duration and the test pressures observed at the start and finish of each test.

When any component part of the preventer assembly is disturbed (including lines and valves), the disturbed portion shall be tested before returning the system to service.

Tests shall be conducted with water or a water/glycol mix. All lines subject to freezing shall be filled with antifreeze, preferably glycol, after testing.

Casing is included in all testing except when the pressure at the casing shoe would exceed 67% of the casing burst pressure. The casing is then excluded using a casing hanger plug.
11.4.6 Blowout Preventer (BOP) Function Testing

All function tests shall be conducted and shall be recorded in the tour book.

The annular preventer shall be mechanically tested by closing on pipe or collars once each day.

The pipe rams shall be mechanically tested by closing on drill pipe once each day.

The blind rams shall be mechanically tested by closing after each trip out of the hole.

The hydraulic valve and remote controlled choke shall be mechanically tested by opening and closing once each day.

11.4.7 Hoisting Equipment (Engineering and Rating Documentation)

In each province, the Occupational Health & Safety Regulations contain several sections that are applicable to rigs. In order to comply with these regulations, the contractor shall be able to produce manufacturer specifications, engineering certificates and maintenance log books. The areas of concern are as follows.

11.4.8 Derricks

Log Book

A derrick log book shall exist and contain records of all inspections, examinations, defects and repairs. All entries shall be dated and signed by a rig company representative. This log book shall travel with the derrick.

Repairs and Maintenance

All structural repairs or modifications shall be certified by a professional engineer to the effect that the workmanship and quality of materials used are such that the capacity of the components is not less than their original capacity.

Plates and Capacities

All derricks shall have attached a plate or weatherproof chart showing:

- Manufacturer rated capacity;
- Manufacturer name; and
- Model, serial number and year of manufacturer’s shipment date.
If the rig design requires guy lines, the manufacturer specifications for the correct number of guy lines, proper spacing and anchor capacity shall be on a plate affixed to the derrick or available as a specification sheet at the rig.

11.4.9 Shop Inspection

Shop inspection of the following components shall be conducted every 3 years (approximately 1000 days of actual service):

- Travelling blocks;
- Hooks;
- Elevator links or bales;
- Elevators;
- Swivels;
- Kelly; and
- Crown blocks.

A certificate of shop inspection shall be kept on the rig. A professional engineer shall certify all structural repairs or modifications to these pieces of equipment.

11.4.10 Tags and Stamps

Provincial and Territorial Occupational Health & Safety Regulations require that all equipment be maintained to manufacturer specifications.

Many pieces of equipment will require shop testing and re-certification to meet manufacturer specifications. Often, no formal documentation is produced during this servicing, but equipment is tagged and stamped. Equipment of concern includes:

- Fall arrest devices;
- Breathing apparatus;
- Derrick safety belts, lanyards and harnesses;
- Fire extinguishers; and
- Pressure safety valves for mud pumps.

11.5 DRILLING BLOWOUT PREVENTION EQUIPMENT

The following guidelines for blowout prevention equipment are based on Industry Recommended Practice (IRP) 1.1 for sour wells.

In selecting a preferred Blowout Preventer (BOP) stack arrangement, it is necessary to accept the fact that equipment can fail and to design a redundant system to reduce the effect of failure. The design shall take into account the probabilities of a given component failing and the probabilities of a given situation occurring.
The safety of the on-site personnel is the most important factor in any design.

11.5.1 Configuration

The minimum component requirements are one annular preventer, two spools and three rams, one ram to be located directly below the annular preventer.

Although a drilling spool is preferred from the bottom secondary spool when rig height is limited, the use of side outlets on the ram preventers shall be allowed. These outlets are as reliable as spool outlets and the consequence of failure is no more severe. Since this is an emergency bleed-off line, erosion of the outlet is not a problem.

11.5.2 Equipment and Materials

Equipment Standards

All test equipment shall conform to applicable standards. Certificate of equipment inspections shall be required at Northern Cross’s discretion. These may include:

- ASME (American Society of Mechanical Engineers),
- ANSI (American National Standards Institute),
- NACE (The National Association of Corrosion Engineers),
- API (American Petroleum Institute), and
- ULC (Underwriters Laboratories of Canada).

Choke Line Usage

The choke line shall be used as the primary line and the bottom choke line shall only be used as a backup system to control the flow in the well during a kill operation.

The choke line is used to control the flow during the kill operation.

The bottom secondary spool shall only be used as an emergency line to control the pressure during a component failure when the top primary spool is inoperative. Unless absolutely necessary, the bottom secondary spool shall not be used to kill the well. Instead, the failure shall be repaired and kill procedures resumed.

Wing Valves

Wing valves on the casing bowl or on the intermediate spool shall not be considered acceptable substitutes for a drilling spool.
HCR Valve Position

The position of the HCR valve shall be at the contractor and operator's discretion.

The inside location of the HCR offers advantages under special circumstances. Since the distance between the stack and HCR is shortened, the potential for plugging and freezing are reduced. This advantage becomes more important when high viscosity weighted drilling fluids are being used and in the case where mud rheological properties are affected by the H₂S influx.

Safety is always the most important concern when making any decision and that is the reason the outside position is generally more favourable. The outside position enables workers to isolate the well when servicing the HCR valve.

Manual override (both opening and closing) is desirable when there is only one spool. Since all the BOP stack configurations recommended for sour wells require two spools with manual valves on the bottom spool, a manual override is necessary.

Handwheels

For manually locking rams, handwheels shall be provided for each ram in a readily accessible location.

Shear Blind Rams (SBRs)

The use of shear blind rams shall be at the operator's discretion, based on well conditions. Specifically, both the risk of a blowout and its attendant consequences shall be addressed.

The use of shear blind rams in land-based drilling in North America has been on an extremely selective basis. Conversely, they are used extensively offshore.

In addition to the obvious advantage of containing the influx through the use of SBRs, the following disadvantages and risks shall be considered:

- Loss of primary well control capability (i.e. circulation of weighted fluid may not be immediately available).
- The risks associated with a fishing job may be added to the post-well control activities.
- The SBRs may not fully shear and/or seal, or be inadvertently activated due to the lack of a foolproof layout and operating instructions (i.e. design deficiencies).
- The SBRs may be prematurely activated (training deficiencies).
Additional equipment may need to be purchased (i.e. higher than 33,000 kPa cylinders or boosters) in order to operate the SBRs. Additional function testing and maintenance of SBRs and additional equipment will be required.

Notwithstanding these issues, there may be special circumstances where the need for SBRs in onshore drilling becomes as crucial as it is in the offshore environment. As an example, for sour wells where predicted well conditions and proximity to a population centre lead to a decision for immediate ignition, SBRs could be considered a more prudent option.

Evacuation is an acceptable alternative to the employment of SBRs for wells drilled on land where there are a limited number of residents and on-site personnel who may be quickly and effectively evacuated.

Advantages of using SBRs relative to using ignition include:

- All equipment, other than the drill string, remain intact and serviceable.
- Environmental damage due to sulphur dioxide is avoided.
- Potentially valuable hydrocarbons are conserved.
- The time to regain primary well control is generally shortened (i.e. no requirements to remove equipment damaged by fire).

**SBR Configuration and Casing Requirements**

Where the use of an SBR is contemplated, it should be selected to replace the conventional blind ram in the preferred configurations shown in IRP 1.1.2.

There are no technical or operational advantages to having the SBR as an addition to the stack components illustrated in IRP 1.1.2.2. The SBR performs the same function as the blind ram when the drill string is out of the hole and with similar reliability.

**Casing Bowls**

- Sour wells shall have welded casing bowls, welded in accordance with IRP 1.15 “Welding Guidelines.” Alternatively, the use of threaded casing bowls is acceptable provided the threads are in accordance with API Spec 6A², Section XO, “Wellhead and Christmas Tree Equipment”, that make up procedure and torque are in accordance with API RP 5C13 “Recommended Practice for Care and Use of Casing and Tubing,” and that thread compound be in accordance with API Bull 5A24 “Bulletin on Thread Compounds”.
- Casing bowl outlets shall be flanged for service on wells that have stack pressure ratings of 33,000 kPa or greater as per API RP53⁵.
Minimum Accumulator Sizing

The accumulator shall be sized such that, when charged to its operating pressure and with the recharge pump off, there should be sufficient volume to open the HCR, close the annular preventer on drill pipe and close, open and close on the ram preventer. The final accumulator pressure shall not be less than 8400 kPa.

Hydraulic Blowout Preventer (BOP) Control Lines

The use of metal sheathing or other fire protection shall be considered on sour wells.

Hydraulic Fluid

The fluid used in the hydraulic system shall have a minimum pour point of 50°C and shall be of a type approved by the Blowout Preventer (BOP) manufacturer.

Accumulator System Recommendations

The hydraulic manifold shall be equipped with a full opening valve and provision for tie-in of an auxiliary hydraulic power source (API TP 53 5.A 16b5).

Provision shall be made for isolation of accumulator banks into at least two sections.

Nitrogen Reserve System

A nitrogen reserve system shall be sized to open the HCR valve and close both the annular preventer and one ram preventer, and maintain at least 1400 kPa over the manifold pre-charge pressure.

Provision shall be included to isolate the nitrogen supply from the accumulator system.

11.5.3 Mechanical Specifications

Pressure Rating

The pressure rating of a Blowout Preventer (BOP) stack is equal to the API pressure rating of the weakest stack component. BOP stack components are casing bowls, valves, preventers, flanges or any other equipment directly attached to the stack/casing bowl that would experience stack pressure (i.e. surface casing if intermediate casing is not required). The following table summarizes minimum pressure ratings for BOP stacks.
<table>
<thead>
<tr>
<th>Class</th>
<th>Maximum Depth (m)</th>
<th>BOP Stack Pressure Rating (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>II, III</td>
<td>1800</td>
<td>14,000</td>
</tr>
<tr>
<td>IV</td>
<td>3600</td>
<td>33,000</td>
</tr>
<tr>
<td>V</td>
<td>6000</td>
<td>34,000</td>
</tr>
<tr>
<td>VI</td>
<td>6000</td>
<td>69,000</td>
</tr>
</tbody>
</table>

11.5.4 Blowout Preventer (BOP) Control System

Hydraulic Pump Requirements

- Two separate sources of hydraulic pressure shall be provided to recharge the accumulators.
- The pumps shall have a working pressure equal to that of the accumulator system (API RP53.5.A.115).
- The preferred combination of hydraulic power sources is one electric and one air powered. Alternative power sources as detailed in API RP535.A.135 are acceptable.
- One hydraulic power source shall, without the accumulator, be capable of closing the annular preventer on drill pipe, opening the HCR valve and obtaining 1400 kPa above the accumulator pre-charge pressure within 5 minutes.

BOP Master Control Station Location

- The master control station shall be located at ground level and not on the rig floor.
- On drilling rigs operating in Western Canada, the BOP master station is commonly located at one of three locations:
  - At the rig floor;
  - Adjacent to the accumulators; or
  - Where three control stations exist at some ground level location other than the accumulator building.

The master BOP control station is located at the rig floor because:

- Less control piping is required as a single control line and return line is routed from the floor to the BOP stack.
- Fewer connections are required, resulting in lower chance for leaks and contamination of control fluid.
- Freeze protection is more reliable as lines are commonly confined to the heated substructure.
Cost is lower due to the above factors.

However, locating the master BOP control station adjacent to the accumulators or at an alternate ground level location is desirable when drilling a sour well because this:

- Provides an opportunity to activate the BOP’s in the event of a fire on the rig floor or in the sub-structure.
- Provides an opportunity to activate the BOP’s in the event of a mechanical failure or interference with BOP control station on the rig floor.
- Provides greater potential for successfully rigging up an auxiliary BOP control system, specifically power and control lines, should the original systems be rendered inoperative.
- Provides individual control and return lines for each BOP element and HCR actuator.

11.5.5 Kick Control

Historically, a high percentage of kicks and blowouts have occurred while tripping. The causes are either not keeping the hole full or swabbing the well in.

It is, therefore, essential that the drilling supervisor ensure proper hole fill procedures, hole fill volume monitoring, trip records, flow checks and drills are conducted.

11.5.6 Flow Checks

Whenever any kick warning sign is noticed, a flow check shall be conducted immediately. All flow checks shall follow this general procedure:

- The driller alerts his crew and sends somebody to notify the drilling supervisor and toolpush.
- Hoist the drill string so the first tool joint is above the table.
- Shut the pumps off.
- Divert the flow into the trip tank.
- Monitor trip tank level for at least 5 minutes to see if any flow occurs.

If sticking pipe is a concern, set slips and rotate the string slowly during the flow check.

Flow checks shall be conducted for the situations listed below, even if no warning signs are observed. These flow checks have such value in well control that, for the minimal effort and time consumed, they shall be standard procedure on all wells.
Flow checks shall be required:

- Prior to beginning a trip out of the hole.
- After pulling the first 15 singles.
- Prior to pulling the first stand of collars out of the hole.
- After all pipe is out of the hole.

For more information on flow checks and kick control refer to Industry Recommended Practices (IRP [1.8]).

### 11.5.7 Hole Filling

A trip record shall be completed for every trip made while drilling the well. Each trip record shall show both the calculated fill-up volume and the actual volume required each time the hole is filled. In addition, both calculated and actual cumulative fill volumes shall be recorded after each successive fill.

Both the rig manager and drilling supervisor shall sign and date the trip sheet. All trip sheets shall be kept and made available for inspection until the rig is released.

If the trip tank requires refilling during the trip, the pipe pulling operation shall be halted until the tank is refilled (IRP [1.8.4]).

Provincial regulations normally allow hole fill volumes to lag behind the volume of pipe pulled. However, the fluid level shall not drop lower than 30 metres.

On sour wells, the hole shall be filled to surface at each fill up point.

To ensure the pipe pulls dry, a weighted fill shall be used. When the entire pipe is out of the hole, the blind rams shall be left open, a cover placed over the hole and the trip tank circulated across the wellhead. This will ensure any change in tank volume is easily noticed.

Each driller shall understand the operation of all kick detection and hole monitoring equipment. The technician who installs the monitoring equipment shall train the drillers in equipment operation and setting of alarm limits. The drilling supervisor shall be responsible for ensuring this training is performed.

Detecting and monitoring equipment shall include:

- A cumulative pump stroke counter,
- A readout at the driller’s station showing pump strokes per minute,
- A PVT (Pit Volume Totalizer) system which:
  - Is capable of detection ±1.0 m³,
  - Has an alarm at the driller’s station,
- Has a chart recorder for mud tank volumes,
- Has a mechanical backup system, and
- When drilling the alarm shall be set to detect a gain or loss in the total drilling fluid of not more than 2.0 m³.

- A flowline sensor capable of:
  - Detecting ± 10% change in the circulating rate, and
  - Recording flow rate where pump speed (SPM) and rate (m³/min) are noted on the chart once each tour.

This flowline sensor shall be checked daily. Change the SPM by 10% and note the corresponding flow reading on the recording chart:

- An indicator light on the flowline sensor showing if the alarm has been turned off,
- Trip tank gauges capable of reading to 0.1 m³ for a mechanical system and 0.01 m³ for a PVT system, and
- A recording device which continuously records:
  - Rate of penetration,
  - Pump pressure,
  - Pump strokes per minute,
  - Hook load,
  - Rotary rpm, and
  - Rotary torque.

11.5.8 Drill Stem Testing

This section will address the safety concerns of drill stem testing. Particular hazards that can occur on the drill stem test would include flammable gases/fluids, poisonous gases/fluids, pressure formation breakdown resulting in loss of hydrostatic pressure and well kick.

11.5.9 Safety Recommendations

General Safety Recommendations

Approved personal protective equipment shall be worn by all personnel on site (including eye and hearing protection as required).

- Fire retardant clothing shall be worn from tool open until shut-in, purging and shipping of flammable fluids is complete.
- Personnel shall be clean shaven in order to facilitate proper fit of respiratory devices.
- Smoking areas shall be limited and clearly defined to personnel and be at least 25 metres from any potential explosion hazards.
- An approved first aid kit shall be on site.
- Warning signs and wind direction indicators shall be posted at site access.
Wellsite lighting (including flashlights) shall be of an explosion proof type and provide adequate illumination.

A telephone (or adequate means of communication) and a telephone list of Northern Cross contacts, police, emergency services, government agencies and written directions to the location shall be kept near the phone.

A means of transportation with an unobstructed exit shall be on location at all times.

Approved fire extinguishers shall be accessible and strategically located in accordance with anticipated hazards.

Minimum of 2 self-contained, positive pressure breathing apparatus (SCBA) shall be on every site for every testing job.

For wells classed as caution or sour wells, an H₂S specialist and breathing apparatus for all personnel shall be available on site.

H₂S detection equipment shall be available on all sites. All H₂S determinations shall be made while wearing breathing apparatus.

Non-essential personnel shall be off location.

All safety equipment shall be inspected and/or serviced prior to tool open.

Test system shall be visually inspected and pressure tested where applicable prior to tool open.

Blowout Preventer (BOP) shall be function tested prior to tool open.

A detailed pre-job safety meeting shall be held and recorded prior to tool open.

All personnel involved in starting up a test on a caution or higher risk well shall wear breathing apparatus until the hazard or operational status has been determined.

The test system shall be inspected for leaks immediately after start up and periodically thereafter. Inspections shall be performed wearing breathing apparatus when indicated.

Status of flow conditions, equipment performance and safety review shall be held with crews at shift change.

Standby safety watch procedures shall be used when gauging tanks, shipping produced fluids to trucks and all other activities in proximity of hazard areas.

For caution or higher wells:
- Test start up shall be executed in daylight hours with an alert crew, and
- Test pull shall be executed in daylight hours unless returns have been reverse circulated from test string.

Specific Safety Recommendations

Prior to testing, the Northern Cross representative shall ensure the availability of all materials, equipment and specialized personnel on location. This shall include adequate plugs, a function mud can and recovery system and a tank to facilitate reverse circulating if necessary.
Should the designation of the well be a caution or higher risk rating, an H₂S specialist shall be contracted to provide additional H₂S safety equipment and chemical for string inhibiting and ammonia to aid in gas sweetening.

The drilling rig shall be adequately equipped and in good working order. Rig motor exhausts shall have an inlet for running a steam blanket during the test and pull and rig motors shall have functional positive air shut-offs.

The test string shall be adequate for the job and treated with inhibitor if necessary. The test tool shall be serviced and tested prior to running in the string. Drill pipe, collars, other BHA components, crossovers and stabbing valve shall be in good order and inspected pursuant to the pipe inspection schedule. Ensure the installation of the pump-out sub above the test tool (suggest 1 single of collar) and the installation of a function test stabbing valve 1 single of drill pipe below test head. Test head shall have a knockout bar securely installed and shall be function tested prior to tool open. Ensure the knockout bar shall pass through ID of open stabbing valve. Chicsans shall be sufficient to allow for access of the stabbing valve and shall be connected to safety lines. If a test manifold is used, it shall be chained to the rig floor to prevent movement should high pressures be encountered. The riser from the flare line to the rig floor shall be secured to prevent movement.

The flaring system shall be checked for closed valves and/or plugging prior to tool open. Dry steam or air shall be used for this purpose. Ensure valves on any risers downstream are closed and the rig manifold system is properly set for test. If flaring to an open pit, an adequate backwall shall exist to contain flare and/or pressure surges. A pilot light of a sawdust/diesel or rags/diesel mixture shall be lit to utilize 2 of these pilots in the pit. Ensure the pilot is not located directly in the path of the gas or fluid blow so as not to be extinguished. If a flare stack is used, it shall be properly erected, purged and coated with its base no closer than 2.5 times its height from the nearest debris or flammable material. All flare stacks shall have a continuous pilot, which is to be lit prior to tool opening. All flare lines are to be staked or weighted to prevent their movement.

The safety trailer shall be equipped with twelve, 300 ft³ breathing air cylinders. Manifolds and airlines shall be designed for all weather service. Two self-contained and six supplied air breathing apparatus shall be supplied, as well as a resuscitator with D size oxygen cylinders, a first aid kit, stretcher, gas detection device and sample tubes. A recharge system shall be included to recharge portable breathing apparatus. The safety trailer shall be properly placed at the location, inspected and serviced. The airline system shall be rigged in accordance to site needs and pressure tested prior to opening the well.
11.5.10 Responsibilities

**Site Representative**

The Northern Cross site representative shall be responsible to ensure necessary permits have been acquired prior to flowing of the well and shall retain overall responsibility regarding the integrity of the equipment used on location, use of equipment and conduct of personnel.

**Contractor Supervisor**

The contractor supervisor shall be responsible for his service company’s equipment and personnel conduct on site. The contractor supervisor shall be experienced, qualified to assume these responsibilities and capable of doing so with no direct supervision.

**Rig Manager**

The rig manager shall be responsible for the overall performance of the drilling contractor’s equipment and personnel. The rig manager shall be experienced, qualified and capable of working with no direct supervision.

**Driller**

The driller shall be responsible for the overall performance of the drilling contractor’s equipment and personnel on a tour. The driller shall be experienced, qualified and capable of working with minimal supervision.

**Rig Crew Members**

The rig crew members shall be responsible for the performance of the drilling contractor’s equipment and their individual function on a tour. Rig crew members shall be experienced, qualified and capable of working with direct supervision.

**H₂S Specialist**

When required, the H₂S specialist shall be responsible for ensuring the integrity of all breathing apparatus, gas detection equipment, resuscitation devices and fire suppression equipment on site. The H₂S specialist shall carry out initial and ongoing routine inspections of the aforementioned safety equipment, conduct and/or provide relevant input at initial and subsequent safety meetings and advise and assist onsite personnel to ensure all Northern Cross and legislated safety requirements are met.
The H₂S specialist shall carry out initial and ongoing checks for hydrogen sulphide gases at the source points and in the local environment as required, advising personnel as to the current status. The H₂S specialist shall stand as watch during tank gauging and all or any other operations where personnel may be within the proximity of operating equipment, tanks containing recovered fluids/gases and trucks loading these fluids. The H₂S specialist shall be capable of initiating and carrying out a rescue/resuscitation operation in the event of a man down emergency. The H₂S specialist shall be experienced and qualified to assume these responsibilities.

11.5.11 Training

All personnel shall have the following basic training:

- H₂S Alive,
- Emergency First Aid
- Workplace Hazardous Materials Information System (WHMIS)

H₂S specialists shall have the following basic training:

- H₂S Alive/Rescue
- Standard First Aid
- Cardiopulmonary Resuscitation (CPR)
- Oxygen Therapy
- Workplace Hazardous Materials Information System (WHMIS)

11.5.12 Test Procedures

The test is to proceed only after a complete walk through inspection of the test surface system, Blowout Preventer (BOP) function test and detailed safety meeting has taken place.

The test shall be conducted in accordance with Northern Cross’s test program.

- All rig lights turned off.
- Steam or water trickle on rig motor exhaust.
- No unnecessary motors running.
- Rig floor and cellar adequately ventilated.
- Rig floor cleared of unnecessary equipment and debris.
- Non-essential personnel off site.
- Turn test to flare when gas returns are indicated at bubble hose. Breathing apparatus shall be used when checking the bubble hose if H₂S is likely.
- Personnel shall not be allowed in or near cellar, flare system or manifold areas during initial period until a competent person declares these areas
safe following inspection. All determinations for \( \text{H}_2\text{S} \) are to be made wearing breathing apparatus.

- Check surface system for leaks as soon as possible and at least once through the test period.
- Monitor mud in annulus constantly during valve openings.
- Watch surface iron for frost or significant decrease in temperature as this may be indicative of a hydrate plug forming, in which case the test shall be aborted.
- Watch flare, particularly on final shut-in:
  - A strong, steady blow that dies rapidly on shut-in indicates little fluid recovery;
  - A lazy flare that dies quickly indicates dead oil or salt water and a lazy flare that surges on shut-in indicates active oil or salt water; and
  - A strong blow that surges vigorously after shut-in indicates light gaseous crude or condensate recovery and may take up to 24 hours to bleed off. Do not attempt to pull this string immediately after shut-in.
- If liquid hydrocarbon or sour water recovery is indicated, the tool shall be hoisted clear of the test interval and left connected to flare until daylight.
- If pulling a test string at night shall continue, the string shall be reverse circulated. Ensure an adequate fluid cushion above the shut-in tool and drop bar and reverse circulate.

### 11.5.13 Pulling the Sour Test

When sour recovery is indicated during the test, special precautions shall be taken during the pull. Sweet gas to surface is not a guarantee of sweet recovery throughout the string. When testing any zone that has not consistently proven sweet at the locale, the zone shall be treated with caution until the test is on the bank.

- An \( \text{H}_2\text{S} \) specialist shall be on location with equipment rigged in prior to attempting to pull a sour string.
- Check for \( \text{H}_2\text{S} \) at surface iron through a bubble hose valve or a valve on the test manifold to determine whether masking up will be required to break surface iron. It may be possible to purge sour gases from surface iron with rig air or air from the safety trailer.
- Break out surface iron.
- Hoist to and close stabbing valve.
- Remove a single with test head.
- \( \text{H}_2\text{S} \) specialist, while masked, will slowly open stabbing valve. All other personnel shall be off the floor.
- Check for \( \text{H}_2\text{S} \). If required, treat the string with ammonia.
- Continue with pull, checking for \( \text{H}_2\text{S} \) at least every 5 stands.
Should H₂S recur, treat again with ammonia. If this is ineffective, determine whether to mask crew or fill string with water and reverse circulate.

Remember to use test plugs if fluid recovery is likely.

When string has been reversed out, begin checking for H₂S at least every 5 stands above pump-out sub. If H₂S is encountered, mask crew to continue pulling collars. Be wary of pressure and keep crew masked until pressure is bled off between shut-in tool and bottom hole sampler.

If sour fluids contaminate rig floor and/or cellar, have the areas washed with ammonia and flushed with water before tool servicing or laydown continues.

Check and evaluate area after the sour test is on the bank.

11.5.14 Ammonia Treatment

Ammonia shall be mixed and the pipe treated while under mask. Mixture shall be 1:1 water/ammonia. A pail of water shall be poured in the string after treatment to flush the ammonia odour. Ammonia is almost always an effective means of neutralizing H₂S in its gaseous state.

11.5.15 Air Purge

Surface iron can be effectively purged with air by making up the appropriate air fitting to the test manifold or to the bubble hose connection. To purge, raise the string, if needed, to access the stabbing valve. Close the valve on the flare side of the airline, sending a brief but sufficient purge of air through the stabbing valve into the test string. Without reducing air, close the stabbing valve, allowing some pressure to build before opening the valve to flare. This procedure should effectively purge the surface iron, allowing workers to safely break out from the test head and the top stand from the stabbing valve.

Effectiveness shall be determined before allowing break out to proceed. The stabbing valve, when free of the top single, shall be slowly opened by a masked worker (normally the H₂S specialist) when other personnel have left the floor. At this point, H₂S determinations shall again be made and ammonia treatment can proceed as necessary.

11.5.16 Reverse Circulating

Reverse circulating shall only be attempted when the test tool has been pulled free and hoisted clear of the test formation.

The knockout bar shall be dropped with an appropriate fluid cushion. To do otherwise can create a hydrostatic imbalance that may result in a kick or wellbore damage. Prior to dropping the bar, calculate the necessary mud volume and pump strokes required to accomplish total pipe volume
displacement. Watch mud in annulus when bar is dropped. Annular mud should visibly drop when the knockout pins shear.

- Start circulating at low pump speed, building no more speed than is required to achieve the objective. Continue to circulate until only clean mud is indicated in drill pipe.
- A worker wearing breathing apparatus in case the connection between the sample bottle and hose is loose and H₂S is released shall take samples at the bubble hose.
- Never reverse directly to a tank truck.

11.5.17 Coring Operations

Although often a routine part of the drilling process, coring presents two major hazards:

- The possibility of taking a kick is often increased while coring; and
- Core recovery may result in toxic gas accumulations on the rig floor.

Well Control While Coring

There are two situations that can arise while coring an interval with production potential:

- Gas enters the well core with the cuttings; or
- Swabbing occurs while tripping.

Coring is usually restricted to those formations with the highest potential for production. For this reason alone, special attention shall be given to kick warning signs. In order to avoid well control problems while coring, the drilling supervisor shall take the following measures:

- Ensure the rig crew are paying adequate attention to the various kick warning signs.
- Conduct flow checks at any warning sign.
- If possible, monitor the mud returns for evidence of gas cutting.
- If gas cutting is suspected, circulate bottoms-up.

Hoisting a core barrel is more prone to swabbing than hoisting a rock bit. Furthermore, if a kick is swabbed in, experience shows that the influx is likely to come up through the drill pipe. In order to avoid well control problems while hoisting the core, the drilling supervisor shall take the following measures:

- Conduct a flow check prior to pulling off bottom and again after hoisting the first 5 stands, even if no warning sign is present.
- Ensure the rig crew are paying adequate attention to the various kick warning signs.
• Conduct flow check at any warning sign.
• Check the fill up record to ensure that proper hole fill procedures are being followed.

If the hole fill volumes decline consistently from the calculated volumes, conduct a flow check immediately. Even if there is no flow, it must still be assumed that gas has entered the wellbore although in insufficient quantities to cause a flow.

If there are signs that swabbing is occurring or a gas bubble has entered the wellbore:

• Stop hoisting.
• Conduct a flow check. If the well flows, shut in immediately and implement well control procedures.
• If the well does not flow, run drill string back to bottom and circulate bottoms-up or until all gas is out of the wellbore.

While circulating out a gas bubble, the bottom hole pressure shall be kept constant. As the gas rises in the annulus it will expand, forcing mud out of the hole and causing a reduction in the hydrostatic pressure. This reduction in pressure may have to be compensated by increasing back pressure on the annulus.

Normally, if the swabbing or gas cutting is noticed quickly, the volume of gas will not appreciably reduce the hydrostatic pressure. However, greater care shall be taken while circulating out the gas. Specifically, the pit gain shall be closely monitored. The amount of gas expansion occurring in the annulus equals the amount of pit gain. A pit gain in excess of 2 m³ will usually require shutting in the well and continuing the circulation through the choke.

**General Procedures for Coring**

It is recommended to run a bit junk sub one bit trip prior to coring to ensure that the hole is free of any metal that would damage the diamond core bit.

Check the core bit for damage both prior to coring and after coring is completed.

When reaching the bottom with the core barrel, circulate at a high rate to flush any junk above the bit. Touch bottom twice with this high circulating rate, then go to bottom, rotating slowly. Upon touching bottom, reduce circulating rate to normal. The exact bit force, mud circulation and rotating speed shall be determined in consultation with the coring operator.

Upon recovering the core at surface, lay it out on the derrick floor in the exact order it is removed from the core barrel. Follow the geologist’s instructions for
washing, steaming or wiping the core. Measure the length of the core, obtain a brief description from the geologist and enter it in the tour book.

Core Removal and Packaging

This operation shall be carried out with the guidance of the geologist but under the supervision of the drilling supervisor.

Extreme care shall be taken in laying down the core so no information is lost due to haste or carelessness.

Cores are packaged according to the type of analysis that will eventually be performed on them. The drilling supervisor is responsible for ensuring that packaging shall be completed as requested by the geologist. Cores are usually packaged as follows:

- **Dry Preservation**: No special packaging required.
- **Wet Preservation**: Special packaging such as plastic bags, plastic coating, paraffin coating or freezing may be required. Special packaging minimizes evaporation of fluids before the core is analyzed.
- **Plastic Sleeve**: The cores are automatically packaged in a plastic tube during the actual coring. Capping the ends of each segment is normally all that is required although sometimes holes must be drilled in the sleeve to bleed pressure.

Cores are normally packaged in sturdy wooden or cardboard containers. The drilling supervisor shall ensure that packages are handled with reasonable care to prevent the loss of valuable information.

11.6 MUD PRODUCTS STORAGE

Most mud products are WHMIS controlled products. The drilling supervisor shall ensure that:

- The products delivered and stored on site carry the proper WHMIS labels.
- The MSDS for the controlled products are available to the workers.
- The workers are aware of any hazards associated with the products.

11.6.1 Mud Vans

In order to create a safer working environment for rig personnel, the Canadian Association of Oilwell Drilling Contractors (CAODC) has developed a set of standards for stairs, lighting and loading of mud vans. These standards have received general acceptance by the Canadian Association of Petroleum Producers (CAPP).
Stairs

The mud van stairs shall be constructed so they do not increase the hazards to workers. Stairs shall:

- Be hinged or pinned to the van so no gaps are created and the stairs rise from the van, as it is unloaded.
- Be wide enough so that workers clear the railings while carrying bags (a minimum width of 80 cm or 30 inches is recommended).
- Have treads built of a material that provides adequate grip and have a width of at least 30 cm (12 inches).
- Have a slope of $30^\circ$ (7 inch rise).
- Be installed at the rear doors.

Lighting

Illumination from outside the van may create a glare hazard and it does not provide adequate light to the front of the van. At least four incandescent bulbs shall be evenly spaced along the roof on one side of the van. The lights shall be protected from breakage by globes or guards.

An integral extension cord 30 metres in length shall be supplied with the van. The cord shall be coiled by the rear doors. Cord ends shall be for a 120 volt, 15 amp service. All wiring shall be to Canadian Standards Association (CSA) standards.

Loading

Mud vans shall be loaded with consideration for the safety of the workers who will have to unload the products. Mud vans shall be loaded so as to meet the following requirements:

- An aisleway shall be provided so workers do not have to climb over pallets.
- Product shall not be loaded so high that bags could fall and injure workers.
- Product shall be removed through the back doors.
- Vans shall not be shipped with broken bags or spilled products.
- All packaging shall comply with Workplace Hazardous Materials Information System (WHMIS) regulations.
11.6.2 Drills and Procedures

**Blowout Preventer (BOP) Drills**

A blowout drill shall be conducted prior to drilling out the surface cement shoe. Each member shall repeat drills every seven days thereafter. All drills shall be recorded in the tour book.

Drilling supervisors shall ensure drills are conducted thoroughly with all crew members at least once per week. Drills shall be timed so crews practice procedures for all drilling conditions (tripping, drilling, tripping with drill collars on BOP stacks and out of the hole). If crews are unfamiliar with their duties, the frequency of the drills shall be increased.

**Recommended Crew Position and Procedures**

In order to facilitate training and maintain consistency, it is recommended that the crew positions and duties as outlined in the ENFORM First Line Supervisor’s BOP training program be followed.

However, the drill supervisor shall be satisfied with the crew’s response. If certain crew members do not exhibit the proper skills or attitude required for their assigned duties, the supervisor shall ask the toolpush that the crew member in question be given further training or that someone else be assigned the duties.
### Shut in Procedure While Tripping

<table>
<thead>
<tr>
<th>Crew Member</th>
<th>Driller</th>
<th>Derrick Hand</th>
<th>Motor Hand</th>
<th>Floorhand #1</th>
<th>Floorhand #2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Position</strong></td>
<td>1. Floor</td>
<td>1. Floor</td>
<td>1. Floor</td>
<td>1. Floor</td>
<td>1. Floor</td>
</tr>
<tr>
<td><strong>Duties</strong></td>
<td>Call Alert</td>
<td>Remain in derrick until called down</td>
<td>Go to floor</td>
<td>Go to floor</td>
<td>Go to floor</td>
</tr>
<tr>
<td></td>
<td>Position upper tool joint above table</td>
<td>Go to mud tanks</td>
<td>Set slips. Remove elevators</td>
<td>Set slips. Remove elevators</td>
<td>Set slips. Remove elevators</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Monitor trip tank</td>
<td>Go to choke manifold</td>
<td>Install stabbing valve. Valve open close valve</td>
<td>Install stabbing valve. Valve open close valve</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Open HCR valve</td>
<td>Close annular preventer</td>
<td>Slow close choke. Do not exceed maximum allowable SICP</td>
<td>Assist driller</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Install kelly. Open stabbing valve. Go to choke manifold</td>
<td></td>
<td></td>
<td>Assist driller</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Let pressure stabilize (5 – 15 min). Read and record SICP. Record trip tank gain.</td>
<td>Report increase in trip tank volume</td>
<td></td>
<td>Assist motorhand</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Prepare to kill well or strip in</td>
<td></td>
<td></td>
<td>Notify rig manager. Notify drilling supervisor</td>
</tr>
</tbody>
</table>

### Shut In Procedure While Drilling

<table>
<thead>
<tr>
<th>Crew Member</th>
<th>Driller</th>
<th>Driller</th>
<th>Motor Hand</th>
<th>Floorhand #1</th>
<th>Floorhand #2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Position</strong></td>
<td>1. Floor</td>
<td>1. Floor</td>
<td>1. Floor</td>
<td>1. Floor</td>
<td>1. Floor</td>
</tr>
<tr>
<td><strong>Duties</strong></td>
<td>Call Alert</td>
<td>Go to floor</td>
<td>Go to floor</td>
<td>Go to floor</td>
<td>Go to floor</td>
</tr>
<tr>
<td></td>
<td>Raise kelly</td>
<td>Go to mud tanks</td>
<td>Go to choke manifold</td>
<td>Assist motorhand</td>
<td>Assist driller</td>
</tr>
<tr>
<td></td>
<td>Stop pump</td>
<td>Monitor trip tank</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Open NCR valve</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Close annular preventers</td>
<td></td>
<td>Slowly close choke. Do not exceed maximum allowable SICP</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Let pressure stabilize (5 – 15 min). Read and record SICP. Record trip tank gain</td>
<td></td>
<td>Report increase in trip tank volume</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Prepare to strip in, snub or top kill well</td>
<td></td>
<td></td>
<td>Notify rig manager and drilling supervisor</td>
<td></td>
</tr>
</tbody>
</table>
### Shut In Procedure While Out of the Hole

<table>
<thead>
<tr>
<th>Crew Member</th>
<th>Driller</th>
<th>Derrick Hand</th>
<th>Motor Hand</th>
<th>Floorhand #1</th>
<th>Floorhand #2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duties</td>
<td>Call Alert</td>
<td>Go to floor</td>
<td>Go to floor</td>
<td>Go to floor</td>
<td>Go to floor</td>
</tr>
<tr>
<td></td>
<td>Go to floor</td>
<td>Monitor trip tank</td>
<td>Slowly close choke. Do not exceed maximum allowable SICP</td>
<td>Prepare to strip in, snub or top kill well</td>
<td>Notify rig manager and drilling supervisor</td>
</tr>
<tr>
<td></td>
<td>Let pressure stabilize (5 – 15 min). Read and record SICP. Record trip tank gain.</td>
<td>Record increase in trip tank volume</td>
<td>Record increase in trip tank volume</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Posted Procedures and Well Information

The drilling supervisor shall ensure all critical information and procedures for well control have been posted in the doghouse.

This information shall include:

- Last leak off test results;
- Current reduced pump speeds;
- Current reduced pump speed pressures;
- Maximum casing limitations; and
- Current pit volumes.

Leak off test results and casing limitations shall be posted in the manifold shack when manual chokes are in use.

A hole fill procedures sheet with hole fill volumes such that the fluid level in the wellbore does not fall below 30 metres shall be in the doghouse during every trip. The actual hole fill volumes used shall be recorded.

### 11.6.3 Sour Wells

Wells that may encounter sour gas bearing formations during drilling may be classed as sour wells. Classification is dependent on the maximum potential sour gas release rate during drilling or the well’s proximity to dwellings.
The well license agreement shall include an emergency response plan and may include enhanced inspections, drills and blowout equipment. The drilling supervisor shall be responsible as follows.

The drilling supervisor’s responsibilities shall be stated in the site-specific emergency response plan filed with the well license application. These responsibilities normally are:

- Ensuring the safety of on-site personnel.
- Supervisory personnel involved in well control operations.
- Requesting outside equipment or assistance as required.
- Directing ignition of blowout if ignition criteria are met.
- Informing supervisor of emergency operations, site operations and alert stage.
- Maintaining liaison with on-site government representatives.

In addition to any responsibilities laid out in the site-specific emergency response plan, the drilling supervisor shall ensure the following inspections, drills and procedures are completed.

11.6.4 Inspections and Drills

- The drilling supervisor shall ensure all blowout equipment and stockpiled supplies meet the requirements of the drilling plan.
- A weekly detailed rig inspection shall be completed with the contractor. A detailed checklist shall be used and retained.
- The contractor shall produce manufacturer certificates for lower kelly cocks and stabbing valves showing them as being operable with 7000 kPa pressure below the valve.
- The rig manager shall hold a Second Line BOP certificate. All drillers shall hold a First Line BOP certificate and all rig hands shall hold H2S certificates.
- All drillers shall receive instruction in, and understand, the operation of kick detection and monitoring equipment.
- A detailed rig inspection and blowout drill shall be carried out:
  - Prior to drilling out the surface cement shoe,
  - Prior to drilling out the intermediate casing shoe, and
  - Within the 24 hour period prior to penetrating the sour zone.
- The applicable territorial or provincial field offices shall be notified at least 48 hours prior to these inspections so that an inspector may witness them.

11.6.5 Flow Checks and Trip Records

Increased attention to kick warning signs and preventive measures is required on sour wells. In addition to regular procedures, the following are mandatory on sour wells.
Flow checks of at least 5 minutes duration are required:
- Prior to starting tripping out of the hole;
- After the first 15 singles of drill pipe have been pulled from the hole;
- Prior to pulling the first stand of drill collars from the hole; and
- After all the drill string is out of the hole.

The hole shall be filled to surface after every 15 singles of drill pipe pulled or after every 3 singles of drill collars pulled:
- The actual volume used each time the hole is filled;
- A running cumulative total fill volume updated after each hole fill; and
- Calculated fill volumes for each fill point and calculated cumulative volume for each fill point.

During the critical drilling period, the trip record sheet shall be signed and dated by the drilling supervisor and the rig manager and kept on file at the rig site.

11.7 RIG MOVES

11.7.1 Responsibilities

Rig Manager

The rig manager or toolpush shall:

- Remain in charge of the rig crew.
- Confirm that the contract trucking company is provided with the following:
  - List of weights, dimensions and number of rig loads;
  - Condition of all access and lease roads; and
  - Location and type of road obstructions, low overhead power and telephone lines and low overhead structures.
- Confirm the contract trucking company is provided with a copy of Northern Cross’s safety requirements for rig movers.
- Discuss with the contract truck push the equipment required, the location of the lease that the rig is on and the final destination of the rig.
- Conduct a pre-job safety meeting with all Northern Cross contract personnel prior to commencing any work, discussing the following:
  - The importance of proper communication between the contractor and Northern Cross workers, and
  - The necessary tasks and any potential hazards of working with or around unfamiliar equipment such as:
    - Contractor vehicles on lease,
    - Crawler tractors, front end loaders, etc.,
    - Working in the vicinity of cranes or pickers,
    - The proper and safe use of slings,
    - Standing or working under suspension loads, and
• Standing or working too close to cables under tension.
- Review rig worker responsibilities. Do not deviate from proper safe work procedures, and
- Confirm that radio communication is established between truck push, truck drivers, swampers, equipment operators or any other person requiring such communication devices.

**Trucking Contractor**

The truck push shall:

- Ensure that industry accepted standard task procedures such as the Canadian Association of Oilwell Drilling Contractors (CAODC) “Rig Moves Procedures Manual” are used during the rig move.
- Confirm that each driver or operator has the required documentation and permits.
- Provide each driver with the weights and dimensions of loads and the established routing.
- Ensure drivers are aware of the maximum heights of each load.
- Provide a radio-equipped escort vehicle as may be required.
- Provide each driver with a detailed list and location of any obstructions, power lines, telephone lines, low overpasses or any other information drivers may require to do an efficient and safe haul.
- Confirm that each driver examines the load and secures the load properly prior to leaving the lease.
- Confirm that drivers have the necessary flagging and signs posted on trailers and that all clearance lights, headlights, brake and turn signals are in working condition prior to leaving the lease.
- Ensure that all trucking personnel are properly attired, wearing proper safety boots, hard hats, gloves and any other personal protective equipment to do the job safely.
- Enforce all trucking safety rules and regulations and the operating company’s guidelines.

**11.7.2 General Guidelines**

Damage to Northern Cross equipment, downtime and personal injury can be very costly to Northern Cross and its operations.

Drilling supervisors shall carefully select trucking companies who have a viable safety program and an accepted accident experience rating.

The following are minimum guidelines for safe rig moves:

- Drivers shall possess the proper class of license.
- All incidents and accidents are to be reported to the Northern Cross representative.
- Smoking is prohibited in areas designated as non-smoking areas.
- Alcohol or non-prescription drugs are not permitted on Northern Cross worksites or roads. Persons impaired by alcohol or drugs, including prescription medications, are prohibited from operating any equipment while on Northern Cross sites or roads.
- Headlights shall be used at all times when driving on lease or access roads.
- Vehicles shall be driven at or below the posted speed limits.
- High visibility vests shall be worn at all times during loading and unloading of equipment at trucks.
- Misconduct or misuse of equipment on Northern Cross property may result in immediate termination of contract.
- To reduce the unplanned movement of fuel in rig tanks, the tanks shall be transported neither less than 1/4 full nor more than 3/4 full unless the tanks are baffled.
- Vehicle operators shall chain up when instructed or where road conditions warrant.
- All equipment shall be chained and securely fastened and checked periodically en route.
- All vehicles taking on or discharging flammable/explosive fluids on Northern Cross property shall have units properly grounded and bonded.
- If a leak occurs on any piece of equipment while being loaded, transported or unloaded, the Northern Cross representative and appropriate authorities shall be immediately informed.
- No person shall stand between the vehicle and the loading or docking area. No person shall stand in the path or within close proximity of the winch line when the winch line is being used and is under load.
- The trucking contractor shall ensure that all vehicles are provided with a communication device.
- No loose fitting clothing or other loose articles are to be worn. Long hair shall be confined.
- No worker shall be permitted to ride on any equipment, on trailers or anywhere but in the cab of the vehicle.
- No worker shall be permitted to jump from or between any piece of equipment, truck or trailer.
- If the load is too high, the Northern Cross representative shall arrange with the field office to have the power lines de-energized or disconnected by a qualified electrician or, if power lines are the property of a utility company, arrangements shall be made with the utility company to remove, de-energize or raise the lines as may be required.
- No equipment shall be permitted to remain stationary below power lines, nor shall workers be permitted to work on, secure, remove or load while in close proximity to any overhead power lines unless the power lines have been de-energized.
Should a power line come into contact with the load, **DO NOT GET OUT OF THE VEHICLE.** Radio the truck push or the office if possible.

If it is necessary to leave a vehicle due to electrical contact and no help is available, jump as far away as possible from the vehicle. Land on the ground with both feet together, and then hop away from the vehicle with both feet together. Never leave the vehicle if it is in or near water.

Defensive and professional driving shall be mandatory at all times.

### 11.7.3 Crane and Picker Guidelines

**General Requirements**

Hoisting equipment is to be operated only by trained and experienced personnel who have been designated by their employer as hoisting equipment operators.

Hoisting equipment operators shall provide their employer with records of training and experience and demonstrate competence in operating the equipment.

With few exceptions (i.e. endless tubing or side boom operations), operators of hoisting equipment with the capacity of greater than 5 tonnes working in Western Canada shall be certified by the apprenticeship board.

The Northern Cross site representative shall verify the competence of hoisting equipment operators before the move starts.

The rig manager or toolpush shall provide the truck push with a list of weights for all material and equipment to be lifted with a crane or picker truck.

The capacity of the hoisting equipment shall not be exceeded at any time. To meet this requirement the following shall be observed.

- Hoisting equipment shall be equipped with functional boom length and angle indicators and a legible load chart.
- Outriggers shall be properly matted and fully extended when in use, and fully retracted when not in use.
- Hoisting equipment shall be levelled in all directions. One degree off level can reduce crane capacity by 30%.
- Impact loads shall be reduced by smooth operating techniques.
- Side lifts or pulls are prohibited. Hoisting equipment is intended to lift only vertically.
- Hoisting equipment shall not be used to break loose frozen equipment.

**Safe Hoisting Rules**

Only one person shall be designated to give signals. The equipment operator and designated signaller shall agree on a signal system before the job starts.
Before attempting a lift, ensure the load does not exceed the capacity of the equipment.
- Rig all loads properly.
- Riggers shall watch for pinch points when loading on to hooks or slings while the slack is being taken up.
- Use tag lines for controlling the load.
- Do not swing loads over workers or pull loads sideways.
- Never leave loads suspended with the crane unattended.
- When the crane is shut down with the boom raised, leave all controls in neutral, drum brakes locked and the rotation lock disengaged.
- Confirm all hooks on the main hoist block, whipline and slings have properly working safety latches.
- Before every lift, visually inspect all lifting equipment. Replace any damaged or worn parts.
- Do not overload slings.
- Chain or fibre rope shall not be used for lifting material.
- Properly store slings when not in use.
- Do not use wire rope slings with kinks or knots.
- Pad sharp corners of the load to avoid damaging the sling.
- Defective, damaged or worn wire ropes and slings shall be removed from service and destroyed.

11.7.4 Power Line Guidelines

No load shall be allowed to proceed from lease until the following conditions have been complied with.

- The height of the load from ground elevation to the uppermost part of the load shall be accurately measured.
- The truck push and a Northern Cross representative shall verify the vertical height of all overhead power lines between the lease that the equipment is being moved from and the new lease.

A person in charge of equipment shall not approach nor permit equipment to approach overhead power lines within the safe limits as shown in the following table.
SAFE LIMITS OF APPROACH DISTANCES FROM OVERHEAD POWER LINES FOR PERSONS AND EQUIPMENT

<table>
<thead>
<tr>
<th>Operating Voltage of Overhead Power Line Between Conductors</th>
<th>Safe Limit of Approach Distance For Persons or Equipment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 – 750 V Insulated or polyethylene covered conductors</td>
<td>300 mm (1 foot)</td>
</tr>
<tr>
<td>0 – 750 V Bare, uninsulated</td>
<td>1.0 m (3 feet)</td>
</tr>
<tr>
<td>Above 750 V Insulated conductors (1) (2)</td>
<td>1.0 m (3 feet)</td>
</tr>
<tr>
<td>0.75 – 40 kV</td>
<td>3.0 m (10 feet)</td>
</tr>
<tr>
<td>69 kV, 72 kV</td>
<td>3.5 m (11 feet)</td>
</tr>
<tr>
<td>138 kV, 144 kV</td>
<td>4.0 m (13 feet)</td>
</tr>
<tr>
<td>230 kV, 260 kV</td>
<td>5.0 m (16 feet)</td>
</tr>
<tr>
<td>500 kV</td>
<td>7.0 m (23 feet)</td>
</tr>
</tbody>
</table>

Before work is commenced in the vicinity of an overhead power line, the site shall be examined for the possibility of conflict between equipment and the power line.

Where work is being carried out near the limits set out in the above table, a watcher or flag person shall assist in the work to ensure the safe limit of approach distance prescribed in the above table is not violated.

Where a signal device is provided as an integral part of the equipment which will alarm when the limits set out in the above table are reached, the requirements of the previous paragraph do not apply.

Where the safe limit of approach distance required as indicated in the table will be exceeded, the person responsible for operating the equipment shall notify the power authority and request assistance. The power authority operating the electrical system shall comply with the request as soon as possible.

Where guy lines or safety lines are used on an oil or gas well drilling or service rig and associated equipment, the guy lines or safety lines shall not cross over or pass under any overhead power line unless the power line is isolated and grounded while the guy wires or safety lines are in place.

11.7.5 Material Handling

Safe Lifting

Arrange for help when lifting heavy objects. When lifting, use the following methods to avoid back injury.

- Place one foot beside the object to be lifted and one foot behind.
- Bend your knees so you are crouching beside the object.
- Grasp the object firmly, keeping your arms and chin tucked in and your back straight.
Bring the object as close as possible to your stomach.
- Straighten your legs, keeping your back straight so your legs, not your back, are doing the lifting.
- If turning while carrying the object, turn your feet not your back.

**Rolling Drums**

To roll a drum, push against the side with your hands. Keep your hands clear of the bung. Do not use your feet to push or change direction of a rolling drum. Watch for pinch points when standing drums together.

**Pipe Handling**

When hauling pipe, the following procedures and precautions are to be followed:

- Personnel must not stand between the truck and pipe rack.
- A sufficient number of chains shall be used to secure the load. Boomers shall be installed on the side of the truck away from the traffic.
- After the pipe is hauling a short way, the chains shall be re-tightened as the settling of the pipe causes the chains to loosen.
- When releasing the chain, personnel should not stand directly over the boom handle.
- When unloading the pipe, the truck shall be positioned so that the pipe can roll directly off the truck onto the pipe rack.
- If a picker is used to load and unload pipe, tag lines shall be used so workers can work from the ends of the pipe.
- Spacers shall be used between layers of pipe and end stops shall be used at both ends of each row.

**Piling Material**

Proper methods of piling material shall be used to prevent the material from sliding or toppling over.

Do not overload shelves, which may collapse and injure workers.

### 11.8 WORKSITE DOCUMENTS

Worksite records shall be prepared, updated and retained as follows:

- Training records – retained indefinitely.
- Inspection reports – retained for one year or job duration.
- Work permits – retained for one year or job duration.
- Dangerous Goods records – retained for two years.
- Equipment maintenance records – life of equipment.
- Hoisting apparatus log books - life of equipment.
Incident Reports – retained indefinitely.

Safety meeting records – retained for one year or job duration.

Workers’ Compensation Reports – retained indefinitely.

11.8.1 Layout and Spacing

Roads

Northern Cross is responsible for constructing safe roads and maintaining them in a safe condition.

Signage

All roads developed by Northern Cross or developed as a joint venture between Northern Cross and other operators shall have appropriate signs posted to warn drivers of road hazards. All users of Northern Cross roads shall be expected to obey signs.

Lease road entry points shall have an “Access Restricted to Northern Cross Personnel Only” or a “Private Road” sign placed to warn and discourage public use.

Dependent upon where the lease is located, consideration shall be given to posting “Active Work Area – No Hunting” signs.

Speed Limits

All personnel travelling on lease roads operated by Northern Cross shall follow the posted limits.

Any personnel who violate the posted speed limits shall be disciplined accordingly.

Speed limits do NOT indicate the recommended speed. They are the maximum speeds permitted if conditions are favourable. Any speed unsafe under prevailing conditions is illegal.

Bridges

Bridges have been constructed for the convenience of Northern Cross and contract personnel.

Signs

Approaches to Northern Cross bridges shall have signs posted at a reasonable distance, indicating as appropriate:
- Bridge ahead;
- Maximum speed for approaching and crossing the bridge;
- The bridge’s maximum load weight per axle;
- The bridge clearance and width (if appropriate); and
- Any other hazard that could be encountered either approaching or crossing the bridge.

- **Ice Bridges**

  An ice analysis performed by a qualified ice specialist may be necessary.

  Gold’s formula shall be used to determine the permissible loading on an ice bridge. Gold’s formula is as follows:

  \[ P = Ah^2 \]

  Where:

  \( P \) = Load in kilograms (short term load assuming vehicle is moving)
  \( H \) = Ice thickness in centimetres, and
  \( A \) = Constant (the recommended value for \( A \) is 3.52 [Adam, 1978])

  The following procedures shall be used to strengthen an ice bridge:

  - Ice thickness can be increased by pumping water onto ice cover, or
  - Logs or poles may be used to strengthen the base.

  The following practices shall be followed when constructing an ice bridge.

  - A channel shall be maintained under the bridge to ensure fish passage.
  - Only ice or snow shall be used for the bridge surface. Poles or logs shall be used only to strengthen the base.
  - Precautions shall be taken to prevent the escape of any toxic or hazardous substances into the water.
  - Measures shall be in place for containment of any deleterious release of substances into the water.
  - Should any such release occur, Northern Cross management and the regional fisheries biologist shall be informed as soon as possible.

  For additional information regarding the construction of bridges as stream crossings, contact the jurisdictional agency responsible.
11.8.2 Leases

Pre-Evaluation

As soon as tree cover is removed, the following precautions shall be taken:

- Photographs shall be taken from several directions;
- Soil samples shall be taken from several points on the lease to determine average topsoil depth; and
- On a map, identify where photographs and soil samples were taken.

These steps will assist in the future in proving that the lease has been returned to its original state.

Lease Access

The main lease access shall enter the lease from the direction of the prevailing wind. If this is not practical, consideration shall be given to a secondary exit on the upwind side of the lease for use in emergencies.

The secondary exit is essential on sour wells.

Drainage

- The lease shall be crowned away from the matting and wellbore.
- The sumps and flare pit shall be located or constructed so they do not collect natural runoff.

11.8.3 Sumps

The site representative shall ensure that any sump used for storage of waste from a drilling or a well servicing operation meets the following criteria.

Rig Sump

- If constructed in a non-clay type soil such as sand, gravel or fractured rock, precautions may be required to prevent seepage into the underground aquifer or out from a side hill.
- The pit shall be located and constructed so it will not collect natural runoff water. Dyked edges and drainage ditches may be required.
- The bottom of the pit shall not reach ground water level.
- Formation water, oil, waste chemical substances or refuse from the wellsite shall not be disposed of in the sump.
Sewage Sumps

The sump for the disposal of effluent shall be constructed at least 4 feet from the rear of the rig lease, accommodation trailers and camp units and shall comply with the following:

- The sump shall be excavated to a size that will accommodate the entire effluent waste accumulated during the total drilling operations.
- Accommodation trailer drainage pipes shall extend a minimum of 12 inches past the closest edge of the sump wall to ensure proper discharge into the sump.
- If a vacuum truck is being used to transfer the effluent from the sump to a location off the lease and the transfer is on a regular basis, the vacuum truck operator shall ensure that public health regulations and any other jurisdictional requirements are fully complied with.

General

- The sumps shall not create a hazard to public health or safety.
- Sump fluids shall not:
  - Run into or contaminate any fresh water stream or body of water or remain in a place from which it might contaminate any water source.
  - Pass into any body of water frequented by fish or flows leading to such water, nor be discharged or allowed to flow on ice over such bodies of water.
  - Pass into any body of water frequented by migratory waterfowl or on ice over such waters.
- The sumps shall be adequately fenced or otherwise secured to ensure that personnel, livestock or wildlife are protected from harm due to inadvertent entry.

11.8.4 Flare Pits

Flare pits shall be:

- Excavated to a depth not less than two metres (seven feet).
- Constructed having side and back walls rising not less than two metres (seven feet) above ground.
- Constructed both to resist the erosion and to contain any high pressure flow of gas or liquid.
- Constructed with berms sufficient to exclude flooding due to surface water.
11.8.5 Drilling Equipment

Northern Cross is committed to ensuring safe and efficient practices and controlling pollution and environmental damage above, at or below the surface. Regular drills and testing are part of this commitment.

The site representative shall confirm all equipment used on a well has been properly inspected, shop serviced, tested and certified.

The contractor or supplier shall maintain a schedule of inspecting and testing of equipment and shall keep adequate records that are readily available to Northern Cross or government representatives.

The equipment owner (drilling/service rig contractor or supplier) shall be responsible for inspecting, shop servicing, testing and certifying the equipment.

Fire Extinguishers

A complete inventory of fire extinguishing equipment shall be compiled for each rig. All fire extinguishing equipment shall be inspected by rig personnel monthly and shall be serviced annually by a technical service company. Monthly inspections shall be recorded on the extinguisher tag. All fire extinguishing equipment shall be tagged as to the date of service and who serviced the unit.

Pressure Safety Valves

All pressure relief valves shall be inspected at least once every two years unless a corrosion or erosion problem indicates they be inspected more frequently.

Diesel Engine Air Shut-Offs

All diesel engines with air intakes within 25 metres of the well shall be equipped with air intake shut-off valves or an equivalent system.

Prior to drilling out the cement shoe of the surface casing, the air shut-offs shall be tested and the results recorded on the tour sheets. Tests shall be repeated every seven days thereafter.

Shop Servicing and Testing Requirements (BOP Stacks, Flexible Bleed-Off and Kill Line Hoses)

At least once every three years, all blowout preventers and flexible bleed-off and kill line hoses shall be shop serviced, shop tested and certified.
Any time blowout prevention equipment is subjected to an uncontrolled flow of reservoir fluid, the equipment shall be shop serviced and tested prior to that equipment going back into service.

After a serious kick or well control operation of extended duration, the site representative and contractor representative shall evaluate the equipment to decide if shop servicing and testing are warranted in accordance with provincial and territorial Guidelines and Industry Recommended Practices.

**Hoisting Equipment**

Overhead cranes, come-alongs, wire rope and fibre slings shall be inspected prior to each use. Mechanical hoisting equipment shall undergo inspection by a qualified person at the interval and using the procedure identified by the manufacturer. Chains shall never be used for hoisting or pulling.

Provincial Occupational Health & Safety Regulations contain several sections that are applicable to rigs. To comply with these regulations, the contractor shall be able to produce manufacturer specifications, engineering certificates and maintenance log books.

A derrick log book shall be maintained containing records of all inspections, examinations, defects and repairs. All entries shall be dated and signed by a rig company representative. This log book shall travel with the derrick.

The areas of concern are as follows:

**Repairs and Modifications**

A professional engineer, certifying that the capacity of the components is not less than the original capacity, shall certify all structural repairs or modifications.

**Plates and Capacities**

All derricks shall have a plate or weatherproof chart attached showing:

- Manufacturer’s rated capacity;
- Manufacturer’s name; and
- Model, serial number and year of manufacturer shipment date.

If the rig design requires guy lines, the manufacturer specifications for the correct number of guy lines, proper spacing and anchor capacity shall be on a plate affixed to the derrick or available as a specification sheet at the rig.

Shop inspections of the following components shall be conducted every three years:
- Travelling blocks;
- Hook;
- Elevator links or bales;
- Elevators;
- Swivels;
- Kelly; and
- Crown blocks.

A certificate of shop inspection shall be kept with the rig. A professional engineer shall certify all structural repairs or modifications to these pieces of equipment.
12.0 COMPLETIONS/WORKOVERS

12.1 PRE START-UP INSPECTIONS

The following inspection criteria shall be met prior to the start-up of the rig to eliminate any possibility of deficiencies, which could result in the rig being shut down for non-compliance with Occupational Health & Safety (OH&S); Yukon Energy Mines and Resources (EMR); or federal regulations pertaining to servicing operations, such as the Canada Oil and Gas Drilling and Production Regulations.

Personnel Certification

Current certification documents for the following shall be available on site:

<table>
<thead>
<tr>
<th>Certification</th>
<th>Requirement</th>
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<tbody>
<tr>
<td>First Line Blowout Preventer (BOP) Ticket</td>
<td>Drillers</td>
</tr>
<tr>
<td>Second Line Blowout Preventer (BOP) Ticket</td>
<td>Tool Pushes/Drillers (sour wells)</td>
</tr>
<tr>
<td>First Aid &amp; CPR</td>
<td>Tool Pushes, Drillers and one other worker per crew</td>
</tr>
<tr>
<td>H₂S Alive</td>
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<tr>
<td>Workplace Hazardous Materials Information System (WHMIS)</td>
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<td>Transportation of Dangerous Goods (TDG)</td>
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</tr>
<tr>
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<td>All personnel</td>
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<tr>
<td>Other certificates as required by provincial/federal regulations</td>
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12.2 SERVICE RIG ANCHORS

Following the investigation of past service rig tip-over accidents in Western Canada, it has been concluded that previously used methods to anchor guy lines have proven inadequate.

These guidelines are intended to reduce the risk to personnel and equipment. They are intended to provide sufficient information for company and contractor personnel to meet or exceed legislated requirements and accepted industry practice.

These guidelines meet the requirements of Alberta WH&S and Yukon OH&S. They reference the American Petroleum Institute Recommended Practice RP4G, which the provinces are using as the foundation for their anchoring requirements.
Responsibilities

Prime Contractor (the company)

- Identify underground structures prior to the installation of anchors.
- Install the anchors.
- Provide anchor capacity verification.
- Replace anchors that are damaged, excessively deteriorated or that fail anchor capacity verification.
- Ensure, as far as is reasonably practical, that contractors comply with all regulations pertaining to the installation of anchors, as well as the inspection and installation of guy lines.

If permanent anchors are installed:

- Ensure that anchors are pull tested at least every 24 months (12 months in British Columbia) or more frequently if conditions exist that could decrease the anchor capacity.
- Maintain records for the anchors.

These responsibilities may be delegated to competent persons.

Company Supervisor

- Instruct the designated site representative, by means of a statement in the completions or workover program, as to his responsibilities regarding anchors.
- Identify for the designated site representative any existing underground lines or structures.
- Ensure that anchor pull test records are attached to the final completions/workover report and put in the well file.

If permanent anchors are installed:

- Provide the designated site representative with a copy of the most recent anchor test report.

Designated Site Representative

- Contact the service rig contractor to determine the number of guy lines, spacing, anticipated load and anchor capacity requirements.
- Contact the anchoring contractor to have anchors installed.
- Confirm that anchors have been properly installed, pull tested immediately after installation, then pull tested within the next 24 months or retested if conditions have changed that may have reduced the capacity of the anchors.
Retain a copy of the anchor pull test records on location until the completion of the job.

Attach the anchor pull test records to the final completion/workover report and send it to the appropriate company supervisor.

Flag or otherwise mark anchors so that they are clearly visible.

If anchor verification tags are missing, obtain tags from the last pull test and re-install on the anchors.

Confirm the anchor installer and service rig contractor have completed their responsibilities.

**Anchor Installer**

- Supply anchors designed by qualified persons and constructed of material specified in the design, using accepted engineering practices;
- Protect steel components from corrosion;
- Install anchors as directed by the designated site representative;
- Attach a weatherproof tag (preferably aluminium) to each anchor. The tag must indicate:
  - Anchor capacity;
  - Name and phone number of the testing company; and
  - Test date;
- Deliver pull test record charts and a note describing soil conditions for each anchor at the time of the test to the designated site representative; and
- Ensure an independent calibration company calibrates devices used to measure and/or record the amount of pull, at least annually, and that a record is kept of the calibration results.

**Rig Contractor**

- Ensure that the manufacturer specifications for the derrick and guy lines are available at the rig. The specifications must include: the guying pattern, anchor spacing and anchor capacity. These specifications may be displayed on a plate fixed to the derrick or on a specification sheet available at the rig.
- Ensure that the anchor capacities have been verified before attaching the guy lines.
- If permanent anchors are installed, ensure that the verification is less than 24 months old.
- Ensure that anchor spacing and capacity are suitable for the derrick-guying pattern, as well as the anticipated hook and wind load.
- Inspect all guy lines and end terminations at least monthly.
- Maintain all guy line and end terminations in safe working conditions (minimum guideline API RP9B).
- Inspect anchors for damage or deterioration prior to rigging up.
Inspect surface ground for conditions that might indicate reduced anchor capacity.
Properly align the rig in relation to the wellhead and anchors.
Properly pre-tense all guy lines.
Flag or otherwise mark all guy lines so they are clearly visible.

**Anchoring Guidelines**

**Types of Anchors**
- Only screw type anchors will be used on company wellsites.
- On completions where the wellsite has not been cleaned up, or on abandonment jobs, temporary anchors will be used and removed at the completion of the job.
- Permanent anchors may be used at producing wells.

**Alternate Guy Line and Anchor Arrangements**
- If the derrick manufacturer specifications cannot be used, because of obstructions at the wellsite (such as roads, pits, power lines or buildings), then the recommended guying pattern shown in API RP4G may be used.
- If the derrick manufacturer specifications for guy lines, guy line brackets, guying pattern anchor spacing, anchor capacity hook load and wind load are not available, such specifications may be developed by a certified professional engineer. The signed specifications must be available at the rig.

**Guy Line Pre-Tensioning**
- Crown-to-ground guy lines should be pre-tensioned to 1000 pounds.
- Tubing board-to-ground guy line should be pre-tensioned to 500 pounds.

**Soil Condition**
- Anchors should be installed so that liquids drain away from the anchor shaft. Soil should be mounded up and tightly packed around the anchor shaft to ensure fluids drain away from the subsurface anchor components.
- Anchors installed in frozen ground shall be inspected after the ground thaws.

**Pull Testing**
- The direction of pull during the test should be in the plane of the anchor and the wellhead, at an angle that approximates the guy line angle.
- The test pull should be applied for at least two minutes after all anchor movement has stopped.
Pull test must withstand at least 20,000 lbs.

**Anchor Flagging**

The purpose of flagging the anchor is to make it readily visible. On many locations, particularly where permanent anchors are installed, this can be accomplished by painting the surface components of the anchor fluorescent orange and keeping vegetation cut around the anchor.

### 12.3 SERVICING BLOWOUT PREVENTION REQUIREMENTS

For the purpose of meeting the servicing blowout prevention requirements and the blowout prevention equipment requirements, wells are classified as follows:

**Class I:**

A well in which the reservoir pressure of the zone is less than 5500 kilopascals, there is no hydrogen sulphide present in the representative sample of the gas and the well:

- Is a gas well; or
- Produces heavy oil with a density greater than 940 kilograms per cubic metre, contains a gas/oil ratio of less than 70 cubic metres per cubic metre, and the well produces by primary recovery or is included in a waterflood scheme.

**Class II:**

A well where the pressure rating of the production casing flange is less than or equal to 21,000 kilopascals and the hydrogen sulphide content, in a representative sample of the gas, is less than 1 percent.

**Class III:**

A well where the pressure rating of the production casing flange is:

- Greater than 21,000 kilopascals, or
- Less than or equal to 21,000 kilopascals and the hydrogen sulphide content, in a representative sample of the gas, is 1 percent or greater.
**Blowout Preventer (BOP) Systems and Equipment Spacing**

For the BOP stack and equipment spacing requirements refer to Schedule 10 of the Oil and Gas Conservation Regulations.

**Sour and Critical Sour Well Servicing:**

- Refer to the "Industry Recommended Practices" for additional requirements.
- All sour wells will require a site specific Sour Gas Emergency Response Plan prior to commencement of operations.

### 12.4 WIRELINE OPERATIONS GUIDELINES

This section is intended to assist the designated site representative in the safe and timely completion of all wireline operations during the drilling, completions and workover phases of a well. These guidelines should be considered the minimal company requirements. The site representative shall ensure that the contractor's Safe Work Practices meet or exceed these guidelines.

**Responsibilities**

**Management**

The management representative shall ensure that:

- Wireline contractors have a copy of the company Guidelines for Contractors and that the contractor is aware of the minimum guidelines for wireline work;
- Develop a wireline program or provide clear direction to the designated site representative for planned work; and
- Contact the wireline company and provide at least the following information:
  - Time, date and location of operations,
  - Type of operation, depth and interval,
  - Tubing, casing and open-hole specifications,
  - Specifications on the wellhead connections or type of fish,
  - Pressures to be encountered,
  - Special equipment required (i.e. breathing apparatus, picker truck, etc.),
  - Special precautions or hazards, and
  - Corrosive characteristics of well.
Site Representative

The designated site representative is responsible to:

- Ensure that the contractor meets or exceeds all of the company’s safety practices, operational guidelines and legislated requirements;
- Ensure that the lease and well are in optimal condition for the work proposed;
- Ensure his or her presence on location from rig up to release of the wireline unit, or ensuring that he or she can be easily contacted and can quickly return to the location, depending upon anticipated hazards;
- Supervise the opening or closing of wellhead valves or Blowout Preventer (BOP) as required, and
- Conduct a pre-job meeting with all personnel, covering:
  - Contents of the work permit,
  - Scope of work,
  - Duties of personnel,
  - Site-specific/task specific hazards,
  - Means of eliminating the hazards, and
  - Emergency procedures and evacuation routes.

The contractor representative and safety specialist (if present) are expected to assist with the pre-job meeting.

Contractor Representative

The contractor representative is responsible to:

- Direct the rig up, operation and rig out of the wireline unit;
- Meet or exceed the company’s guidelines for the safe and efficient completion of the job;
- Erect all necessary warning signs;
- Provide competent supervision of his workers to ensure the safety of all personnel on site; and
- Report hazardous conditions to the site representative.

Recommended Equipment

Safety Equipment

- A fully stocked, clean, regulation approved first aid kit shall be available in each vehicle.
For wells where the H₂S level may exceed 10 ppm, one breathing apparatus must be provided for each person essential to the operation. Non-essential personnel shall not be allowed on site. For wells classed as caution or critical wells, the use of an air trailer and safety specialist is recommended.

Supplied air breathing apparatus is recommended for greater mobility.

If a Self-Contained Breathing Apparatus (SCBA) is used, a supplementary supply of breathing air must be available.

Suitable detection equipment shall be available where H₂S may be present.

Where H₂S is present, all personnel shall have a valid H₂S Alive certificate.

All personnel are to wear the following:
- Canadian Standards Association (CSA) approved hardhat;
- CSA approved footwear;
- Fire retardant outerwear; and
- Other personal protective equipment as required.

A minimum of one 30 lb (ABC) chemical dry powder fire extinguisher per vehicle is required. The fire extinguisher shall be removed from the unit and placed adjacent to the unit.

The fire extinguisher shall be checked for serviceability and tagged with current date.

**Lubricator**

A lubricator shall be used above the wing valve and master valve to run in tools and instruments under pressure.

The lubricator shall be equipped with a saver head and bleed-off valve.

The lubricator shall have a pressure rating at least equal to that of the wellhead and be of sufficient length to accommodate the entire tool or instrument string.

**Blowout Preventer (BOP)**

A wireline BOP shall be used on all jobs.

**Depthometer**

All units shall be equipped with a depthometer that is in good working order.

**Weight Indicator**

Wireline units shall be equipped with a calibrated weight indicator. The pull on the line shall not exceed manufacturer specifications for the size of the line being used.
Lines

All lines shall be in good condition and free of any kinks or broken strands.

Corrosion Inhibitor

A corrosion inhibitor or use of a special alloy line is **required** for wells with a corrosive (H₂S, CO₂) environment.

Logging Tools

- Tools shall have adequate clearances on the inside of the tubing string to ensure that fishing equipment can be utilized when required. All measurements (inside/outside diameters and lengths) are to be recorded.
- Rope socket size and tool dimensions shall be measured and recorded prior to each trip.
- The tool and line weights shall not exceed the limitations of the crane or picker unit.

Vehicles

- Vehicles not required to assist with the wireline operation shall be parked at the lease boundary, toward the exit.
- No gasoline-powered equipment is to be within 25 metres of the well unless the well has been shut in.
- Units required on the lease shall have an exhaust system installed that is designed to eliminate sparks. Exhaust systems of all equipment shall be directed away from the wellhead.
- Vehicles or equipment with diesel engines shall be provided with a positive air shut-off. Vehicles without the required equipment shall not be allowed within 25 metres of the wellhead unless the well has been, and will remain, shut-in. An operational check of the positive air shut-off shall be performed before the job starts.
- All engines shall be turned off when not in use, or when the operator is not in attendance.
- The picker truck shall be located on solid ground, upwind from the wellhead. Solid matting shall be provided for the stabilizers. It shall be backed in beside the wellhead so inadvertent movement will not result in damage to the wellhead. If a hydraulic picker is being used, ensure that all the hydraulic equipment is in good condition and free of any leaks or defects, to prevent accidental dropping of the lubricator or load. The picker truck shall be properly bonded to the surface casing flange.
**General Guidelines**

- Smoking is permitted in designated areas only, at least 50 metres upwind of the wellhead.
- Good housekeeping shall be maintained at all times. Tools shall be kept clean and free of defects. Gasoline or other flammable liquids are not to be used for cleaning.
- The wireline unit is to be positioned upwind or crosswind, at least 25 metres from the wellhead, in such a manner that the wellhead and lubricator are in view at all times. The unit shall be bonded to the casing flange.
- The lower sheave shall not be connected to any portion of the lubricator, but instead, to the casing bowl using a cable stronger than the wireline.

**Rigging In**

- Close master valves or Blowout Preventer (BOP).
- Bleed off pressure to a safe area (to be done by a worker wearing breathing apparatus if in an H₂S environment).
- Raise assembled lubricator into position using a tag line to control movement.
- Secure the lubricator to the wellhead or BOP.
- If necessary, secure the lubricator and wellhead to resist lateral movement (i.e. jarring).
- Attach a high-pressure hose to the lubricator bleed-off valve.
- Direct the end of the hose downwind and secure the hose to prevent whipping.

**Pressure Testing the Lubricator**

- Pull tools to the top of the lubricator.
- Slowly open the master valve and pressure test the lubricator using wellhead pressure. If there are two master valves, use the top one as the working valve.
- Record the number of turns required to fully open the master valve.

**Gauging**

- Consider making the first run with a gauge ring to ensure the working tools will not be hung up downhole.
- If tools or instruments become stuck downhole, or any other problems are encountered, the company supervisor is to be immediately notified.
Rigging Out

The following procedure covers requirements for rigging down the wireline unit or changing tools, as required.

- Ensure tools are in lubricator and that the tool trap is closed.
- Close the master valve, counting the turns previously recorded.
- Use bleed-off hose to bleed pressure off the lubricator.
- Lay the lubricator down, using a tag line to control its movements.
- Install cap on wellhead.
- Clean up lease and wellhead.
- Release wireline unit.

12.5 PERFORATING WITH ELECTRIC WIRELINE

Pre-Planning

Review the program and notify the service company of:

- Date, time, legal description and directions.
- Give perforating requirements.
- Anticipated pressures.
- H₂S or other corrosive content of the well.
- Special personal protective equipment needed.
- Determine the perforating company’s method of safely relieving trapped pressure inside the gun in the event of a miss run or incomplete firing.
- Ensure all equipment is on location prior to the operation.
- Do not allow perforating during a lightning storm.

Procedure

Pre-Job Meeting

Conduct a pre-job safety meeting addressing:

- Scope of work;
- Assignment of tasks;
- Hazards and means of reducing hazards;
- Emergency procedures; and
- Emergency evacuation procedures.

Lease and Traffic Control

- Clear the lease of all non-essential personnel.
- Watch for unauthorized vehicles entering the jobsite.
- Shut off all mobile radios and telephones before rigging up begins and
until perforating is completed, otherwise the units may set off charges. If it is necessary to use a radio or telephone, drive off lease a minimum of 1 km.

- Place signs saying, "Perforating, Shut Off Radio Transmitting Equipment," at the lease entrance and on the lease roadway, at least 70 metres from the perforating gun.
- If the position where the perforating gun must be loaded and assembled or if the wellhead is located less than 70 metres from a public road, then signs must be posted in both directions on the public road at least 70 metres from the gun or wellhead. Vehicles may have to be stopped to ask the drivers to shut off their radios. If this must be done on a numbered highway, first obtain RCMP approval.
- Personnel assigned to stop vehicles must be adequately protected from vehicle traffic; equipment required depends upon existing conditions. Reflective traffic vests are the minimal requirement.

**Safety Procedures**

- Bond the wireline unit to the wellhead or Blowout Preventer (BOP).
- Install the lubricator. A complete lubricator with a pump-in connection must be used at all times. The lubricator must be long enough to accommodate all tools. Use inhibited line where H₂S is present. When there is no tubing in the hole, adapt the line BOP and lubricator to the rig BOP with an adapter flange. Ensure there is sufficient length above the blind rams to accommodate the overall length of the tools. When using a large diameter lubricator on top of a rig BOP, a smaller diameter line BOP may be installed approximately 2 metres below the stuffing box (use one when a large diameter line BOP is not available).
- Pressure-test the lubricator to 1 1/2 times the maximum anticipated surface pressure to the wellhead pressure rating. Check with the service engineer prior to pressure testing if the loaded guns are in the lubricator.
- Consider making a dummy run with a gauge ring to ensure that the gun will get to bottom.
- Perforate the well.
- Check pressure response at the lubricator.
- Hoist tools into the lubricator.
- Close in well.
- Bleed off lubricator.
- Treat unopened guns as loaded until determined otherwise.
- Rig down lubricator.
- Rig out wireline unit and release after ensuring that the contractor has tidied up the location.
12.6 RETRIEVING AND DISARMING A MISFIRED PERFORATING GUN

This section recommends procedures and safety precautions for retrieving and disarming a misfired perforating gun. Use extreme caution when handling a misfired gun. Never retrieve a gun during a lightning storm. Closely consult with the perforating representative.

**Procedures**

- Do not move the gun from the established perforating depth.
- Have the safety switch turned off and take possession of the key.
- Hold a safety meeting to determine a strategy and discuss procedures. Establish who the essential personnel will be during the retrieving of the live gun. When the gun is at the surface, all other personnel shall be off the lease until the gun is disarmed.
- Shut off the wireline generator and rig generators.
- Turn off the main circuit breakers.
- Disconnect all panels used in the gun firing procedure.
- Ensure the casing-to-rig voltage monitor is reading less than 0.25 Volts.
- When tubing perforated guns misfire, the detonating bar is to be retrieved before pulling the gun.
- Pull the gun up to 30 metres from the surface. Check all two-way radios and mobile phones and ensure they are turned off. Post a guard at the lease entry to prevent any vehicles or personnel from entering. All non-essential personnel must move a pre-established distance off location.
- Recheck procedures.
- Pull the gun up into the lubricator and close the valve. Break out the lubricator and lower it carefully.
- After lowering the lubricator and gun, all personnel except the perforating crew shall move to a safe location and not return until it is safe to do so.

12.7 WELL CONTROL

Early detection of a kick, followed immediately by the actions necessary to kill the well, is the key to success in well control. A gas kick becomes increasingly difficult to control as the volume of the bubble is allowed to increase and it may, given enough time, become impossible to circulate the gas to surface without exceeding the maximum allowed surface and wellbore pressure. It is of the utmost importance to ensure that a suitable early warning system is installed and working and that the service rig crew are well trained in kick detection and blowout control procedures.
Kick Warning Signs

A number of actual and possible warning signs of kicks can be observed at the surface. Early recognition and understanding of these warning signs is necessary to prevent a potential blowout from occurring.

Although these signs do not positively identify a kick, they do warn of a possible kick situation. The warning signs are:

- While drilling (packers, bridge plugs, retainers, cement plugs or drilling a new hole):
  - Well flowing (tank gain).
  - Increase in return flow rate.
  - Evidence of gas/oil in returns.
  - Pump pressure decrease.
  - Loss of returns (well on vacuum), and
  - String force (weight) increase or decrease.

- While tripping:
  - Well flowing (tank gain).
  - Well on vacuum (tank loss).
  - Tubing will not pull dry.
  - Hole fails to take correct amount of fluid on fill-up.

- While out of the hole:
  - Well flowing (tank gain).
  - Evidence of gas at surface.
  - Pressure build-up on the casing.

Kick Warning Sign Discussion

Well Flowing (Tank Gain) - Primary Indicator

If the volume of fluid in the rig tank has not increased as a result of current surface operations, a tank gain indicates the well is flowing. The formation fluid entering the wellbore displaces an equal volume of completion fluid from the well, resulting in a tank gain. Should the well flow with the pump off, this indicates that a kick is in progress.

Increase in Return Flow Rate - Primary Indicator

Should the volume of returning fluid be observed or measured at the flowline, any increase (assuming that the pump rate is constant) will be noted before the corresponding pit level increase can be measured. The increased flow rate means that formation fluids have entered, or are entering, the wellbore, assisting the pump in moving fluid up the annulus (normal circulation).
Gas in Returns or at Surface - Secondary Indicator

Gas cut fluid is often an indication of a flow, and it is important that bottom hole conditions causing the gas cutting be fully understood. As the gas rises in the annulus, it slowly expands until it reaches the surface. At this point, expansion occurs very rapidly and causes a reduction in the fluid density. Even though the fluid density is reduced appreciably, this does not necessarily mean a blowout will occur. The majority of the gas expansion takes place close to the surface and the reduction in hydrostatic pressure is usually quite small. Gas cut fluid may occur for one or more of the following reasons:

- Gas feed-in from a low permeability formation, having a core pressure greater than the hydrostatic pressure.
- Swabbing while making connections or as a result of tripping.
- Drilling a gas bearing formation using fluid of the correct density.

Generally, if the well has not kicked by the time it is required to circulate the gas to surface, it probably will not kick. Quite often, it may become necessary to circulate through the choke manifold to prevent fluid unloading too rapidly, thus reducing hydrostatic pressure appreciably.

Pump Pressure Decrease - Secondary Indicator

A kick is sometimes initially indicated due to a pump pressure increase. Because of its short duration, this increase is seldom recognized. Normally, as lighter formation fluids continue to flow into the wellbore displacing heavier completion fluids, the pump pressure will gradually decrease and may be accompanied by an increase in pump speed.

A washout or hole in the tubing/work string will also indicate similar characteristics: pump pressure decrease and pump speed increase. Regardless of the circumstances, a kick must be assumed until verified otherwise.

Loss of Returns (Well on Vacuum) - Primary Indicator

It is possible for a producing permeable formation to go on vacuum and cause an underbalance in the well. This condition will show up as a decrease in fluid volume in the tank while tripping or drilling and will be noticed ONLY if close attention is paid to the correct hole filling volume or total volume in rig tank. This reduction in hydrostatic pressure could result in a kick if the wellbore pressure becomes less than the core pressure of the producing formation.

Any unexplained loss of fluid indicates that the well is on vacuum and should serve as a warning to the supervisor that a kick may be impending.
String Weight Increase or Decrease - Secondary Indicator

The fluid in the well provides a buoyant effect to the tubing string and effectively reduces the actual pipe weight that must be supported by the derrick. Heavier fluids have a larger buoyancy force than less dense fluids. When a kick occurs and low-density formation fluids enter the well, the total buoyancy force of the mud system is reduced. As a result, the string weight observed at the surface will begin to increase.

If the kick is allowed to continue unchecked, the force of the fluid moving up the well will tend to push the tubing or drill string out of the hole, resulting in a decrease in the observed weight at the surface.

If an increase in string weight is observed, this should alert the driller to the possibility that a kick has occurred. Other signs which indicate a kick should be checked for. If there is a sudden decrease in string weight, this is a primary kick indicator and the well should be shut in without delay.

Tubing Will Not Pull Dry - Secondary Indicator

Under normal conditions, tubing or drill pipe should pull dry when tripping out of the well. Should the string initially pull wet, it could mean the tubing is plugged, for whatever reason, or that formation fluids are being swabbed into the wellbore. Should this occur, check to determine what the problem is, even if it involves breaking circulation and circulating bottoms up. Do not proceed with the trip until the cause has been determined and cured.

Many times a gas bubble will follow a packer or large diameter tool out of the hole. This may not be recognized until this gas begins to expand in the upper portion of the wellbore. The tubing normally will pull dry until the gas begins its rapid expansion. This phenomenon is easily recognized when the tubing begins to pull wet. Quick reaction by the rig crew is required to shut the well in and initiate kick procedures.

This situation can also develop when pulling bottom hole pumps and wireline tools. The operation will proceed normally until gas expansion results in fluid flow from the tubing. Again, awareness and quick action are required to maintain well control.

Hole Fails to Take the Correct Amount of Fluid on Fill-up - Primary Indicator

A primary indication of a kick is the well not taking the proper amount of fluid during a trip. As previously discussed, as the tubing string is pulled out of the well, the fluid level should decrease by an amount equal to the amount of steel removed. If the well does not require the calculated amount of fluid to fill it, we
can assume that a kick fluid has invaded the well, and that a kick is in progress. That is why it is important to monitor hole fill volumes closely during a trip.

**Pressure Build-up on Casing - Secondary Indicator**

While the work string is out of the hole, many operators tend to close the well in using the blind rams. The purpose may sometimes be to function test the ram or to prevent unwanted objects from being dropped down the wellbore. Regardless of the reason, pressure build-up under the ram should be monitored closely for kick detection and safety reasons.

Early detection of casing pressure build-up may preserve the ability to strip the tubing back in the well. Once the pressure becomes excessive, the tubing will have to be snubbed. Additionally, the blind rams should never be opened after having been closed for prolonged periods without checking the shut-in casing pressure. This will prevent unnecessary surprises that can result in serious injuries to crew members and loss of equipment through explosions and fires. This is particularly true when working in a sour (H₂S) area.

Should a pressure build-up be observed, monitor closely to determine the rate of pressure increase. A gas bubble migrating up the wellbore will exhibit a steady pressure increase while trapped pressure will show an irregular build-up. If bleeding off small amounts of fluid from the casing fails to stop pressure build-up, prepare immediately to start stripping back into the well.

**12.8 FLOW CHECKS**

If any of the surface warning signs appear, an immediate flow check must be conducted to determine if a kick is underway. Should any doubts exist as to whether or not the well is flowing, shut it in and check for pressure build-up. Early kick recognition is the key to successful well control.

The decision to run a flow check is predicated upon one or more of the warning signs being observed at surface. Good well servicing practice also incorporates flow checks as a preventive procedure. These are conducted at specific times during well servicing operations. The times at which flow checks should be run are summarized below:

- While drilling/cleaning to bottom (any warning signs);
- Prior to tripping (3-5 stands off bottom);
- While tripping (any warning sign);
- Prior to pulling drill collars or bottom hole assembly;
- While the string is out of the well; and
- Prior to removing the wellhead and/or Blowout Preventer (BOP) stack.
Flow Check Procedures

**While Drilling/Cleaning to Bottom (Any Warning Sign) Pack-Off in Place**

- Call alert;
- Stop rotating, pull power swivel (or kelly if used) and position uppermost tubing coupling/tool joint at normal working height above rig floor;
- Stop circulating - shut off pump;
- Measure fluid level in rig tank;
- Observe the return line at the rig tank for flow for a minimum of 5 to 10 minutes; and
- If no flow recorded, resume operations. If well is flowing, shut in immediately.

**Prior to Tripping (No Pack-Off in Place)**

- Call alert;
- Position the uppermost tubing coupling/tool joint at normal height above the rig floor;
- Set slips, clear elevators, install the stabbing valve (safety valve) in an open position, then close;
- Close the appropriate BOP and open the return line to the tank;
- Fill the hole and stop the pump;
- Measure the fluid level in the tank;
- Observe the return line at the rig tank for flow, for a minimum five to ten minutes; and
- If no flow recorded, resume operations. If well is flowing, shut in immediately.

**While Tripping**

- Call alert;
- Position the uppermost tubing coupling/tool joint at normal height above the rig floor;
- Set slips, clear elevators, install the stabbing valve (safety valve) in an open position, then close;
- Close the appropriate BOP and open the return line to the tank;
- Fill the hole and stop the pump;
- Measure the fluid level in the rig tank;
- Observe the return line at the rig tank for flow for a minimum five to ten minutes; and
- If no flow recorded, resume operations. If well is flowing, shut in immediately.
Prior to Pulling Drill Collars

- Call alert;
- Position the uppermost tubing coupling/tool joint at normal height above the rig floor;
- Set slips, clear elevators, install the stabbing valve (safety valve) in an open position then close;
- Close the appropriate BOP and open the return line to the tank;
- Fill the hole and stop the pump;
- Measure the fluid level in the rig tank;
- Observe the return line at the rig tank for flow for a minimum five to ten minutes; and
- If no flow recorded, resume operations. If well is flowing, shut in immediately.

While the String is Out of the Hole

- Call alert;
- Close the blind rams and open the return line to the tank;
- Fill hole and stop the pump;
- Measure fluid level in rig tank;
- Observe the rig tank for flow for a minimum five to ten minutes, on thirty-minute cycles, making sure the hole is filled each time; and
- If no flow recorded, resume operations. If well is flowing, shut in immediately.

Recommendations

The primary objective of running flow checks is early detection in order to minimize the size of well kicks. The maximum surface pressure required to kill the well depends upon the volume of formation fluid allowed to flow into the wellbore. Flow checks form an integral part of the early warning system.

Flow check procedures should not be attempted on wells that go on a continuous vacuum. Kill fluid should be pumped to the well at all times to keep it under control. Remember:

- When removing the displacement of the pipe tripping out, the fill rate should be increased to account for the pipe displacement.
- When pulling tubing into a larger size of casing (as when pulling to the top of a line), the fill rate may have to be increased to maintain control.
- With the tubing out of the hole, the fill rate may have to be further increased to maintain control.
12.9 OPERATING AND SERVICING OF WELLHEADS

This section provides procedures for the safe operation and maintenance of wellheads, particularly in high-pressure areas on wellheads equipped with dual master valves.

Wellheads

During production operations, wellhead valves are critical for well control and should, therefore, be treated as priority equipment.

- The bottom master valve on a dual valve wellhead is intended to provide a back up for the top master valve during servicing and under emergency conditions. The bottom master valve shall be left in the open position and shall not be used during routine operations.
- Wellhead valves shall only be opened or closed by hand. Cheaters (pipe wrenches, hammers, chisels, etc.) shall not be used. If the valve cannot be opened or closed by hand it shall be serviced. If the bottom master valve on a dual valve wellhead is to be repaired or replaced, no operation shall take place without a tubing plug in place and the wellhead depressurized. This also applies to back seating for packing change-out. Site-specific procedures shall be followed.
- If the bottom master valve is to be removed with a tubing plug in place, a site-specific procedure shall be followed, a company representative shall be on site and a pre-job meeting shall be conducted and documented.

Lockout

Tag and lockout control point:

- On gas engines, attach to the fuel gas valve.
- On electrical motors, attach to the breaker.

Run a chain through the sheave on the pumpjack's gearbox, then around the crank arm and install a lock and tag. The tags must not conduct electricity and shall contain:

- Words directing persons not to start or operate the machine.
- The date when the tag was installed.
- The printed name and signature of the person who installed the tag.
12.10 WORKING WITH PRESSURED LINES

This section is intended to provide basic, safe work guidelines for the completion of work involving pressured lines, to ensure compliance with legislated requirements and to prevent injury to personnel, damage to equipment, property or the environment and to prevent production loss.

Working with high pressure lines is conducted for fracking, acidizing, hot oiling, high pressure pumping, drill stem testing and production testing.

Responsibilities

The Company

- Develop a preventive maintenance program and Code of Practice that will identify deterioration and replacement of components that may no longer be capable of meeting their original safe working pressure.
- Identify, in writing in the service program, the safe working pressure of the system to be subjected to high pressure.
- State in writing in the service program that no person will exceed the identified safe working pressure.

Note: The safe working pressure is the pressure stated by the manufacturer, or by a professional engineer (in writing). So called "safety factors" are not to be considered.

Designated Site Representative

The designated site representative is responsible to:

- Ensure compliance with this practice and endorse any deviation, in writing, prior to commencement of the job.
- Participate in the pre-job meeting with all personnel to discuss the scope of work, permit requirements, emergency and evacuation procedures and any other pertinent issues specific to the job.
- Provide continuous supervision, if possible, and necessary supervision during the rig up, rig out and securing of the well. A simple tank heating operation utilizing a hot oiler may not require continuous supervision, for example. The emergency telephone numbers and written directions to the location must be provided to the contractor representative.
Contractor Representatives

The contractor representative is responsible for ensuring that:

- His or her workers comply with the requirements of this Safe Work Practice. If the contractor's procedures provide equal or greater protection, the site representative must endorse these procedures before they are used.
- The work is performed by experienced and competent workers, or under the direct supervision of an experienced and competent supervisor.
- He or she participates in the pre-job safety meeting with the aim of contributing his or her expertise to the safe completion of the task.
- Ensure that neither he nor she nor any of his or her personnel exceed the safe work pressure stated in the service program.

Recommended Safety Procedures

- Conduct a pre-job safety meeting to inform all workers of the following, along with any other pertinent information:
  - Scope of work.
  - Emergency and evacuation procedures.
  - The need to stay away from piping during testing or pumping.
  - Hazards associated with the job (i.e. chemical hazards and protective equipment).
- Rig in equipment.
- Erect "Danger - High Pressure" signs near the lines.
- If swivel joints are used in the piping system, the pump end and the discharge end must be secured.
- Pressure test all lines. Do not exceed the equipments safe working pressure.
- Proceed with pumping operations.
- During rig out, ensure that products that may be hazardous to the environment are contained and disposed of safely.

12.11 HYDRATES, WAX PLUGS AND FROZEN LINES

Introduction

Hydrate plugs, wax plugs and frozen lines expose workers and equipment to similar hazards, and they all result in production loss. The safety precautions needed to remove these obstructions are also similar to one another.

Hydrate plugs can form in any piping system, whether it is downhole or on the surface. Expanding gas or fluids, pressure drops or temperature drops may create a cooling effect on the production fluid. These conditions may be caused by:
 The use of a bottom hole choke;
 The wellbore bottom hole temperature is too low;
 Pressure changes when the wellbore product flows through the perfs, past the recorders or through surface chokes and pressure regulating systems;
 High moisture content in the well;
 Failure to maintain the temperature of the formation product through use of a heater string; or
 Pressure changes caused by the formation product flowing around bottom hole equipment such as those used on drill stem tests.

Identification

 Static pressure spiking often indicates the formation of plugs. Plugging should be suspected if the system pressure and temperature are dropping.
 A drop in flow rate should not be solely attributed to liquid hole-up. Plugging must be considered a possible cause.
 A system should not be operated if hydrate plugs are forming, unless methanol is injected and/or system temperature is increased over a short period of time. Both of these solutions to combat hydrate formation require input from the company site representative. Problems shall be reported to allow for long-term solutions.

Hazards

If hydrate plugging has occurred, pressure is trapped by one or more plugs (never assume there is only one plug). Thawing these plugs or reducing the pressure on the upstream or downstream side can release the pressures trapped by the plugs. When these pressures are released dynamic shock loading occurs. This can cause:

 Snapping of the piping system at flanges or unions which results in sudden, violent movement of the pipe with the potential to kill or maim.
 Sudden releases of toxic or flammable gases to atmosphere.
 The creation of secondary hazards such as fires, explosions, machinery or equipment failures, as well as damage and injuries.
 Extreme pressure releases, which can maim or kill, or contribute to secondary hazards.

Prevention

Taking measures to prevent plugs from forming can reduce the frequency of exposure to the risks of plug removal.

 Follow recommended chemical injection rates.
Maintain the system at the designed operating temperature.

Regularly inspect heat tracing for proper operation.

Promptly replace insulation following repairs.

Follow a planned pigging schedule.

When depressurizing piping systems or vessels suspected of hydrate problems, do not create a differential pressure of more than 20% between the upstream and downstream sides of the plugs. The line should never be depressurized to less than 80% of the operating pressures encountered. This will help reduce the dynamic energy encountered when the plug lets go and releases the pressure. Never bleed all the pressure off and leave the piping end open. You will know the plug has been removed when all pressures are the same.

In drilling or tubing strings where hydrates have occurred, the pipe should never be pulled out of the hole.

Note: On wells with other plugs, such as wax or sulphur, equipment shall be used for chemical injection inside the drilling or tubing string. With this type of operation, a hydrostatic pressure greater than that of the formation must be maintained. Returns shall be controlled and monitored only while using breathing apparatus.

All surface flare or flowlines should be staked down. All piping and piping connections must be secured.

On locations with H₂S, personnel involved with the depressurizing operation shall wear breathing apparatus and be under mask.

At no time will personnel hammer unions or fittings loose to find the plug.

The working pressure of all piping used while depressurizing must exceed the wellhead pressures.

Never stand in front of, or next to, an open line.

These procedures, when implemented, do not remove all the dangers encountered with hydrate plugging, but will reduce the risk of injury in most cases.

**Removal**

Depending on the type of plug, it may be removed by heating, depressurizing, chemical injection or hot oiling. Always follow these general recommendations:

Never exceed the safe working pressure or temperature rating of any component in the system. Some auxiliary equipment may have to be isolated from pressure increases.

Note: If a hot oiler or other pumping service is used, the maximum safe working pressure of the system must be given to the worker or contractor in writing. This pressure must not be exceeded.
Thaw or clear sediment from drain and vent points.
• If possible, do not disconnect lines. If lines must be disconnected, secure the lines to prevent unexpected movement.
• Never stand in front of, or near, an open line, pig trap or drain/vent line.
• Use personal protective equipment, clothing and respiratory protective equipment appropriate for the hazards.
• Protect sensitive equipment from steam and hot water. This will include gas, fire and H₂S detection heads, catalytic heaters, recorders, instrumentation panels and electrical equipment.
• In drilling or tubing strings where hydrates have occurred, the pipe shall never be pulled out of the hole. Equipment such as a coiled tubing unit or spaghetti string shall be used to inject hot oil/liquids in the tubing/drill pipe casing annulus to warm up the pipe and dissolve the plug.

Warning: Do not reduce the hydrostatic pressure in the annulus to remove the plug. The wellbore shall never be assumed to be free of hydrate plugs until communication can be established with the bottom of the well or pipe.

Heating
• Open flames (torches, fires, construction-type heaters) shall not be used.
• Check for flammable gas and follow hot work procedures if using vehicle exhaust for heat. If the vehicle exhaust is directed into a confined space, provide adequate ventilation.
• Position portable steamers a minimum of 25 metres from process equipment and tanks unless they are equipped with flame arrestors.

Depressurizing
• Hydrate plugs can often be removed by depressurizing both sides of the plug. Depressurizing only one side and attempting to move the plug with the pressure drop may result in more severe hydrating.
• Rapid vaporization of hydrates and expansion of the product can result in sudden pressure increase and violent movement of the plug.
• When possible, depressurize the downstream side of the plug to approximately 80% of the upstream pressure or anticipate pumping pressure on the upstream side of the plug. This will reduce the risk of dynamic shock loading which can rupture piping and cause unexpected pipe movement.

Chemicals
• Plugs can sometimes be removed by injection of methanol, de-icing chemical, glycol or wax solvents.
Procedures for Thawing Hydrated, Frozen Lines with Methanol

- Isolate the upstream and downstream piping of the problem section;
- Depressurise piping downstream of hydrate plug to approximately 80% of the upstream pressure. Inject methanol on the upstream side of the hydrate plug. When upstream and downstream pressures have equalized, the hydrate plug is dissolved;
- Continue injecting methanol and depressurizing downstream piping, monitoring upstream pressure until pressures are below hydrate forming conditions;
- Pressure upstream side to normal operating pressure while monitoring downstream pressure; and
- Place line back on production, monitoring pressure until flow and operating conditions are normal.

Procedures for Thawing Frozen or Plugged Oil and Drain Lines with Hot Water or Steam

- Isolate upstream piping.
- Check line pressure upstream of frost plug. Raise upstream pressure approximately 10 - 20% above the downstream pressure.
- Open downstream valving to vessel/process.
- Steam the exterior of the line to melt or thaw the plug or ice and release it into the vessel/process.
- Monitor pressure upstream of the frost plug. When upstream and downstream pressures have equalized, the plug should be dissolved.
- Place line back on production, monitoring pressures to ensure the plug does not re-form until flow and operating conditions are normal.

Note: Be aware than more than one plug may be in the line. The problem, and associated hazards, is not eliminated until normal operating conditions have been re-established.

12.12 LOW VAPOUR PRESSURE FLUIDS

Low vapour pressure (LVP) fluids are frequently used during completions and workover operations for tasks such as fracturing or hot oiling. LVP fluids may have an ignition temperature lower than the ambient atmospheric temperature. Special precautions must be taken to protect personnel and equipment from the extreme fire and explosion hazard.

Definitions

Flammable Fluids

Flammable fluids are fluids having a closed cup flash point below 27°C (80°F).
**Combustible Fluids**

Combustible fluids are fluids having a closed cup flash point equal to or higher than 27° C (80° F).

**Non-High Risk Fluids**

- Combustible fluids are fluids such as kerosene, diesel and other fluids with an open cup vapour pressure equal to, or greater than 27° C (80° F). These are the preferred fluids when hydrocarbons are necessary as a frac fluid.
- Flammable fluids such as crude oils, refined oils and mixtures can be pumped as non, high-risk fluids if they meet all of the following criteria:
  - Field Vapour Pressure equal to, or less than, 7 kPa (1 psi);
  - API gravity equal to, or less than, 50;
  - Open Cup Flash Point equal to, or greater than, 0° C (32° F); and
  - Reid Vapour Pressure equal to, or less than, 10 kPa (1.5 psi).

**High Risk Fluids**

Any fluid not included in the criteria listed above may be pumped, with special precautions, if it falls within the following criteria:

- API gravity less than 50;
- Field Vapour Pressure less than 14 kPa (2 psi);
- Open Cup Flash Point greater than -12° C (10° F);
- Reid Vapour Pressure below 10 kPa (1.5 psi); and
- Open Cup Flash Point 20° C higher than the fluid temperature during the job.

**Non-Pumpable Fluids**

Any fluid, not included within any of the above criteria shall not be used:

- Fluids such as aromatic solvents (toluene, xylene, acetone) or alcohol shall not be used undiluted, but may be used as additives. In order to use these substances, less than 50% aromatic solvents to diesel or less than 40% alcohol in water may be used.
- Additives designed specifically to reduce fire and explosion hazards are available and shall be utilized.

**Equipment Placement**

- Fluid tanks shall be positioned crosswind or downwind of pumping units. If practical, tanks shall be dyked to contain spills.
- Fluid tanks shall be at least 46 metres (150 feet), or the maximum
distance possible from the wellhead.

- The blender and pumper trucks shall be at least 8 metres (25 feet) from the fluid or product tanks.
- Pumper trucks shall be at least 8 metres (25 feet) from the blender.
- All trucks shall be at least 23 metres (75 feet) from the wellhead.
- The fire truck(s) shall be positioned so unreeled hoses can reach the wellhead, blender and tanks.
- The supplemental fire or water truck shall have clear access to the foam or dry chemical fire truck.

**Pumping Low Vapour Pressure Fluids**

**Fire Protection**

Fire protection is required. The minimum recommendation is a fire truck with 2,000 litres (500 gallons) of foam capacity plus bulk dry chemical. On a large pumping operation, two fire trucks may be necessary to reach all areas of the lease.

Portable fire extinguishers shall be placed on the ground at least 5 metres (15 feet) from each truck.

**Hoses, Lines and Wellhead**

- The company site representative shall personally inspect the wellhead to determine the safe working pressure of the wellhead and all fittings attached to the wellhead. The safe working pressure shall be communicated, in writing, to the contractor’s site representative.
- Only pressure rated hoses and lines shall be used for suction and discharge.
- Hoses and lines shall be bonded, as proof of current pressure test.
- Cam lock fittings are not permitted. Hammer unions shall be utilized.
- Frac companies may insist that only frac company hoses or lines be attached to their equipment.
- Hose covers shall be used on all blender discharge hoses.
- Metal drip pans shall be used at open blender hoppers where fluids may splash out.

**Bonding and Grounding**

- All units and tanks shall be bonded together.
- Drip pans shall be bonded to the blender.
- The entire system shall be grounded to the wellhead.
Pressure Testing

- Water is the preferred medium for pressure testing.
- Pressure testing may be done with a combustible fluid (for example, diesel fuel).
- High-risk flammable fluids shall never be used for pressure testing.

Fire Prevention

- Do not run flammable fluids through an open tub blender, a mixing tub or displacement tanks.
- Flammable fluids shall not be pumped after dark.
- Tanks shall be gauged using a gauge board or with a non-ferrous, non-sparking gauge.
- Matches, lighters and tobacco products shall be left at the designated safe area.
- Tanks shall not be overfilled.

General Requirements

- Do not cavitate pumps. Do not pull tanks too low or pump individual units too fast.
- Designate a safe area. This area shall be used as a staging area for non-essential personnel, a location for the pre-job safety meeting and a muster point at which to conduct a head count following an emergency.
- Conduct a pre-job meeting. Material Safety Data Sheets (MSDS) must be available for all products, including crude oil. The MSDS must include API gravity, Reid Vapour Pressure and Open Cup Flash Point.
- Test all emergency engine kills.
- Vacuum trucks may be used to clean out lines, but all equipment must be shut down first and only pressure-tested hoses used.
- Non-essential personnel shall remain off lease or at the safe area.
- Personnel and equipment on location shall be minimized as much as reasonably practical. For example, frac crews and equipment shall stay offsite while hot oilers are working or tanker trucks are unloading.

Emergency Procedures

In the event of a major leak or spray:

- Kill all equipment.
- Evacuate personnel.
- Conduct head count.
- Foam down the spill.
- Assess the situation for repairs.
- All spills will be foamed and then cleaned up.
12.13 STIMULATION (ACIDIZING AND FRACTURING)

This section will assist the wellsite supervisor in the safe and timely completion of stimulation operations (acidizing and fracturing).

Safety Meeting

Recognition of the hazards by all personnel on the job is the biggest factor in protecting personnel and equipment. A pre-treatment safety and procedures meeting between all personnel (rig crew, testers, visitors, etc.) shall be held prior to the treatment. The company representative is responsible to call the meeting. The following topics shall be covered:

- Introduction of the contractor and operator personnel in charge of the operation.
- All hazards associated with the operation.
- Explanation of the treatment and procedures to be followed. Include hook-ups, equipment and personnel positions and discuss in detail any unusual hazards or procedures which will be used.
- Keeping the lease clean and free of chemical and oil spills.
- Restriction of smoking during the treatment.
- Plan of action in the event of a problem.
- Toxic fluids and fumes.
- Define the maximum operating pressures (tubing and annulus).
- Designation of a mustering point and instruction to personnel to report to this point in case of an emergency. Any non-essential personnel (rig crew, visitors, etc.) shall be restricted to this location during pumping operations.
- Ensure all communications systems are fully operational. If hand signals are to be used, ensure everyone is completely familiar with them.
- Where a radioactive tracer is to be used, ensure handling procedures are correct, safe and fully understood. Have barricades and signs erected at the entrance to the lease to prohibit entry.
- Personal protective equipment that must be worn.
- The location of a fresh water source should be pointed out to all personnel on the lease prior to an acid stimulation. Flooding acid with fresh water after it has been accidentally spilled on skin, clothing or leather shoes shall be done to wash it off.

Equipment

Wellhead

- All components within the wellhead system shall be individually checked by part number and rating stamp.
Casing bowls shall be included in the pressure rating check. The majority will be low pressure and must be isolated from the high pressures.

All valves shall be checked to ensure that they are full opening and pressure ratings are adequate. Double valving is recommended in H₂S areas.

**Tree Savers and Fracheads**

Tree savers and fracheads are available from rental companies. They should be used wherever highly corrosive fluids or large volumes of sand are pumped. A working pressure rating of approximately 70 mPa is preferred.

Tree savers work by inserting a heavy wall, high pressure mandrel through the master valve(s) and then sealing with external seals against the inside of the top joint of tubing. The pressure is thereby isolated from the wellhead and wellhead valves.

The major problem with the use of tree savers results from a lack of roundness in the top joint of tubing in the seal area. This can be eliminated through the use of a polished bore joint at the top of the tubing string with a microbore callipered ID. If there is a possibility that a tree saver will be required, the top joint should have the polished bore over the top 2 metres.

Secondary causes of failure occur if the mandrel is too short or misaligned. A small misalignment on the top flange could result in seal damage.

**Fracheads re-installed on the casing bowl, instead of using a conventional wellhead.** Removal of these heads shall be done utilizing a permanent packer and a blanking plug and will often be done in conjunction with a tubing change out (i.e. 89 mm work string to 60.4 mm production string). Care must be taken to ensure the blanking plug will pass through the smallest potential tubing size.

**Positioning and Spacing**

All equipment shall be spaced out according to the Alberta ERCB standard diagram for "Equipment Spacing for Well Servicing."

On multiple pumper frac or high rate acid jobs, the service rig shall be moved off the hole to allow free access.

The following separation distances should be maintained:

- The tanks shall be at least 50 metres from the wellhead and located on solid ground.
- The blender shall be located at least 25 metres from the tanks if possible.
- The other units (pumpers, bulkers, etc.) shall be a minimum of 5 metres away from the blender.
• An adequate egress aisle shall be maintained between the pumpers.
• All units shall be a minimum of 30 metres from the wellhead.
• All recording equipment (data vans) shall be as far from the wellhead, lines and pump units as possible.
• Where pumpers are manned units, ensure all operators have clear view of the frac company engineer and are equipped with two-way radios.

Communications

On all multi-unit jobs, two-way radios will be used. Hand signals shall be used for backup. Ensure all operators and service personnel are familiar with the various signals.

Fire Protection

Fire protection is required on all multiple unit jobs when pumping flammable fluids, and on very large non-flammable fluid jobs. More than one fire truck may be required on large volume jobs or when lease configuration limits access to all units.

Deploy the portable fire extinguishers from the units in safe areas around the worksite.

Ambulance

An ambulance will be required on high-risk jobs (large volume flammable fluid and/or when in excess of 11 personnel on site).

When required, an emergency response vehicle and two attendants, at least one being an Emergency Medical Technician, will be utilized.

Shower Truck

A shower truck is required where acid is in the line at the surface with a pressure of 7 mPa or greater and on all larger volume acid jobs.

Personal Protective Equipment

• Breathing apparatus shall be available on all locations where there is a possibility of sour gas.
• Ear protection is mandatory.
• Goggles, apron and rubber gloves will be worn by all personnel handling corrosive or toxic materials.
Other Items

- Hose Jackets:
  - Any hoses used on suctions shall be jacketed to ensure leaks are contained. This is particularly important when pumping volatile or corrosive fluids.

- Pressure Testing:
  - All lines, connections and valves must be tested prior to beginning the job. Where possible, the system will be tested to the maximum safe limit (test pressure) of the weakest equipment line or valve. Under no circumstances shall an operating pressure exceed 80% of the test pressure. All pressure tests will be a "period of time" test.

- Fluid Types:
  - Condensates, pentanes and butanes shall not be used as a frac fluid or for placement of chemicals.
  - High gravity hydrocarbons (reformates, crudes) require fire protection standing by during heating and pumping operations. All other safety precautions shall be followed. Only weathered or aged crude shall be used. "Live" crude must not be used.
  - Methanol is highly flammable and special precautions must be taken to ensure no leaks occur. Fire protection must be available. Toxicity is high and breathing apparatus shall be available for the fire fighters.
  - Acids (particularly greater than 28%) are highly corrosive and care shall be taken to avoid spills and, particularly, skin contact. The fumes are toxic.
  - Energized fluids (foams, nitrified, CO₂) shall have special emphasis placed on return line sizing and consideration for erosion. Energized flammable fluids are highly volatile therefore additional precautions are advised.

Inhibitors and Chemicals

Many inhibitors, particularly for acids, are arsenic compounds and must be regarded as extremely toxic. Many will cause death within minutes if ingested. In all cases where inhibitors and chemicals that are toxic are used, handling shall be done by at least two people (one to assist the other in the event of spillage or mishap) and the supply or service company shall be required to supply antidotes or neutralizers at the worksite.
12.14 SWABBING

This section addresses the hazards associated with swabbing operations, recommended placement of Supplied Air Breathing Apparatus (SABA) and Self-Contained Breathing Apparatus (SCBA) and recommended minimum duties to be addressed by the on-site safety specialist.

Swabbing consists of running a line off the service rig sandline drum through a lubricator. The sandline is fitted with sinker bars and cups and is run into the well in order to reduce the hydrostatic pressure on the formation to allow fluids to flow into the well. The cups are lowered below fluid level and are expanded upon hoisting to lift fluids to the surface (mechanical recovery) where they are flowed through a flow tee, through piping, across a gas separator and into storage tanks. Many of the precautions associated with swabbing are similar to those addressed in other parts of the section that are associated with well servicing operations where formation fluids are brought to the surface.

**Recommended Minimum Procedures**

- Swabbing operations will be conducted only during daylight hours due to the necessity of maintaining visual contact with all associated personnel and equipment during the swabbing operations.
- All pumping lines must be tested to anticipate pumping pressures, and verify the placement of check valves.
- Wellhead valves, fittings and tie-ins to separators, storage tanks and all associated equipment must be checked for adequate pressure ratings, leaks and proper staking.
- At a minimum, supplied air system airlines must be run as follows (in H₂S environments):
  - 1 airline at the swabbing controls, with one SABA.
  - 2 airlines at the wellhead, with two SABA (for installation, removing or changing of cups under mask).
  - 2 airlines at the rig/production tank with 2 SABA (for gauging under mask).

In addition a minimum of:

- 1 SCBA must be in the company representative’s possession.
- 1 SCBA in the safety representative’s possession.

**Safety Meetings**

A safety meeting must be held with all personnel. The following items shall be discussed in the meeting:

- Fire equipment placement.
Special procedures (tank gauging, fluid monitoring precautions etc.).
- Designated duties.
- Escape paths, wind directions.
- Hazards associated with:
  - Moving lines and equipment
  - Recovery of fluids to surface
  - Leaks, flammable product and H₂S
  - Changing of cups
  - Removal/installation of lubricator
  - Gauging of tanks
- Use of personal protective equipment (i.e. fire retardant coveralls, ban on synthetics). Use of SABA, SCBA.
- Necessities of assuming that all formation fluids brought to surface are extremely toxic and flammable.

Duties Of Safety Specialist (In H₂S Environments)
- Verify that all personnel are wearing protective clothing.
- Verify that all tank gauging is done under mask.
- Ensure that lubricator installation, removal and cup changing are performed under mask.
- Monitor personnel movement.
- Control access to the lease.
- Verify that gas plume tracking is performed under mask.
- Ensure that the operator is under mask during pulling of swab.
- Identify wind direction and adjusting to conditions.
- Verify non-essential personnel are in the briefing area.
- Check that testers are properly protected.
- Monitor fluid returns from wellbore and that checks to the piping system for leaks, are performed under mask.

The Industry Recommended Practices will be followed on all company sites. As such, all wells with an H₂S concentration of greater than 1% will be flowed back to a closed system and not to open rig tanks or vessels.

12.15 HOT OILING

Introduction

This guideline is to provide safe work procedures for hot oiling operations. Users of this safe work practice shall consult local legislation prior to implementing these practices.
Definitions

**Designated Site Representative**

The person designated by the company who will directly supervise the work.

**Hot Oil Unit Operator**

The contract company representative who is responsible for the operation and supervision of the hot oil unit and any associated ancillary equipment.

**Transfer Equipment**

Any tankage, pumps and interconnecting lines that may be used to supply feedstock to the hot oil unit are considered transfer equipment.

**Bonding**

Bonding means a continuous electrical connection between all containers, tanks, production equipment, the hot oil unit and transfer equipment. Bonding is intended to keep all the equipment at the same electrical potential.

**Grounding**

Grounding means safely dissipating any build-up of static electricity to earth.

**Responsibilities**

**Designated Site Representative**

The designated site representative is responsible to:

- Inspect production equipment to determine that all wellheads, lines, gaskets and related equipment will withstand anticipated tests, as well as working pressures and temperatures.
- Inform the contractor, prior to the job, of maximum pressure, temperatures and volumes of fluids, safety equipment, personal protective equipment, training requirements and worksite hazards.
- Issue a Hot Work Permit to the contractors prior to job commencement.
- Participate in a pre-job safety meeting with all personnel.
- Witness the pressure testing of the temporary piping system.
- Provide proper lighting for working after dark.
- Designate an area for personnel to meet during an emergency. Extra safety equipment shall be kept at this area.
- Confirm that a communication system is on site and operationally tested.
- Ensure that a site-specific emergency telephone list is available, with clear
directions to the location.

- Provide current Material Safety Data Sheets (MSDS) for chemicals and fluids supplied by the principal contractor.
- Have wind indicators on site.
- Ensure that only personnel essential to the operation are on site.
- Monitor compliance to proper practices and authorizing any deviation prior to job commencement.
- In conjunction with the contractor representative, inspect all equipment.

**Contractor Representative**

The contractor representative is responsible to:

- Perform work with experienced and trained workers under the direct supervision of an experienced and trained supervisor.
- Participate in the pre-job safety meeting and contribute their expertise.
- Ensure that all equipment operators remain at their equipment when it is in operation.
- Provide MSDS to the company representative for products supplied by the contractor.
- Space equipment as per legislated requirements.
- Place signs to warn personnel approaching the worksite of pressurized lines and the hazards.
- Ensure that a minimum of two people are on site at all times.
- Confirm that all fire suppression equipment, safety equipment, personal protective equipment and gas detection equipment is ready for use.

**Equipment Placement**

**Hot Oil Unit**

The hot oil unit shall be positioned at least:

- 25 metres from the equipment to be hot oiled;
- 25 metres from the transfer unit;
- 50 metres from the production or returns tanks; and
- 50 metres from the flare stack or pit.

**Transfer Unit**

The transfer unit shall be positioned at least:

- 25 metres from the equipment to be hot oiled;
- 25 metres from the hot oil unit;
- 50 metres from the production or returns tanks; and
- 50 metres from the flare stack or pit.
**Returns Tanks**

The returns tanks shall be positioned at least 50 metres from:

- The hot oil unit;
- The transfer unit;
- The flare stack; and
- The equipment to be hot oiled.

**Wind Direction**

- The hot oil unit shall be crosswind of the transfer unit.
- The hot oil and transfer units shall be upwind or crosswind of the production equipment.

**Fire Extinguishers**

- Two 30 lb. ABC extinguishers at least 15 metres upwind of the hot oil unit.
- One 30 lb. ABC extinguisher at least 15 metres upwind of the transfer unit.
- One 30 lb. ABC extinguisher at least 15 metres upwind of tanks or production equipment.
- One 150 lb. ABC extinguisher with a minimum of 15 metres of hose shall be provided and positioned at least 15 metres upwind of the hot oil unit.

**Breathing Apparatus**

- If required, breathing apparatus shall be positioned at the workstations of all essential personnel.
- Extra breathing apparatus shall be positioned at the designated safe area.

**Wind Indicators**

Wind indicating devices shall be positioned so as to be visible from each workstation.

**Equipment Inspections**

Confirm that:

- Safeguards for belts, pulleys, rotary shafts and hot surfaces are in place.
- The heater has an appropriate flame arrestor in place.
- Each unit is equipped with an automatic high temperature shut down for the heater. This temperature shall never exceed:
  - Maximum working temperatures of facility equipment; or
  - The hot oiler manufacturer recommendations; or
- 150º C.

- Diesel-powered units have a positive air shut-off with a control at the operator's panel and one control remote from the control panel.
- Heater and engine exhausts are of sufficient height or length to prevent the emergence of live sparks.
- All equipment is bonded together and the entire system is grounded.
- Temporary line pipe has undergone non-destructive testing, is properly maintained, and correct ANSI piping is safely secured.
- Pressure relief valve discharge is piped into tank and away from personnel.
- Pressure relief valves are set to discharge at pressures not in excess of equipment specifications (hot oiling and wellhead/production facility).
- Transient vapours are vented away from work areas and sources of ignition.
- Trucks have parking brake set or wheels chocked.
- Metal drip containers used under hose or piping connections are electrically bonded to the system.
- Isolation valves with check valves and bleed valves are located upstream of the wellhead, pipeline or tank. Check valves and bypass lines, allow for complete depressurizing for rig-out and abnormal operating conditions.

**Pre-Job Safety Meeting**

The following points shall be discussed with all personnel:

- Potential hazards.
- Safety equipment and designated meeting area.
- Emergency procedures, evacuation, communication and head count.
- Review of work, including each person's responsibilities.
- Maximum allowable pressures, temperatures, fluid volumes and pumping rates.
- Pressure testing.
- Non-essential personnel.
- If there is any uncertainty concerning job safety, the operation shall be shut down and shall not continue until all concerns are resolved.
- Walking on the top of any tank is not permitted.

**Abnormal Conditions**

In the event of vapour locking of a heater or pump, the hot oil unit will be immediately shut down and the block valve to the well or facility closed. The hot oil unit operator and the site representative will assess the situation and check for any damage.

The unit must be circulated with fresh fluid to cool it down. If this cannot be done safely, the unit shall be bled down through the bleed valve at the well or facility.
If the unit cannot be bled down safely, the unit shall be left for a minimum of 2 hours to allow air-cooling. When the unit has been cooled, bleed it down.

Lines must be pressure tested again before commencement of the job.

**Pressure Testing**

Hydraulically test all lines from pump discharge to the wellhead at 1.5 times the anticipated working pressure for the job and hold for a minimum of 10 minutes. Do not exceed the maximum allowable working pressure rating of the equipment. While filling lines for the test, vent all air from the lines before pressuring them up.

12.16 **ACIDIZING**

This section addresses acidizing hazards and hazards presented by associated equipment such as the endless tubing unit. For the optimum production of hydrocarbons from the formation, damage during perforating, drilling and cementing must be repaired. This usually is accomplished by washing the sand face with acid. The acid is spotted at the perforations with a coiled tubing unit.

**Coiled Tubing Unit (CTU)**

The typical CTU consists of a picker, reel, injector and 10,000 to 14,000 feet of 3/4" to 1-1/4" hollow steel alloy tubing (coiled tubing). The procedures for acidizing are:

- Place a jet nozzle on the end of the coiled tubing.
- Place the injector and Blowout Preventer (BOP) system on top of the wellhead. Installing the injector and BOPs on the wellhead shall be done while under mask when H₂S is present or suspected.
- The tubing is then run into the hole by chains on the injector. The operator controls this operation from a cab on the CTU. While the tubing is being run into the hole, a stripper at the base of the injector prevents gas from escaping from the well. While the tubing is being run into the hole, constant pressure is maintained with N₂ or fluid to prevent the tubing from collapsing as a result of bottom hole pressures. The returns from this operation would normally go to the rig tank or separator.
- When the tubing jets reach the perforations, acid is pumped down the tubing. When the acid is at the jets, the tubing is repeatedly run up and down past the perforations. This acid wash will remove any glazing that may have occurred during perforating. Shutting in the wing valve on the wellhead and increasing pressure to allow acid to be squeezed into the formation helps repair the damage caused by cementing. This exposes the raw formation to the wellbore and increases the production capabilities of the reservoir.
• The tubing is then removed from the well and the CTU is rigged off the wellhead. Personnel shall wear breathing apparatus while removing the injector and BOPs.
• The spent acid will be returned to the surface through circulating or flowing of the well. This spent acid is still dangerous. All personnel must wear proper protective equipment.

**Hazards Of Acidizing**

• Installation and removal of injector or BOP (to be done under mask if H₂S is present or suspected).
• High-pressure lines (no unauthorized personnel to cross).
• Corrosive chemicals (use proper personal protective equipment). The following protective equipment must be worn by all personnel:
  - Goggles.
  - Fire retardant acid suit.
  - Rubber gloves.
  - Rubber boots (steel toed).

**Safety Meeting**

Before acidizing operations are started a safety and procedure meeting is to be held to discuss hazards involved. All lines shall be pressure tested above the maximum treating pressure. The acid company’s employees shall do all actual handling of the acid, including repair of acid leaks in injection lines.

**Fresh Water Source**

The location of the fresh water source, showers and eye wash shall be pointed out to all members of the rig and acidizing crews before acidizing operations commence. Acid accidentally spilled on the skin, clothing or leather shoes shall be immediately washed off by flooding it with clean water.

**Breathing Apparatus (For Sour Wells)**

• Provide three 1/4" airlines and three Supplied Air Breathing Apparatus (SABA) at the wellhead.
• Provide one 1/4" airline and SABA at the operator’s cab, acid pumper and N₂ tanker.
• The company representative and contractor representative shall each have access to a Self-Contained Breathing Apparatus (SCBA).
Safety Representative

During acidizing, the safety representative shall wear all applicable personal protective equipment (SCBA, gas detector, fire retardant wet suit, rubber gloves and boots). Duties include:

- Watch for leaks.
- Monitor, under mask, any returns for H₂S.
- Monitor the use of SABA during installation and removal of the injector.
- Check wellhead for leaks prior to and after rigging-in and out.
- Monitor personnel work stations and movement.
- Verify that all personnel are using proper protective equipment.

12.17 LEAVING A WELL AT NIGHT DURING COMPLETION OR WORKOVER OPERATIONS

Introduction

In order to facilitate well control procedures, it is recommended that as much tubing as possible be left in the hole before shutting it down (if working in open hole, then pull up into the casing before shutting down).

When drilling out cement, bridge plugs, packers, etc., it is recommended that one complete circulation (or until returns come clean) be pumped before shutting down, and that at least two stands be pulled prior to shutdown to lower the fluid level in the well.

The company representative should witness closing and opening of the well.

Procedures

The procedure for leaving the well at night is:

- Install a stabbing valve on the working string.
- Land the tubing with the tubing hanger and pup joint, or hang in the slips. Whenever possible, land the tubing hanger.
- Close the pipe rams on the Blowout Preventer (BOP) and lock. Visually check that rams are closed.
- Ensure all wellhead valves are closed, and tapped bull plugs and valves are installed.
- In freezing weather, the wellhead and BOP will need to be heated to prevent freezing overnight.
- Lower the blocks to the floor level and chain them to the girder under a slight tension.
- Chain and lock the brake handle.
- Shut down and bleed off the hydraulic BOP system.
- The rig engines may be left running in the winter if a watchman is on the
lease, otherwise shut down is recommended.

- Lock the stabbing valve key in the toolbox.
13.0 CONSTRUCTION OPERATIONS

13.1 POLICY

Northern Cross is committed to ensuring all construction work, including ditching and trenching, is conducted in accordance with safe work practices. All excavation, ditching and trenching around underground lines and utilities shall be done with approval of the owner of the facility or line.

13.2 DEFINITIONS

Trench
A dugout area of earth, the depth of which exceeds its width at the bottom.

Excavation
Any other dug out area of earth.

Hard and Compact
Soil that can only be dug by machinery, and shows no sign of cracks after being dug, and soil which has not been subject to fissures, previous disturbances, vibrations, standing water or ground water seepage.

13.3 GENERAL REQUIREMENTS

- The use of internal combustion engines shall be permitted in gas free areas only.

- Prior to excavation work in any area call Yukon Electric at 1-800-661-0513 or 867-633-7000, and have the area searched for underground line and facilities.

- Prior to any excavation the facility owner shall locate all underground facilities, pipelines, electrical lines, sewer lines and water lines.

- When excavating in an area containing underground facilities:
  - All work shall conform to the conditions set out by the facilities owner and applicable provincial regulations.
  - All work shall be done under the supervision of a designated responsible person usually a representative of the facility owner.
  - All pipelines, electric lines or conduits must be hand exposed prior to doing any trenching with power equipment.

- All employees engaged in excavating operations shall wear appropriate Personal Protective Equipment including safety hat, safety boots, and suitable hand protection.
Whenever a ditch or trench must be crossed by workers, or pedestrian traffic, a walkway of not less than 510 mm (1.67 ft.) width will be provided. When the ditch or trench is deeper than 2.0 m (6.5 ft), the walkway must be provided with adequate guardrails on both sides.

Whenever a worker is required to enter a ditch or trench which is more than 1.5 m (4 ft.) deep, the walls of the ditch or trench will be either cutback, shored or braced as follows:

- In hard, compact soil, cutback to not less than 30 degrees from the vertical.
- For vertical trenches in other soils cutback to not less than 45° from the vertical.
- Shored or braced – designed, constructed and installed according to the standards.
- Where temporary protective structures are used to prevent a cave-in, they are to be certified by a professional engineer.

All ditch and trench support systems shall be inspected on a daily basis.

Whenever a worker is required to enter a ditch or trench, which is deeper than 1.5 m (4 ft.), a responsible person shall be stationed on the surface as an observer.

Whenever a worker is required to enter a ditch or trench, which is deeper than 1.5 m (4 ft.), a ladder shall be provided such that it is no further than 8.0 m (26 ft.) from the worker. The ladder shall extend from the bottom of the trench to at least 1.0 m (3.3 ft.) above the surface ground level.

The job supervisor shall inspect all excavations after a hazard increasing situation such as rain, ground vibration, or equipment close to the edge. The job supervisor shall also inspect excavation daily and upon completion of the excavation.

A Northern Cross Inspector or responsible person shall inspect each line crossing.

When work is being done which could affect the operation of another part of the plant or another facility, all affected personnel shall be informed. Radio / telephone contact shall be maintained during the time the work is in progress.

In the unusual event that a ditch or trench must be excavated to deeper than 6.0 m (19.7 ft.), the appropriate provincial regulations concerning these trenches must be consulted.
13.4 RECOMMENDED PROCEDURES

- Review current drawings and locate existing lines within 30 meters of the area of excavation.

- Locate underground lines using a combination of mechanical or electronic locating devices and expose by hand digging any line within 5 m of the excavation.

- Excavate:
  - Remove trees, boulders or other surface objects, which may create a hazard during trenching operations before the trenching work in the area is started.
  - Do not prod with sharp or pointed tools to locate underground utility lines.
  - When excavating near overhead lines, take care to ensure that there is no reduction in the original support of the overhead line poles.
  - Do not excavate with mechanical equipment within 7 m of any existing line.
  - Pile material excavated from a ditch or trench at least 1 metre (3.3 ft.) from the edge of the excavation or trench.
  - Slope the spoil pile to an angle of 45° or less from the horizontal.
  - Do not place tools, materials, equipment or machinery closer than 600 mm (2 ft.) from the edge of the excavation, including machinery actually involved in digging, backfilling and laying pipe.

- Cover or adequately guard with barriers installed along both sides, excavations that create a hazard to workers or the general public.
  - Use posts and lumber, rope or yellow plastic tape, and other necessary materials.
  - Install the barrier approximately one meter above the ground, outside the excavation and excavated material. No less than one metre from the edge of the excavation.
  - Install blinkers or other lighted warning equipment if the excavation is to be left open at night.

- When excavating lines containing low flash products:
  - Determine whether any dangerous conditions exist.
  - Assign one person equipped with a radio as fireguard.
  - Inform the equipment operator of all dangerous conditions and the special precautions to be taken.
  - In tight areas, excavate with hand-held shovels.
13.5 **RECOMMENDED GUIDELINES FOR SAFE CONSTRUCTION NEAR PIPELINES**

Before undertaking any ground disturbance such as excavating, digging, trenching, ploughing, drilling, tunnelling, augering, backfilling, blasting, stripping topsoil, levelling, removing peat, quarrying, clearing, grading or pounding posts, refer to the guidelines listed below.

Careless construction near pipelines can cause serious accidents and costly damages. Proper pre- and post-construction procedures must be followed.

The requirements in these guidelines apply to:

- Operating pipelines
- Discontinued pipelines
- Abandoned pipelines

There are two exceptions that do not qualify as “ground disturbances”:

1. Land disturbances of less than 30 cm that do not reduce the pipeline cover to less than that when first installed, and
2. Normal cultivation that does not exceed a 45 cm depth.

**13.5.1 Ground Disturbance Guidelines**

More information for Ground Disturbance can be found in Section 5.21: Ground Disturbance. The following are pre-construction procedures for ground disturbance:

1. Look for pipelines in the following records.
   
   - Call Yukon Electric at 1-800-661-0513 or 867-633-7000 before you dig.
   - Check with your local utilities services.
   - Check land title for easements that may indicate the location of pipelines.

2. Look for pipelines at the site:
   
   - Look for warning signs where pipelines cross roads or waters.
   - Look for wells, tanks, or valves which may indicate the presence of pipelines.
   - Look for ground settling from previous work.
   - Talk to nearby / adjacent landowners and residents.
13.5.2 Determine the Extent of Disturbance

- Determine where the construction project will be in relation to the existing pipeline.
- Determine the boundaries of the controlled area. A pipeline’s controlled area is the land bordering it for 30 m along each side. Refer to diagram below.

![Diagram of pipeline controlled area and right-of-way](image)

- Determine where the pipeline right-of-way lies. A pipeline right-of-way is the land allocated for the pipeline and its maintenance as set out in the agreement between the landowner and the pipeline company. The right-of-way will usually be less than the 30 m controlled area, but could possibly be more.
- Do not assume that the pipeline is in the middle of the right-of-way.
13.5.3 Other Than Controlled Areas

If work is to be performed in the controlled area outside of the pipeline right-of-way, the following applies:

1. Call the pipeline owner at least two full working days before digging, so that the pipeline can be located and marked.

2. Install temporary fencing, if necessary, to control access and restrict heavy equipment from operating over the pipeline.

13.5.4 Within the Pipeline Right-of-Way

If work is to be performed within the pipeline right-of-way, the following applies:

1. Get written approval from the pipeline owner before digging.

2. Call the pipeline owner at least two full working days before digging, so that the pipeline can be located and marked.

3. No excavation with machinery is allowed within 5 m of the pipeline. The pipeline must be exposed by hand within the 5 m zone.

4. Ensure that no machinery comes within 60 cm of a pipeline or any distance underneath a pipeline without the supervision of the pipeline owner.

5. Call the pipeline owner at least one full working day before covering any exposed pipeline.

13.5.5 Responsibilities

Your responsibilities are to:

- Search 30 m beyond the dig area.
- Check records for the existence of pipelines.
- Obtain written permission for working within the pipeline right-of-way.
- Call pipeline owner at least two full working days before you dig so pipeline position can be marked.
- Erect temporary fencing along right-of-way if needed.
- Construct proper crossings to allow access over the right-of-way, if needed.
- Hand-expose the pipeline before using machinery within 5 m, requesting attendance of pipeline owner.
- Avoid using machinery within 60 cm of pipeline, unless supervised by the owner.
- Call the pipeline owner at least one full working day before you cover any exposed pipeline.
The pipeline owner’s responsibilities are to:
- Provide pipeline information upon request.
- Provide reasonable assistance to anyone carrying out a ground disturbance.
- Mark the position of the pipeline before a ground disturbance takes place.
- Be present, if asked, during hand exposure.
- Inspect the pipeline for damage prior to backfilling, and keep a written record of this inspection.
- Supervise any mechanical excavation within 60 cm of the pipeline or underneath the pipeline.

13.6 **ELECTRICAL SAFETY**

1. Stay back at least 10 metres 33 feet from any downed power line, exposed underground cable, or where there is contact with an overhead power line. Depending on voltage, this distance may increase up to 32 metres or 105 feet.

2. Workers who operate machinery or equipment that could come in contact with overhead or underground powerlines need to look up and check for overhead powerlines, or obtain underground locates (see 6) before beginning work.

3. When operating machinery or equipment in close proximity to power lines, always maintain the limits of approach: from 3 to 7 metres or 10-23 feet depending on the voltage. For proper safe working distances contact Yukon Occupational Health and Safety at 867-667-5645 or 1-800-661-0443. In keeping with the Yukon OH&S Code, if equipment COULD come closer than the minimum distances, you must contact Yukon Electrical before beginning work.

4. Stay at least 10 metres or 33 feet away from equipment operating near power lines because if it contacts an energized line, the electricity will go to the ground. The operator should be on the vehicle with everyone else clear of the vehicle when a boom is in motion. If you must approach, ensure the equipment is not operating.

5. If the machinery you are operating contacts an energized line, move it away from the line to break contact. If this can’t be done, remain on the machine. If there is an uncontrollable fire, jump off the machine keeping your feet together. Never contact the machine and the ground at the same time. Once clear of the machine, shuffle away, never allowing the heel of one foot to move beyond the toe of the other, or, hop with both feet together to a minimum distance of 10 metres or 33 feet.

6. Before you dig or drill you must determine the location of all underground services. Call Yukon Electrical at 1-800-661-0513 or 867-633-7000 before you dig. If a cable is accidentally dug up, call Yukon Electrical immediately. Move the digger bucket clear of the cable and stay out of the trench. If the machine can’t be moved, keep workers 10 metres or 33 feet away and have the operator
remain on the vehicle. In the case of fire, follow the “Shuffle or Hop, Don’t Step” rule.

7. Always call your local emergency services when someone is injured in an electrical accident. If they are still in contact with the electrical source and you touch them, you could be seriously injured or killed. Keep everyone back, a minimum distance of 10 metres or 33 feet and have someone call for help immediately.

13.7 **POWERED MOBILE EQUIPMENT**

- Powered mobile equipment is defined as any equipment that is engine or battery powered and used for excavating, material handling, elevating men etc. Examples are skid steer loaders, bulldozers, backhoes, cranes, man lifts, etc.

- All powered mobile equipment operating on the work site must have a trained and competent operator, or a trainee operator under the direct supervision of a trained and competent operator.

- Where there is potential for the equipment to move in a direction that is not clearly visible to the operator then the equipment shall have an audible signaling device that can be clearly heard above the ambient noise level.

- Prior to use the operator shall complete a visual inspection of the equipment. Any deficiencies in the equipment must be documented and reported. Where the inspection reveals a deficiency that is hazardous or potentially hazardous the equipment shall not be used until the deficiency is corrected.

- Powered Mobile Equipment may not be started until the inspection is completed.

- An Inspection and Maintenance log shall be maintained for all powered mobile equipment in use and shall be readily available to the operator.

- When entering an area to perform work the employee must complete a visual inspection of the site before entering. If there is potential to come into contact with other workers or equipment there shall be a designated spotter who will maintain contact with the operator at all times.

- If the operator of equipment leaves the controls the equipment must be secured against movement and all suspended or elevated parts are landed or secured in a safe position.

- If at any time powered mobile equipment comes into contact with process equipment or structures, no matter how minor the contact, an Incident Report must be completed.
General Safety for Heavy Equipment

Only trained and authorized operators shall be permitted to operate the designated equipment.

1. Personal protective equipment is mandatory and may include the following:
   - boots or safety shoes  - eye/face protection
   - long pants  - hard hat
   - hearing protection  - gloves

2. Pre-start/Walk around inspection:
   - Check for loose or worn parts and repair or replace immediately.
   - Check all fluid/coolant levels.

   Caution: Open the radiator cap only when the engine is cooled.

   - Inspect hydraulic line connectors and hoses for leaks before applying pressure to the system. Use paper or cardboard, not your hands, to search for leaks.

   Caution: Hydraulic fluid escaping under pressure can penetrate skin and cause serious bodily harm.

   - Check tires for cuts, bulges, irregularities, abnormal wear and proper inflation.
   - A fire extinguisher and first aid kit shall be mounted in the cab.

3. Machine Maintenance:
   - When servicing equipment, fasten a Do Not Operate tag on the steering wheel. Review Lock Out/Tag Out Procedures prior to servicing any equipment.
   - Ensure the cab area is clean and free of debris and tools.
   - Clean windshield, mirrors and lights.
   - Remove all oil, grease or mud and snow from grab irons, hand rails, steps, pedals, and floor to prevent slips and falls.
   - Remove or secure any loose items such as tools, chains, or lunch boxes from the cab.

4. Work Site:
   - Check and mark the area for underground cables, gas lines, and water mains.
   - Know work area clearances - watch for overhead or underground objects, holes, drop-offs, and partially hidden obstacles and wires.

5. Mount properly:
   DO NOT GET ON OR OFF A MACHINE THAT IS IN MOTION
   - Maintain a 3-point contact with the steps and hand rails while getting on/into the machine - do not use the controls or steering wheel as a
handhold.
- Do not operate the machine with wet, greasy, or muddy hands or shoes.

6. Starting and Testing:
EXHAUST FUMES ARE DANGEROUS - ALWAYS HAVE A RUNNING MACHINE IN A WELL VENTILATED AREA.
- Fasten your seat belt and adjust the seat prior to starting.
- Controls should be in neutral and the parking brake set before starting engine.
- Start the engine only from the operator’s seat.
- Warn personnel in the area that you are starting the engine.
- Check all gauges, light, instruments and warning devices to assure that they are functioning properly and the readings are within normal range.
- Test steering right and left.
- Test brakes against ground speed to be certain there is no malfunction.
- Ensure all implement controls are operating properly.

7. Machine Operation
SMOKING IS PROHIBITED AT ALL TIMES.
- Acquaint yourself with the controls before operating the machine.
- Only the operator is permitted to ride on the machine.
- While backing up use extra care and sound the horn to clear the area.
- If a malfunction is observed, "DO NOT OPERATE" until the proper repairs have been made.
- Drive at speeds compatible with working conditions.
- Do not coast downhill. Select a gear that will prevent excessive speed when going downhill. Do not park on a steep incline.
- Know the stopping distance at any given working speed.
- Do not permit anyone to stand or pass under the bucket or lift arms.
- Follow the manufacturer’s load capacity limits. Identification plates are attached to all machines.
- If the machine is stuck, back it out or stop engine and get help.
- Do not make mechanical adjustments while the unit is in motion.
- Always follow the manufacturer’s recommendations for pulling or towing.
- Lower all the hydraulic equipment before shutting down or getting off the machine.
- During snow removal, be alert for any obstructions covered by snow.

8. Ether - Cold Start Precautions
- Diesel cold start systems contain ether which is explosive. Keep away from heat, sparks, and open flames. Work in a well-ventilated area.
- If swallowed, breathed or contacted on skin or eyes seek medical attention immediately. Follow recommendations on the MSDS sheets.
- Point the openings of the valve, tube or atomizer away from yourself and others while testing the diesel cold start system.
• Store replacement ether cylinders in a cool dry place away from direct sunlight. Do not keep them in the operator's compartment.

9. Refuelling
• Shut off and cool the engine and any electrical equipment before fuelling.
• Ensure the fuelling area is well ventilated.
• Do not smoke while refuelling. Keep open flames and sparks away from area.
• Ground the funnel or fuel nozzle against the filler neck to avoid sparks when refuelling.
• Do not use gasoline or diesel fuel for cleaning parts.
• Check the battery and electrolyte levels according to manufacturer's instructions.
• Know where the fire extinguishers are located.

10. Road Rules
• When turning, use hand or turn signals.
• Obey all traffic regulations. Know local traffic laws regarding lights, warning signs, load limits, and slow moving equipment on highways/roadways.
• If traffic is backing up behind you while driving, pull over and allow the vehicles to pass.

11. Shut Down/Parking
• Park on level ground.
• When parking on a grade, block the wheels and set the parking brakes.
• When parked, ensure all loaders, buckets and hydraulics are lowered to the ground.

Backhoes
• KNOW THE WORKING RANGE OF THE MACHINE.
• Be sure attachment or load doesn’t catch on obstructions when lifting or swinging.
• When lifting a load, do not lift, swing or stop unnecessarily fast.
• Be sure everyone is in the clear before swinging or moving in any direction. NEVER swing or position attachment or load over personnel or vehicle cabs.
• Never allow personnel to walk or work under any part of the machine or load while the machine is operating.
• Never allow anyone to ride the attachment or the load. This is an extremely dangerous practice.
• Do not load a truck unless the driver is in a safe place. Then, load the truck from the rear or side.
• Use a signal person. The signal person must be in direct communication with the operator, and the operator must pay close attention to the signals.
• Never exceed the lifting capacity of the machine. Stay within the lifting limits shown on the Load Rating Chart. Remember - you may be able to lift the load in close, at ground level, but as the load radius and elevation change, the lifting capacity of the excavator may decrease.

• Keep the machine well back from the edge of an excavation. Avoid undercutting the machine. If necessary, provide adequate shoring to prevent the machine from falling into the excavation.

• Level off the work area if possible.

• Avoid swinging or extending the bucket farther than necessary in a downhill direction. This will reduce the stability of the machine.

• When working with the bucket on the uphill side, the excavator may tip over if the slope is too steep.

• Avoid working with the tracks across the slope, as this reduces stability and increases the tendency for the machine to slide.

• Always be sure that slings or chains used to lift the load are of adequate strength and that they are in good condition.

• Watch your boom clearance at all times.

• Turn off the engine and allow the machine to cool before working on the machine. Most fluids on the excavator are hot enough to cause severe burns at normal operating temperatures.

Dozers

• Operate the controls only with the engine running.

• Do not allow riders on the machine unless additional seat, seat belt, and rollover protection are provided.

• The operator must satisfy himself that no one will be endangered before moving the machine.

• Report any needed repairs noted during operation.

• Carry implements close to the ground, approximately 40cm (15 in) above ground level.

• Stay a safe distance from the edge of cliffs, overhangs, and slide areas.

• If the machine begins to sideslip on a grade, immediately dispose of the load and turn the machine downhill.

• Be careful to avoid the condition which could lead to tipping when working on hills, banks, or slopes, and when crossing ditches, ridges, or other obstructions.

• Work up and down slopes, rather than sideways, whenever possible.

• Keep the machine under control and do not work it over its capacity.

• Be sure hitch points and the towing device are adequate.

• Connect trailing equipment to a drawbar or hitch only.

• Never straddle a cable, wire rope, or similar device nor allow others to do so.

• Personnel are prohibited to be between the machine and trailing equipment when manoeuvring to connect them. Block the tongue or hitch of trailing equipment to align it with the drawbar or hitch.
Loaders

- This is a one-person machine, NO RIDERS ALLOWED.
- Know the pinch points and wrap points on the loader.
- Operate at a speed consistent with working conditions, visibility, and terrain.
- Ensure loader has an adequate rear counterweight.
- When crossing exposed railroad tracks, ditches, ridges, or curbs reduce speed and cross at an angle.
- Carry loaded buckets as close to the ground as possible. The further a loaded bucket is from the ground the more unstable the loader becomes.
- Use extreme caution when operating a loader on a side slope. Slow down and carry the bucket, loaded or empty, as close to the ground as possible.
- Stay in gear when travelling downhill - this will help control speed.
- Never move a load above the heads of other workers.
- When back filling, use extreme caution. The weight of the material plus the weight of the machine could cause the new construction to collapse.
- Keep work area level; avoid developing ruts by occasionally back dragging the bucket to smooth the surface.

Road Grader

- Do not permit riders in or on the grader. Grader is a one-person piece of equipment.
- Do not dismount from the grader with the engine running - lower all attachments and stop engine first.
- Before backing up, use extra care to ensure persons and vehicles are clear of the grader.
- Know and use hand signals required for particular jobs and know who has the responsibility for signalling.
- Select a gear that will prevent excessive speed when going downhill. Do not coast downhill.
- Note and avoid all hazards and obstructions such as overhangs, ledges, slide areas, electrical lines, underground cables, water mains, or gas lines.
- Watch for bystanders and never allow anyone to be under or to reach into the grader and its attachments while operating.
- Check the local traffic laws for correct travelling requirements. If necessary, pull over and allow traffic to pass.
- When working near traffic areas or at night, use extra care. Use precautions, such as flares or reflectors, cones, red flags or red lights, barricades, flashing lights, and flagmen.
- Do not operate the grader in areas where volatile gases, dust, and combustibles may be present.
- Ensure the grader is properly equipped for grading in dry or forested areas.
- Avoid lubrication or mechanical adjustments with the grader in motion or the engine operating. Keep your head, body, limbs, feet, and hands away from all
moving parts.

- Use extreme care when working with hydraulic systems. Relieve the hydraulic system pressure before performing any service.
- Match speed of the vehicle to job conditions.
- Be careful when operating with the wheels at right angle to a slope.
- When hooking up trailing equipment, keep all personnel away.
- Know your stopping distance at any given speed.
- Use caution when crossing side hills, ridges, ditches, and other obstructions.
- Keep close to inside bank when working on a side hill road or cut. Extend the blade to material near outer edge.
- Use extreme care to avoid tipping when working on hills, banks, or slopes.
- Cross obstacles at an angle and at slow speed. Be alert for sudden movement of machine when going over centre of obstacle.
- Operate the vehicle only on level surface when cutting high banks.

**Scrapers**

- Do not try to climb on or off the machine when carrying tools or supplies. Use a hand line to pull equipment up onto the platform.
- Check for proper operation of all controls and protective devices while moving slowly in an open area.
- Operate the machine only while seated.
- Operate the controls only with the engine running.
- Do not allow riders on the machine unless additional seat, seat belt, and rollover protection are provided.
- Carry bowl close to the ground, approximately 40cm (15 in) above ground level.
- Stay a safe distance from the edge of cliffs, overhangs, and slide areas.
- If the machine begins to sideslip on a grade, lower the bowl and bring the machine to a safe stop.
- Be careful to avoid the condition which could lead to tipping when working on hills, banks, or slopes, and when crossing ditches, ridges, or other obstructions.
- Work up and down slopes, rather than sideways, whenever possible.
- Keep the machine under control and do not work it over its capacity.
- Personnel are prohibited from being between the machine and trailing equipment when manoeuvring to connect them. Block the tongue or hitch of trailing equipment to align it with the drawbar or hitch.
- Park on a level surface. If necessary to park on a grade, block the machine. Lower bowl to the ground and apply slight down pressure. Stop the engine.

**Trucks**

- Truck drivers will be properly and thoroughly trained before attempting to do any work with or on any type of truck.
- Our motor vehicle policy, as well as Territorial and Federal regulations prohibit the operation of commercial motor vehicles by individuals who do not have the proper training and license. Do not attempt to operate any dump truck unless you have the proper license and training.
• Thoroughly inspect the truck for any defects that may inhibit safe operation of the vehicle. Regulations require that the operator fill an inspection form each day before placing the truck into operation. This form is an excellent tool to help the operator remember to check all necessary items.
• Always use the steps and grab irons and face the vehicle when getting in or out of the truck.
• Place the gearshift into neutral and set the parking brake before starting the engine.
• Allow the engine to reach operating temperature and the air pressure to build to operating pressure before placing the truck into motion.
• Carefully check the area around the truck before placing it into motion. Objects or people that are very close to the truck may not be visible from the driver's seat.
• Always make sure that your seatbelt is properly fastened before driving the truck.
• Allow adequate stopping distance between the truck and the vehicles in front of it.
• Check the area around the truck for obstructions (tree limbs, overhead wires, etc.) before raising the dump box. Make sure that the spreader chains aren’t set if you intend to dump in a pile.
• Always try to be on a level surface when you raise the dump box. As the box raises the truck’s centre of gravity goes up and the truck becomes less stable and more apt to tip over. If you must dump on a slope place the truck so that it faces straight up, or down the slope. Do not try to raise the box with the truck parked parallel with the slope. Remember that a dump truck is much more apt to tip over (or run into overhead obstructions) when spreading material then it is when dumping in a pile.
• NEVER work under a raised box (not even “for just a little bit”) unless the box is adequately supported by a prop rod or cribbing. Do not rely on the truck’s hydraulic system to hold the box up while you work under it.

Skid Steer Loader

• The skid steer loader is used for a variety of tasks from material handling to snow removal.

• The loader is permitted to work along all paved roads, parking areas and open spaces without requiring a permit. A courtesy notification to the Site Supervisor is recommended.

• If it is necessary to come closer than 3 metres to any process equipment, piping, or structure while working with the loader the following must occur:
  (ii) A Safe Work permit must be completed for the task
  (iii) A spotter shall be designated to maintain contact with the operator while working in proximity to such equipment
  (iv) Prior to entering any building a gas test must be performed.
(v) Using the loader to remove snow from the paved walkways or from within 3 meters of process equipment, piping or structures is not permitted.
NORTHERN CROSS (YUKON) LTD.
INCIDENT/ACCIDENT INVESTIGATION REPORT

LOCATION/FACILITY

<table>
<thead>
<tr>
<th>OCCURRENCE</th>
<th>MONTH/DAY/YEAR</th>
<th>TIME (24 HOUR CLOCK)</th>
<th>REPORTED (MONTH/DAY/YEAR)</th>
<th>WHERE DID IT OCCUR</th>
</tr>
</thead>
</table>

**TYPE OF INCIDENT/ACCIDENT**

- [ ] PERSONAL INJURY
- [ ] INHALATION EXPOSURE
- [ ] CHEMICAL EXPOSURE
- [ ] OCCUPATIONAL ILLNESS
- [ ] EXPLOSION/FIRE
- [ ] EQUIPMENT FAILURE
- [ ] EQUIPMENT DAMAGE
- [ ] PROPERTY DAMAGE
- [ ] MATERIAL LOSS
- [ ] SPILL/RELEASE
- [ ] ENVIRONMENT
- [ ] OPERATION UPSET
- [ ] SECURITY/Theft
- [ ]-contamination
- [ ] PRODUCT MIX
- [ ] TDG VIOLATION
- [ ] NEAR MISS
- [ ] OTHER

**ATTACH SUPPLEMENTARY REPORTS AS APPLICABLE SUPPLEMENTAL REPORT NO.**

**VEHICLE NO.**

**CRASH/LANDSCAPE**

**EMPLOYEE**

- [ ] EMPLOYEE
- [ ] CONTRACTOR
- [ ] OTHER

**EMPLOYER:**

**EMPLOYEE SURNAME:**

**FIRST NAME(S):**

**EMPLOYEE NO.:**

**AGE:**

**FIRST AID**

- [ ] MEDICAL TREATMENT
- [ ] LOST TIME
- [ ] RESTRICTED WORK

**ORIGINATORS SIGNATURE:**

**DATE:**

**CAUSES OF INCIDENT:**

**PREVENTIVE ACTION:**

- [ ] PREVENTABLE
- [ ] NON-PREVENTABLE

**FREQUENCY POTENTIAL:**

- [ ] FREQUENT
- [ ] OCCASIONAL
- [ ] RARE

**SEVERITY POTENTIAL:**

- [ ] MAJOR
- [ ] SERIOUS
- [ ] MINOR

**INVESTIGATING SUPERVISOR:**

- [ ] INITIAL
- [ ] INTERIM
- [ ] FINAL

**SIGNATURE:**

**DATE:**

**IS FURTHER INVESTIGATION REQUIRED?**

- [ ] YES
- [ ] NO

**WILL A FOLLOW UP INVESTIGATION FOLLOW?**

- [ ] YES
- [ ] NO

**CORRECTIVE FOLLOW-UP ACTION REQUIRED**

**ACTION BY**

**TARGET DATE**

**DATE COMPLETED**

**INITIALS**

**MANAGEMENT APPROVAL OF ACTION TAKEN:**
# JOB SAFETY ANALYSIS WORKSHEET

<table>
<thead>
<tr>
<th>Job Task:</th>
<th>Manager:</th>
<th>Created/Revised by:</th>
<th>Page:</th>
<th>Date Completed/Revised:</th>
<th>Approved by:</th>
<th>Position:</th>
<th>_____ of _______</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>

## Job Steps:

<table>
<thead>
<tr>
<th>Potential Incidents or Hazards:</th>
<th>Hazard Classification</th>
<th>Hazard Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Identify HAZARDS: Is there a possibility of striking against, being struck by, or making harmful contact with an object; of being caught in, by or between objects; of slipping, tripping or falling; of developing a strain from pushing, pulling, lifting, bending or twisting; of coming in contact with electricity or other power source; of receiving a thermal or chemical burn; of being exposed to a hazardous environment?

2. Hazard Classification:  
   - A  High Risk  
   - B  Medium Risk  
   - C  Low Risk

---

2012 Northern Cross (Yukon) Ltd. Appendices
<table>
<thead>
<tr>
<th>Load Up</th>
<th>Load Down</th>
<th>Load Up Slowly</th>
<th>Load Down Slowly</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Load Up" /></td>
<td><img src="image2.png" alt="Load Down" /></td>
<td><img src="image3.png" alt="Load Up Slowly" /></td>
<td><img src="image4.png" alt="Load Down Slowly" /></td>
</tr>
<tr>
<td>Boom Up</td>
<td>Boom Down</td>
<td>Boom Up Slowly</td>
<td>Boom Down Slowly</td>
</tr>
<tr>
<td><img src="image5.png" alt="Boom Up" /></td>
<td><img src="image6.png" alt="Boom Down" /></td>
<td><img src="image7.png" alt="Boom Up Slowly" /></td>
<td><img src="image8.png" alt="Boom Down Slowly" /></td>
</tr>
<tr>
<td>Boom Up Load Down</td>
<td>Boom Down Load Up</td>
<td>Everything Slowly</td>
<td>Use Whip Line</td>
</tr>
<tr>
<td><img src="image9.png" alt="Boom Up Load Down" /></td>
<td><img src="image10.png" alt="Boom Down Load Up" /></td>
<td><img src="image11.png" alt="Everything Slowly" /></td>
<td><img src="image12.png" alt="Use Whip Line" /></td>
</tr>
</tbody>
</table>
**Safe Work Permit**

**Type of Work:**
- ☐ Cold Work
- ☐ Hot Work
- ☐ Confined Space Entry
- ☐ Radiography
- ☐ Vehicle Entry
- ☐ Electrical
- ☐ Trenching/Excavating
- ☐ Explosive materials
- ☐ Fire Suppression system
- ☐ Facility Construction
- ☐ Turnaround
- ☐ Environmental
- ☐ Drilling Operations
- ☐ Well Service
- ☐ Work Clearance

**Date Issued:**
- Issued To: 
- Time Issued: 
- Valid From: 
- Valid To: 
- Permit Extended to: 
- Approved By: 

**Location(s) of Work:**

**Work To Be Done:** (No work other than that shown will be done)

**THESE ITEMS MUST BE REVIEWED BY ALL PERSONNEL RESPONSIBLE FOR THIS PERMIT AND ANY SPECIAL PRECAUTIONS MUST BE COMPLETED IN WRITING UNDER THE SPECIAL PRECAUTIONS/COMMENTS SECTION BEFORE THIS PERMIT CAN BE ISSUED**

**PRECAUTIONS/REQUIREMENTS/LIMITATIONS**

<table>
<thead>
<tr>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underground Piping/Electrical Lines</td>
<td>Identified and Localized</td>
<td>Excavations Properly Sloped or Shored</td>
<td>Necessary Connections/Equipment</td>
<td>Air</td>
<td>Water Wash</td>
</tr>
<tr>
<td>Forced Ventilation</td>
<td>Isolated:</td>
<td>Double Block &amp; Bleed</td>
<td>Nitrogen</td>
<td>Steam</td>
<td>Other:</td>
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<tr>
<td>Steam</td>
<td>Blanked</td>
<td>Closed &amp; Locked Valve</td>
<td>Steam</td>
<td>Cathodic Protection</td>
<td>Personal Protective Equipment:</td>
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<tr>
<td>Pneumatic</td>
<td>Equipment Depressurized, Drained, Steamed or Ventilated</td>
<td>Chemical/Glove</td>
<td>Air</td>
<td>Low Voltage Equipment</td>
<td>Respirator:</td>
</tr>
<tr>
<td>Heat</td>
<td>Radiation Monitoring</td>
<td>Goggles</td>
<td>Electric</td>
<td>Other:</td>
<td></td>
</tr>
<tr>
<td>Other:</td>
<td>Radiation Film Badges</td>
<td>Fire Retardant Wear</td>
<td>Confined Space Entry</td>
<td>Hot Work</td>
<td>Explosion Proof Equipment</td>
</tr>
<tr>
<td>Vehicle/Crane Manoeuvre</td>
<td>Other:</td>
<td>Fire Blanket</td>
<td>Pits, Excavations/Floor Openings Covered</td>
<td>Safe Haven/Egress From Worksite</td>
<td>Identified</td>
</tr>
<tr>
<td>Radio Silence Requested</td>
<td>Combustible Material Removed/Protected</td>
<td>Pneumatic</td>
<td>Precautions Necessary for Radiography</td>
<td>MSDS Required</td>
<td>Gas Test Results</td>
</tr>
</tbody>
</table>
| Have the Necessary Gas Tests Been Performed | Radiation Monitoring | Radius Test Time | Time: 

**Gas Test Results**

<table>
<thead>
<tr>
<th>Test Time</th>
<th>H2S (ppm)</th>
<th>SO2</th>
<th>O2</th>
<th>Flammable (%LEL)</th>
<th>Other</th>
<th>Tester’s Signature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CODE OF PRACTICE: (A Copy Must Be Provided to Worker(s) Involved)**

|☐|☐|☐|☐|☐|
|☐|☐|☐|☐|☐|
|☐|☐|☐|☐|☐|
|☐|☐|☐|☐|☐|

- ☐ Climbing
- ☐ Chemicals
- ☐ Heat or Hot Piping
- ☐ Explosive Materials
- ☐ H2S/SO2
- ☐ Combustible Materials
- ☐ Flammable Materials
- ☐ Corrosive Materials
- ☐ High Voltage
- ☐ High Pressure
- ☐ Overhead Obstructions
- ☐ Oxygen Deficiency
- ☐ Energized Equipment
- ☐ Open Pits/Excavation
- ☐ Toxic Vapours
- ☐ High Noise Levels
- ☐ Adverse Weather
- ☐ Poor Visibility
- ☐ Slipping
- ☐ Heavy Vehicle Traffic
- ☐ Heavy Loads
- ☐ Difficult Terrain
- ☐ Moving Machinery
- ☐ Auto-Start Machinery

**PRE-JOB SAFETY MEETING/ORIENTATION**

Conducted By: 
- Time: 
- Personnel Present:

**Special Precautions/Comments:**

Agreement: I have reviewed both the job and the permit. I understand the nature and extent of the work and agree to abide by all the conditions and precautions as stated above to complete the work safely.

**Permit Issuer:** Print 
- Permit Receiver: Print 
- Signature 

**Please Return and Sign-Off Permit when Job/Shift is Completed**

- Time: 
- Job Status: ☐ Complete 
- Receiver’s Signature:

Signature:
CONDITIONS OF ENGAGEMENT BY NORTHERN CROSS (YUKON) LTD.

- Contracted companies must have a safety program which follows (as minimum) the UPITFOS Basic Safety Program outline, or agree to follow the health and safety programs outlined in the Northern Cross Safety Manual.
- All personnel will arrive on location with required personal protective equipment to conform to applicable regulations and to safely complete the task at hand.
- All personnel will wear fire retardant clothing where required by government regulations or when instructed by the Northern Cross supervisor responsible for the job to be done.
- All personnel will have required certified training. Those practicing a licensed trade must have a valid ticket.
- All vehicles will be equipped and operated in accordance with government regulations and prudent safety practices.
- Illegal drugs or alcohol are prohibited on any Northern Cross location and must be reported immediately to the Northern Cross supervisor responsible for the job.

THIS PERMIT IS VALID ONLY AS LONG AS WORK CONDITIONS EXISTING AT THE SAME TIME OF ITS ISSUANCE CONTINUE AND EXPIRES UPON OCCURRENCE OF ANY HAZARDS SUCH AS GAS LEAK, LIQUID SPILL, DRASTIC OPERATING CHANGE IN ADJACENT EQUIPMENT OR CHANGE IN WIND DIRECTION BLOWING VAPOURS INTO THE WORK AREA. ANY WORKER, CONTRACTOR OR SUPERVISOR WILL HAVE THE RIGHT TO STOP THE JOB IF HE HAS REASONABLE GROUNDS TO BELIEVE THAT THE JOB IS, OR LIKELY WILL BECOME, UNSAFE OR UNLAWFUL. WORK SHALL NOT RESUME UNTIL A NEW PERMIT IS ISSUED.

- Contracted companies or personnel agree to abide by all Provincial, Federal and Local Laws and Regulations governing the work contemplated by this permit and warrants that their employees and sub-contractors will similarly comply.
- A pre-job safety meeting must be conducted by the job foreman with his crew prior to the start of work.

Definitions

Confined Space - An enclosed, or partially enclosed, space having restricted access and egress which, due to its design, construction, location, atmosphere, the materials or substances in it or other conditions is, or may become, hazardous to a worker entering it, or does not have an easy means of escape for, or rescue of, a worker entering it.

Hot Work - Means cutting, welding, burning, air gouging, riveting, drilling, grinding, chipping, using non-classified electrical equipment, the introduction to a work process area of a combustion engine or any other work where flame is used or sparks are produced. Hot work is not to be performed in a location where: (1) a flammable substance is, or may be, in the atmosphere or stored, handled, processed or used, or (2) on or in an installation or item of equipment that contains, or may contain, a flammable substance or its residue, or (3) in a vessel that contains residue that may release flammable vapours or gases when exposed to heat UNLESS tests have been made that indicate the work may be safely performed and procedures have been implemented to ensure continued safe performance of the hot work.

Tests - Means tests to determine whether the atmosphere contains a flammable substance in a quantity sufficient to ignite, TOXICITY above the O.E.L. of a given chemical or OXYGEN CONTENT above or below the considered safe limit. No testing shall be conducted inside a confined space unless a non-flammable atmosphere is established from outside that space, and providing the person doing the testing is equipped with adequate personal protective equipment and is competent to conduct the tests. Periodic testing while the worker is in a confined space is to be carried out to ensure that hazards do not develop.

Flammable Atmosphere - For cold work or for confined entry without breathing apparatus, must not exceed 10% L.E.L. For hot work, must not exceed 0% L.E.L.

Toxic Atmosphere - Means above the Occupational Exposure Limit (O.E.L.) of a given substance. No person shall enter into an area where a toxic atmosphere exists without utilizing the proper personal protective equipment (i.e. approved respiratory equipment, protective clothing, eyewear, headgear, footwear, etc.) and appropriate rescue equipment and procedures. (Toxic atmosphere for H₂S is above O.E.L. – 10 ppm).

Oxygen Deficient Atmosphere - Means any atmosphere that contains less than 18 percent by volume in air (18 kilopascals partial pressure equivalent). Approved breathing apparatus must be worn by persons entering into any area that contains less than 18 percent by volume in air. (Normal oxygen contains 20.9 percent by volume in air).

Oxygen Excessive Atmosphere - Means any atmosphere that contains more than 23 percent by volume in air (23 kilopascals partial pressure equivalent). No person shall enter into or perform hot work in any oxygen excessive atmosphere.

Locked Out - Means a condition that prevents movement of a control device to the “operating” or “on” position by means of a lockout device.

Lockout Device - Means a mechanism or arrangement that will hold and maintain a control device in an “inoperative” or “off” position.

Communication and Alert - Where the atmosphere contains a harmful substance or a deficiency of oxygen, a worker must be attended by, and in communication with, another worker stationed at or near the entrance. Medical support must be contacted at the time of an alarm.

NOTE: If any of the above gas levels are subject to change during the operation due to the agitation of sludge, temperature change, welding or cutting, use of solvents, purging with inert gasses or deviation from procedures previously set, monitoring for the above contaminant may be required on a continuous basis. Further, any procedures previously set may have to be changed accordingly. Given this situation, a new permit may be required.
MONTHLY HEALTH & SAFETY REPORT

Area: ___________________________ Date: ______________________

Completed by: ____________________________________________

Activities

INCIDENTS/ACCIDENTS & NEAR MISSES – include minor injury
(brief description of and corrective actions/required follow-up – no names)


(brief on topics discussed, corrective actions & required follow-up)


H A Z A R D S – both reported formally and informally
(brief description of and corrective actions/required follow-up)


S A F E T Y T R A I N I N G C O M P L E T E D – include indoctrinations
(who and course taken)


S A F E T Y I N S P E C T I O N S – include facility, emergency equipment and vehicle
(how many, locations, etc.)


O T H E R
(anything that requires management attention)


Attach any pertinent documentation
# Emergency Equipment Checklist

**Facility:**

**Date:**

**Checked by:**

## Fire Extinguishers
- Ensure extinguisher is in place, that it is operable – annual certified inspection tag in place, pin seal, cartridge is not punctured/or pressure is within the green area of gauge, powder is loose and hose is unplugged, hydrotest date within 12 years.

<table>
<thead>
<tr>
<th>Type/Size</th>
<th>Location</th>
<th>Serial #</th>
<th>In Place</th>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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## Breathing Apparatus
- Ensure BA is in place and operable – bottle pressure above 1500 psig, hydrotest date on bottle is within 3 yrs. For fibreglass and 5 yrs. For steel, mask is clean and wrapped in a clean plastic bag, check remote gauge and alarm bell, ensure bypass valves are closed and pack is on positive pressure mode.

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<th>Type/Size</th>
<th>Location</th>
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## First Aid Kit
- Ensure kit is in place, that it is properly stocked and clean.

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## Eye Wash Bottles
- Ensure bottles are in place, that all parts are in place, that they are filled with clean saline solution and dated for next solution change.

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<th>Type/Size</th>
<th>Location</th>
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<th>Condition</th>
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</table>

## Fire Blankets/Burn Kits
- Ensure they are in place and clean.

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## Other

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</tbody>
</table>
HAZARD REPORT FORM

☐ Unsafe Condition  ☐ Unsafe Act  ☐ Near Miss

Location:  

Reported By (Optional):  

Description:  

Action(s) Taken:  

Further Action Required:  

Follow-up By:  

Completion Date:  

Management Review:  

Lead Operator/Field Foreman

Production Superintendent
NORTHERN CROSS (YUKON) LTD.  
BREATHING APPARATUS FIT TEST RECORD

A. EQUIPMENT INFORMATION

1. Make: __________________________
2. Model: __________________________
3. Size: __________________________

B. TEST INFORMATION (Check Method)

Qualitative using Isoamyl Acetate Vapour (Banana Oil): User dons equipment in normal manner. Person testing breaks an Isoamyl Acetate ampoule and passes it close to the respirator sealing surface, taking care to avoid touching the skin.

Other: Explain type and method (must be pre-approved by Superintendent)

C. RESULTS

Wearer could not smell Isoamyl Acetate. Fit check is OK. User may resume regular duties with this piece of equipment.

Wearer could smell Isoamyl Acetate. Explain what caused the failure of the seal and what action is required to obtain a seal. An effective seal must be obtained prior to resuming regular duties.

Comments __________________________
_______________________________
_______________________________
_______________________________
_______________________________

D. Person Tested: ________________ Signature: ________________

Test Given By: ________________ Signature: ________________
## CONFINED SPACE ENTRY CHECKLIST

**OPERATING AREA:**

**LSD:**

**WORK TO BE PERFORMED:**

**CHECKS COMPLETED BY:**

**DATE**

- **ALTHOUGH AN ATTEMPT HAS BEEN MADE TO LIST THE FOLLOWING IN SEQUENTIAL ORDER, ENTRY PREPARATION AND PLANNING MAY REQUIRE ADDITIONAL PLANNING AND CONSIDERATIONS.**
- **THIS CHECKLIST IS TO BE USED IN CONJUNCTION WITH VIRTUS ENERGY’S SAFETY PROCEDURE 5.4.**
- **THIS CHECKLIST SHOULD BE COMPLETED AT THE FIRST ENTRY INTO A CONFINED SPACE AND BE ATTACHED TO THE SAFE WORK PERMIT.**

<table>
<thead>
<tr>
<th>Task</th>
<th>Completed</th>
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<tbody>
<tr>
<td>Clean, purge, empty, decontaminate from outside space</td>
<td></td>
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<tr>
<td>Positively isolate at closest point to confined space – Blind, double block &amp; bleed, lock and tag all valves, etc.</td>
<td></td>
</tr>
<tr>
<td>Lockout and tag all equipment that may affect safety of workers – Mixers, valves, any normally energized equipment</td>
<td></td>
</tr>
<tr>
<td>Ensure adequate ventilation through confined space</td>
<td></td>
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<tr>
<td>Check qualifications of standby personnel &amp; persons entering confined space</td>
<td></td>
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<tr>
<td>Ensure appropriate emergency response equipment is available</td>
<td></td>
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<tr>
<td><strong>Initial inspection and testing</strong></td>
<td></td>
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<tr>
<td>- For gas:</td>
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<tr>
<td>- Oxygen (19.5 – 23% by vol.)</td>
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<tr>
<td>- Flammable gas (10% LEL max.)</td>
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<tr>
<td>- H₂S (10 ppm max.)</td>
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<tr>
<td>- Toxic gases (MSDS)</td>
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<tr>
<td>- Temperature (30°C max.)</td>
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<tr>
<td>- Clean, liquid and hazard free as much as possible</td>
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<tr>
<td>- Pyrophoric materials</td>
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<tr>
<td>- Continuous gas monitoring required</td>
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<td>- Scaffolding required</td>
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<tr>
<td>Ensure appropriate personal protective equipment is worn for conditions</td>
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<tr>
<td>Ensure proper respiratory protective equipment is work if the above parameters are not met</td>
<td></td>
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<tr>
<td>Ensure only approved equipment is used in confined space – Low voltage, explosion proof, GFI protected</td>
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<tr>
<td>Ensure a safe work permit is issued</td>
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<tr>
<td>Other considerations:</td>
<td></td>
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</table>
CONTRACTORS EVALUATION SHEET

- Does your Company have a current WCB account in good standing for the Province(s) in which you will be completing this work for Virtus Energy? Please provide proof of this account (check with WCB to ensure that the account is current).

- Please provide your Company’s accident statistics for the past three years, including:
  
  Years: 201__ 201__ 201__
  
  Hours Worked:
  
  Medical Aid Accidents
  (Include any injury where medical attention was provided):
  
  Total # of Lost Days
  
  Compensation Costs
  
  Other Significant Losses
  (Provide details below)
  
  Details

3. Do you have a written Safety Program and safe work procedures?

4. Do you have a new employee orientation program?

5. Do you perform worksite inspections?

6. Do you hold formal safety meetings where minutes are maintained? How often?

7. Please provide proof of employees’ safety training/certification (i.e. copy of certificate).

Other Comments:
NEW EMPLOYEE INDOCTRINATION CHECKLIST

Employee/Contractor Name: ____________________________________________________________
Facility/Location: ___________________________ Date: ______________________________

WORKER RESPONSIBILITY:
- Company specific
- Legislative

EMERGENCIES
- General responsibilities and precautions
- Site-specific procedures – responsibilities, who does what, evacuation, rescue emergency contacts and numbers, ESD and alarms, muster point location, etc.
- Use and Care of Equipment – breathing apparatus, eyewash, first aid supplies, rescue equipment, fire extinguishers, etc.

SAFETY RULES
- Smoking, alcohol & drugs, conduct & appearance, housekeeping, firearms, security, etc.
- Facility-specific

PERSONAL PROTECTIVE EQUIPMENT
- General requirements, when and where
- Equipment types and who supplies
- Issue of company supplied
- Facility-specific

GENERAL WORK PROCEDURES
- Equipment lockout, ladders, electrical, lifting, compressed gas, gas detection
- Safe Work Permits, application & responsibility
- Facility-specific

INCIDENT/ACCIDENT REPORTING

SAFETY/ENVIRONMENT PROGRAM

JOB ASSIGNMENT AND SPECIFIC HAZARDS
- Job duties and expectations
- Specific hazards of equipment & process
- Chemical/gas hazards
- Temperature extremes, electrical & confined space hazards
- Identify WHMIS and MSDS specific to facility

I, __________________________, hereby acknowledge that I have been provided with a Northern Cross (Yukon) safety indoctrination and a facility tour. I understand that I must abide by the instructions, rules, procedures and practices as outlined or ask if I do not understand something before proceeding with a task.

Indoctrinator Signature: __________________________________________________________
New Employee/Contractor Signature: _____________________________________________
SAFETY MEETING AGENDA

AREA: ____________________________________________________________

MEETING DATE: __________________________________________________

MEETING TIME: ___________________________________________________

LOCATION: _______________________________________________________

OLD BUSINESS/CONCERNS – Review of last minutes

1. _______________________________________________________________
2. _______________________________________________________________
3. _______________________________________________________________
4. _______________________________________________________________
5. _______________________________________________________________

NEW BUSINESS/CONCERNS

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

INCIDENTS/ACCIDENTS/HAZARD REVIEW

_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

TOPICS FOR DISCUSSION

Should be listed out with brief description of topic, times for each and name of presenter
SAFETY MEETING MINUTES

AREA: ___________________________ MEETING DATE: _______________________

LOCATION: ________________________ TIME: ____________________________

MEETING COORDINATOR: ____________________________

MINUTES BY: ____________________________

ATTENDEES: ____________________________

<table>
<thead>
<tr>
<th>ITEM #</th>
<th>TOPIC/CONCERN AND CORRECTIVE ACTION</th>
<th>FOLLOW-UP BY</th>
<th>DATE BY</th>
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</table>
SAFETY BULLETIN

CRITICAL INCIDENT/ACCIDENT REVIEW

LOCATION: __________________________________________________________

DATE/TIME OF OCCURRENCE: __________________________________________

AMBIENT CONDITIONS: ________________________________________________

DESCRIPTION OF LOSS: ________________________________________________
  ▪ Brief
  ▪ To the point
  ▪ Without names

CAUSE ANALYSIS: ______________________________________________________
  DIRECT
  INDIRECT

LESSONS LEARNED
  ________________________________________________
  ________________________________________________
  ________________________________________________

PREVENTIVE ACTION: ____________________________________________________
  ________________________________________________
  ________________________________________________
Spill Incident Report

REPORT DETAILS

Author: ___________________ Entry Date: ___________________

Business Unit: ___________________ Company: ___________________

Supervisor: ___________________

Date of Incident: ___________________ Time of Incident: ___________________

Location: ___________________ Legal Description: ___________________

Detailed Description of Incident (enter spill details here):

Witnesses: ___________________

Severity: ___________________ Recurrence: ___________________

SPILL DETAILS

Spill Source: ___________________ Source Status: ___________________

Facility Type: ___________________ Equipment Type: ___________________

Substances Spilled:

<table>
<thead>
<tr>
<th>Substances</th>
<th>Oil m³</th>
<th>H₂O m³</th>
<th>C5+ m³</th>
<th>Total liquid (m³)</th>
<th>Gas E m³</th>
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<tr>
<td>Spilled</td>
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<tr>
<td>Recovered</td>
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Solids Recovered (m³): ___________________

Surface Features Affected: ___________________

Affected Area on Lease: ___________________ Affected Area Off Lease: ___________________

Area Affected (m²): ___________________

Land Owner: ___________________ Phone No.: ___________________

Crown Land: ___________________

Occupant: ___________________ Phone No.: ___________________

Company Contacted: ___________________ Regulatory Agency Contacted: ___________________

Comments: ___________________

SPILL CLEANUP DETAILS

Start Date: ___________________ Initial Inspection: ___________________

Subsequent Inspections: ___________________ Final Inspection: ___________________

Cleanup Procedure: ___________________

Summary of Cleanup: ___________________

Summary of Repairs Conducted: ___________________

Contaminants Moved to: ___________________ Contaminants Used for: ___________________

Type of Soil Added: ___________________ Amount Added (m³): ___________________
## CAUSE ANALYSIS

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
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<tr>
<td>Unsafe Practice</td>
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<tr>
<td>Unsafe Condition</td>
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<tr>
<td>Contributing Factor</td>
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<tr>
<td>Initial Corrective Action</td>
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<tr>
<td>Recommendations</td>
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<tr>
<td>Final Corrective Action</td>
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<tr>
<td>Person responsible for implementing final action</td>
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<tr>
<td>Target date for completion</td>
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</table>
NEW EMPLOYEE INDOCTRINATION CHECKLIST

Employee/Contractor Name: __________________________________________________________

Facility/Location: ____________________________ Date: _____________________________

WORKER RESPONSIBILITY
 Company specific
 Legislative

EMERGENCIES
 General Responsibilities and Precautions
 Site Specific Procedures – responsibilities, who does what, evacuation, rescue, emergency contacts and numbers, ESD and alarms, Muster Point location, etc.
 Use and Care of Equipment – breathing apparatus, eyewash, first aid supplies, rescue equipment, fire extinguishers, etc.

SAFETY RULES
 Smoking, alcohol & drugs, conduct & appearance, housekeeping, firearms, security, etc.
 Facility specific

PERSONAL PROTECTIVE EQUIPMENT
 General requirements, when and where
 Equipment types and who supplies
 Issue of company supplied
 Facility specific

GENERAL WORK PROCEDURES
 Equipment lockout, ladders, electrical, lifting, compressed gas, gas detection
 Safe work permits, application & responsibility
 Facility specific

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SAFETY/ENVIRONMENT PROGRAM

JOB ASSIGNMENT & SPECIFIC HAZARDS
 Job duties and expectations
 Specific hazards of equipment & process
 Chemical/gas hazards
 Temperature extreme, electrical & confined space hazards
 Identify WHMIS and MSDS specific to facility

I, _________________________________ hereby acknowledge that I have been provided with a Northern Cross (Yukon) safety indoctrination and a facility tour. I understand that I must abide by the instructions, rules, procedures and practices as outlined, or ask if I do not understand something before proceeding with a task.

Indoctrinator’s Signatures: _________________________________

New Employee’s/Contractor’s Signature: _________________________________
Northern Cross (Yukon) Ltd.
850, 700 – 4 Ave SW
Calgary, Alberta
T2P 3J4

MATERIAL TRANSFER

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<thead>
<tr>
<th>NUMBER</th>
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<td>Day</td>
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**Condition Legend**

- **A** New Material (100% Value)
- **B** Good Used Material (75% Value)
- **C** Used (50% Value)
- **D** Used (Less than 50%, please specify)
- **E** Salvage

**ACCOUNTING CODING (For Accounting Use Only)**

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<tr>
<th>Account</th>
<th>Project #</th>
<th>Description</th>
<th>Debit</th>
<th>Credit</th>
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**SHIP VIA**

- **FIELD APPROVAL**
  - 8
- **OFFICE APPROVAL**
  - 8