

835001

see SEL13/98 P14 TCR 01-4562
letter 18/5/01



GREAT SOUTH LAND MINERALS LIMITED

STRATIGRAPHIC SLIMHOLE DRILLING PROGRAM

MICROFILMED
FICHE No. 015572-

HUNTERSTON #1

WELL PLAN

01_4562

Well Plan for Hunterston #1 - Stratigraphic Slimhole
Drilling Program - SEL 13/1998
Great South Land Minerals Proprietary Limited*
Anon SEL13/1998

MINERAL RESOURCES		
FILE REF: SEL13/98		
21 MAY 2001		
DOC. REF:		
OFFICER	FOR ACTION	FOR INFO
See folio 59		
RESUBMIT TO	DATE	

May 2001

HUNTERSTON #1 WELL PLAN

CONTENTS

	Page
1. INTRODUCTION	
1.1 Well Data Summary	3
1.2 Location Map	4
2. GEOLOGY	
2.1 Well Prognosis	5
2.2 Geological Map	6
2.3 Geological Cross Sections	7
3. ENVIRONMENTAL MANAGEMENT	
3.1 Landholders	8
3.2 Site Access	8
3.3 Wellsite Preparation	8
3.4 Wellsite Operations	9
3.5 Clean-up and Rehabilitation	9
4. DRILLING PROGRAM	
4.1 Outline Summary	10
4.2 Setting and Cementing Casing	10
4.3 Drilling Fluids Program	11
4.4 Well Diagram and Volumes	12
5. FORMATION EVALUATION	
5.1 Core Recovery, Logging and Analysis	13
5.2 Mudlogging Services	13
5.3 Wireline Logging and Drill Stem Testing	13
6. TESTING AND SAFETY PROCEDURES	
6.1 BOP Testing Procedures	14
6.2 Pressure Integrity Test	14
7. COMMUNICATIONS AND REPORTING	15
8. PLANT AND EQUIPMENT DETAILS	
8.1 Mindrill F66 Drill Rig	16
8.2 BOP Equipment	16
8.3 Site Layout	17

Appendix 1: Standard Manual for Blowout Prevention
and Well Control.

HUNTERSTON #1 WELL PLAN**1. INTRODUCTION**

Hunterston #1 is located near Porters Pinnacle on a domal structure in central Tasmania about 20 km north of Bothwell and 2 km east of the Lake Highway, opposite the homestead on the property named 'Hunterston'.

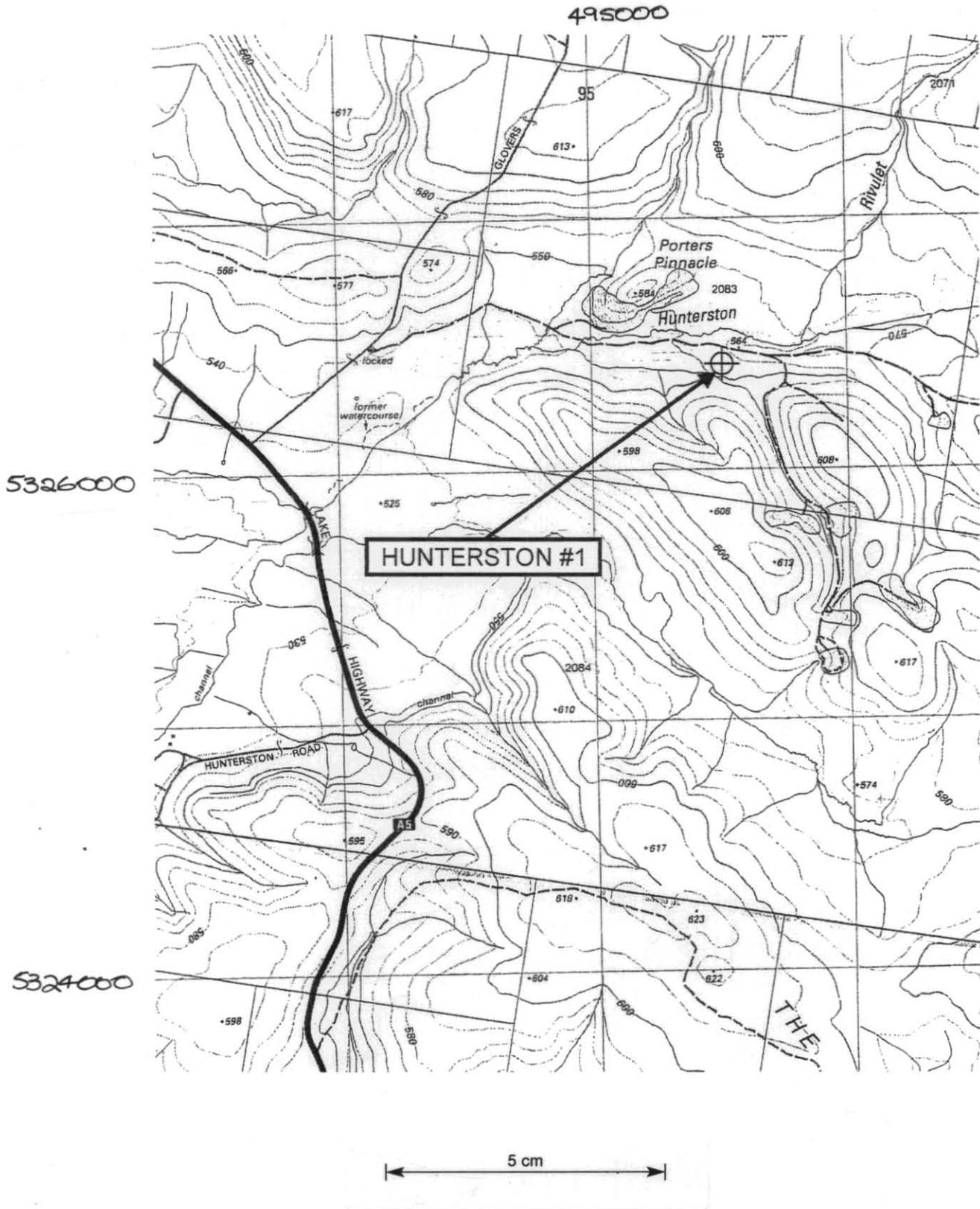
Further details can be found under *Geology Section 2.1 Well Prognosis*.

1.1 Well Data Summary

State:	Tasmania
Location:	Hunterston
Municipality:	Central Highlands
Licence No:	SEL 13/98
Well Name:	Hunterston #1
Coordinates:	495,500 E 5,326,400 N
Elevation:	550m ASL
Datum:	Footclamps
Drill Rig:	Mindrill F66
Spud Date:	Precollar spudded August 1997; coring planned June 2001
Planned Depth:	900 -1200 m (see prognosis)

HUNTERSTON #1 WELL PLAN

1.2 Location Map - Tasmap 1:25,000 Hermitage Sheet 4832 Edition 1, 1993



HUNTERSTON #1 WELL PLAN

2.3 Geological Cross Sections

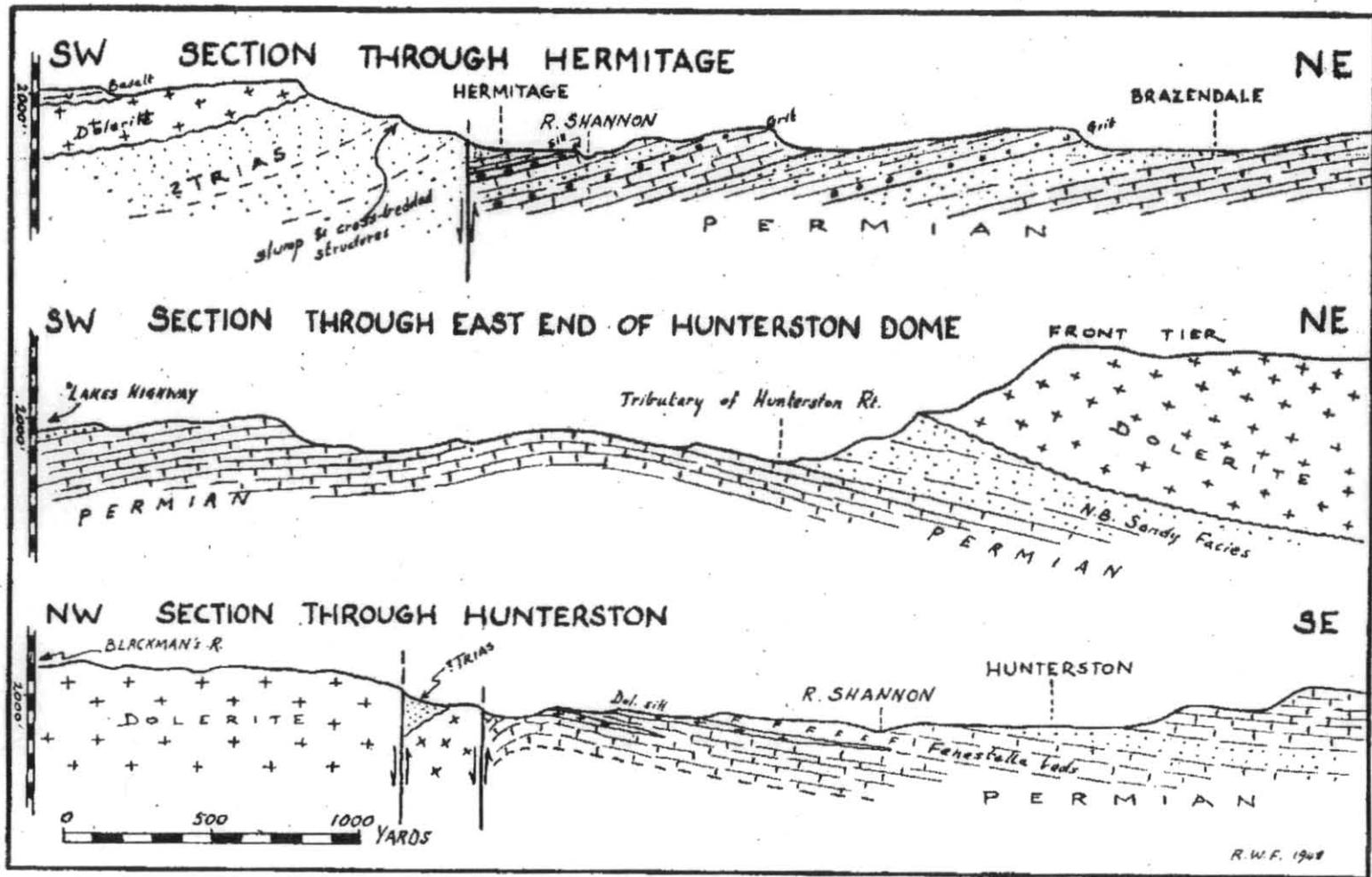


FIG. 5.—Sections through Hermitage and Hunterston.

5 cm

HUNTERSTON #1 WELL PLAN

3. ENVIRONMENTAL MANAGEMENT

Great South Land Minerals Pty Ltd is committed to conducting its business with the desire to protect the natural environment. The company plans and manages its operations to ensure minimum impact on the environment. It will continue to meet all industry environmental standards and obligations. In applying this policy, activities will be governed by the APPEA Code of Environmental Practice.

The company will maintain an active rehabilitation program to restore land disturbed by exploration activities and will respond quickly and effectively if accidental pollution or environmental damage occurs.

3.1 Landholders

Hunterston #1 is situated on the private sheep grazing property of Hunterston, belonging to Mr. Neil Monks. Initial discussions have been held with Mr. Monks, but no final agreement has yet been made for the continuation of drilling operations on his property. Although generally supportive in relation to the exploration program, Mr. Monks has expressed some concern at the potential noise nuisance during the lambing season which extends through to November, and also the possibility for scaring off deer during the hunting season during February and March.

3.2 Site Access

The planned drillsite is only 2 km off the Lake Highway alongside an existing gravel road that branches off Glovers Road shortly after leaving the Highway. No vegetation has been cleared, and the existing access road is adequate.

3.3 Wellsite Preparation

Mobilisation of the drilling equipment at Hunterston #1 would require the construction of six small concrete footings on which to mount the drill floor support frame, thus providing clearance for installation of the BOP stack without recourse to a deep cellar. An area of gravel hardstanding would be constructed around the drillrig in order to maintain a clean and tidy operation.

A flare pit would be excavated about 70m northeast of the wellhead. Mud pits and associated silt traps would be constructed on cleared land adjacent to the drillsite, with drainage to the nearby creek. All mud handling operations are now carried out in CGI tanks, with silt traps downstream of the overflow.

Refer to the Site Layout sketch in Section 8 for further details.

HUNTERSTON #1 WELL PLAN

3.4 Wellsite Operations

Water for drilling operations will be sourced from Hunterston Rivulet, about 250m north of the proposed drillsite. Under drought conditions it may be necessary to cart water in from the Shannon River about 5 km away. Waste water run-off will be directed through silt traps to the small creek at the drill site. Based on earlier experience, mud chemical use should be limited to liquid polymer for viscosity and caustic soda for pH correction. Experience has shown that the resulting fluid is environmentally friendly.

Calcium chloride will be stockpiled on site for weighting up in the event that a kill mud is required. Cellulose fibre is also held on site to treat any lost circulation zones. All mud additives will be handled with care to reduce the risk of spillage.

Diesel fuel will be held on site in a 1500 litre bunded tank, with fuel being pumped up into the drillrig tank daily. Minimal quantities of other lubricants will be stored in secure steel containers, with waste oils being removed from site.

All other wastes and rubbish will be carted away to the local Municipal disposal area, or inert wastes buried on site where appropriate.

3.5 Clean-Up and Rehabilitation

On abandonment of the drill site, concrete footings will be buried and the mud pit, flare pit and silt traps will be backfilled and covered with available topsoil.

Any other rubbish will be removed from site and the area re-seeded in agreement with the landowners requirements. A final inspection will be carried out with the landowner to confirm acceptance.

HUNTERSTON #1 WELL PLAN**4. DRILLING PROGRAM**

All diamond drilling operations will be carried using the OME Rig #002 Mindrill F66 track mounted hydraulic over mechanical driven swivel head type drilling rig. The rig is diesel powered and provides power via a bank of hydraulic pumps to drive the various functions of the rig. The main drive is through a five speed gearbox and main drive shaft to the rotating head. A separate hydraulic circuit drives the operation of the hydraulic head feed mechanism. The rig has an angle package, nine metre mast for drilling at angles from the vertical to horizontal.

The drill rig has been designed for the requirements and safety of drillers engaged in drilling down to +1400 metres in NQ size equipment.

The wellhead will be fitted with a 5000 psi BOP stack and 3000 psi Choke assembly.

The hole has been pre-collared to a depth of about 336m. The hole has been cased with 100mm HW fully welded API rated casing. The hole will be drilled with HQ (89mm rods drilling a 96mm hole and 63mm core) to a depth of around 800m, followed by NQ (70mm rods drilling a 76mm hole and 48mm core) to planned total depth of up to 1200m.

4.1 Outline Summary

Drilling contractors Gerald Spaulding Drillers P/L were used to drill the pre-collar and run casing. For details, refer to Section 4.2 *Setting and Cementing Casing*.

The Mindrill F66 drillrig will be set up over the hole on a 2.1m high steel subframe and work will continue in accordance with the following program:

- Run in HQ string and drill out cement plug and casing shoe at 336m.
- Weld 4¹/₁₆" 5M 6B flange to top of casing and nipple up BOP stack.
- Pressure test casing and BOP as per testing and safety procedures.
- Carry out pressure integrity test of casing shoe.
- Continue drilling HQ (96mm hole) to around 800m.
- Run in NQ string and complete drilling (76mm hole) to target depth.
- Condition hole for Wireline Log or DST as required.
- Evaluate drilling results and finalise report.
- Establish plug and abandon program as per Schedule C provisions.

4.2 Setting and Cementing Casing

The casing was ERW Ultrapipe supplied by Tubemakers of Australia Limited, complying with API Specification 5L (GDE-B & X42).

Nominal bore:	100mm	Outside diameter:	114.3mm
Wall thickness:	6.0mm	Mass:	16.02 kg/m

HUNTERSTON #1 WELL PLAN

Maximum pressure rating: 21,800 kPa at 72% of minimum yield stress
30,280 kPa (4390 psi) at yield

The casing was supplied in 12m lengths with bevel preparation at each end for full strength butt welds. The pipe was run in the hole with each joint being welded by a qualified pressure pipe welder, and 10mm centralisers fixed at each joint.

A tool joint was attached at the top of the casing to allow circulation and flushing of the annulus. The casing was then cemented using Type B Portland cement mixed at the rate of 35 bags per cubic metre, and circulated until grout of the same consistency emerged from the top collar. The area surrounding the wellhead was concreted to provide support for the BOP stack and to anchor the choke and kill lines.

4.3 Drilling Fluid Program

With no evidence of overpressured formations, we plan to continue using fresh water polymer drill fluids during normal diamond coring operations, with caustic soda used for pH correction. Mud weight, viscosity and pH are monitored continuously during each shift.

Two pallets of calcium chloride are kept on site in case weighted kill mud is required. 350 bags of barite are also available if kill mud heavier than 11 ppg is needed, although the use of barite in deep slimhole drilling operations could lead to plugging off circulation.

All drilling mud is mixed in a 3500 litre tank fitted with a high speed hydraulically driven stirrer, and then transferred to 1500-3000 litre CGI holding tanks. The surface circulation system incorporates three CGI tanks to allow for settling of fine cuttings and effective degassing of the drill fluid.

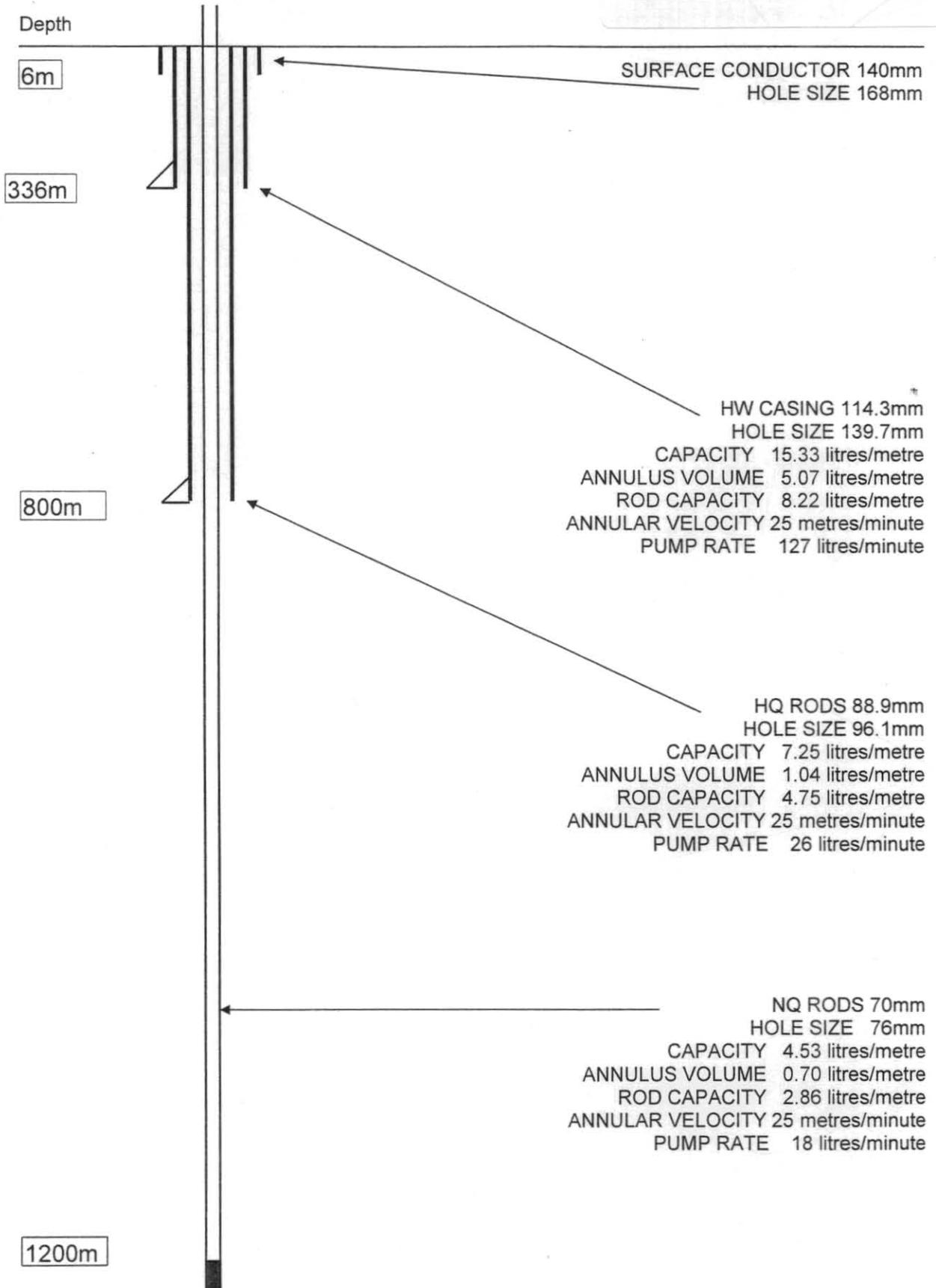
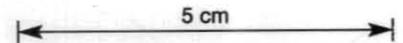
Standard Mud Properties:

Weight:	8.35 ppg (SG 1.0)
pH:	9.5 -10
Marsh Funnel:	35 - 60 sec
Plastic Viscosity:	8 - 15 cp
Fluid Loss:	5 - 8 cc
Yield Point:	13 - 18
Solids:	Minimum

All mud engineering problems are referred to Kerry Booth of Australian Mud Company (08) 8359 6611 for advice.

HUNTERSTON #1 WELL PLAN

4.4 Well Diagram and Volumes



HUNTERSTON #1 WELL PLAN**5. FORMATION EVALUATION****5.1 Core Recovery, Logging and Analysis**

Drill core will be recovered continuously from the bottom of the pre-collar hole. This core will be stored in metal core trays clearly numbered and marked for depth and direction, then logged in detail before being transported to storage.

Samples of the core will be taken periodically for ageing, and hydrocarbon analysis by Amdel Laboratories in Adelaide. Potential reservoir rocks will be tested for porosity and permeability. Gas samples will also be taken and analysed by Amdel to correlate against mudlogging results, and for detection of helium and other gases not measured by mudlogging instruments.

5.2 Mudlogging Services

Mudlogging services will be provided throughout drilling of the hole, and will include provision for monitoring and recording the following data:

(a) Gas Detection

- total gas
- chromatographic analysis
- running of calibration gases

(b) Drilling Parameters

- depth
- rate of penetration
- weight on bit/ hydraulic pressure
- speed of rotation
- pump rate
- calculation of lag time
- pit level monitoring
- mud rheological properties

5.3 Wireline Logging and Drill Stem Testing

Once drilling results have been fully analysed, a decision will be made on the extent of wireline logging and drill stem testing to be carried out. Full core recovery with the ability to test for porosity and permeability reduces the imperative for wireline logging, although these logs are valuable for comparative purposes and for establishing a standard point of reference within the industry.

Due to the significant cost of mobilising this equipment to Tasmania, any testing work will probably be combined with other wells, and hence may not occur until a later date. A separate testing program will be issued at this time.

HUNTERSTON #1 WELL PLAN**6. TESTING AND SAFETY PROCEDURES**

All operations will be under the direct control of qualified personnel holding current BOP and Well Control Certificates.

6.1 BOP Testing Procedures

- (a) Following nipping up of the BOP, the Annular Preventer, Choke Manifold, Kill valves, stand pipe and swivel will be tested to 3000 psi in 500 psi increments.
- (b) At intervals not exceeding 7 days after drilling below surface casing a pressure test of BOP's and manifold equipment will be carried out using a cup tester.
- (c) The Annular Preventer and Accumulator will be operated daily.
- (d) Safety drills will be carried out periodically at the discretion of the Supervisor.

6.2 Pressure Integrity Test

The Pressure Integrity Test provides a safe method of testing the casing and determining the amount of pressure or equivalent mud weight that the wellbore can withstand without fracturing and losing returns. All pressure integrity tests will be conducted using a small output pump with a pressure gauge. A graduated tank will be used to provide accurate volumetric measurements. The mud weight will be uniform in the wellbore. A pressure integrity test form will be used to record all data as accurately as possible.

Procedure:

Drilling out the shoe and 5 metres of cemented plug, circulate to normalise drilling fluid and test as follows:

- Pull into the casing and fill the hole. Stop pumps and close the annular preventer and kelly cock.
- Begin pumping down the annular at no more than 10 litres per minute. Record and graphically plot the casing pressure versus the volume pumped.
- Terminate the test at a pressure limit of 2000 psi or at the point where the pressure versus volume plot ceases to be a straight line, whichever occurs first.
- Record the instantaneous shut in pressure and trapped pressure for 15 minutes at 1 minute intervals or until it levels off, whichever occurs first.
- Bleed off into the graduated suction tank and record fluid volume recovered, then open the annular preventer.

HUNTERSTON #1 WELL PLAN**7. COMMUNICATIONS AND REPORTING**

All communications to the Operating Company and third parties will take place through Great South Land Minerals Limited office at Level 3, 65 Murray Street, Hobart

David Tanner
Chief Executive Officer
Great Southland Minerals Pty Ltd
Level 3, 65 Murray Street
Hobart TAS 7000
Telephone: 03 6231 9339
Facsimile: 03 6231 9338
Mobile Phone: 0417 354 412

All operational reports will generally be initiated by Great South Land Minerals Limited, Mr. David Tanner, Phone/Fax: 03 6231 5677, Mobile: 0417 354 412.

Daily Logs and geological reports will be forwarded to Mineral Resources Tasmania on a regular basis.

HUNTERSTON #1 WELL PLAN**8. PLANT AND EQUIPMENT DETAILS****8.1 MINDRILL F66 DRILL RIG DESCRIPTION**

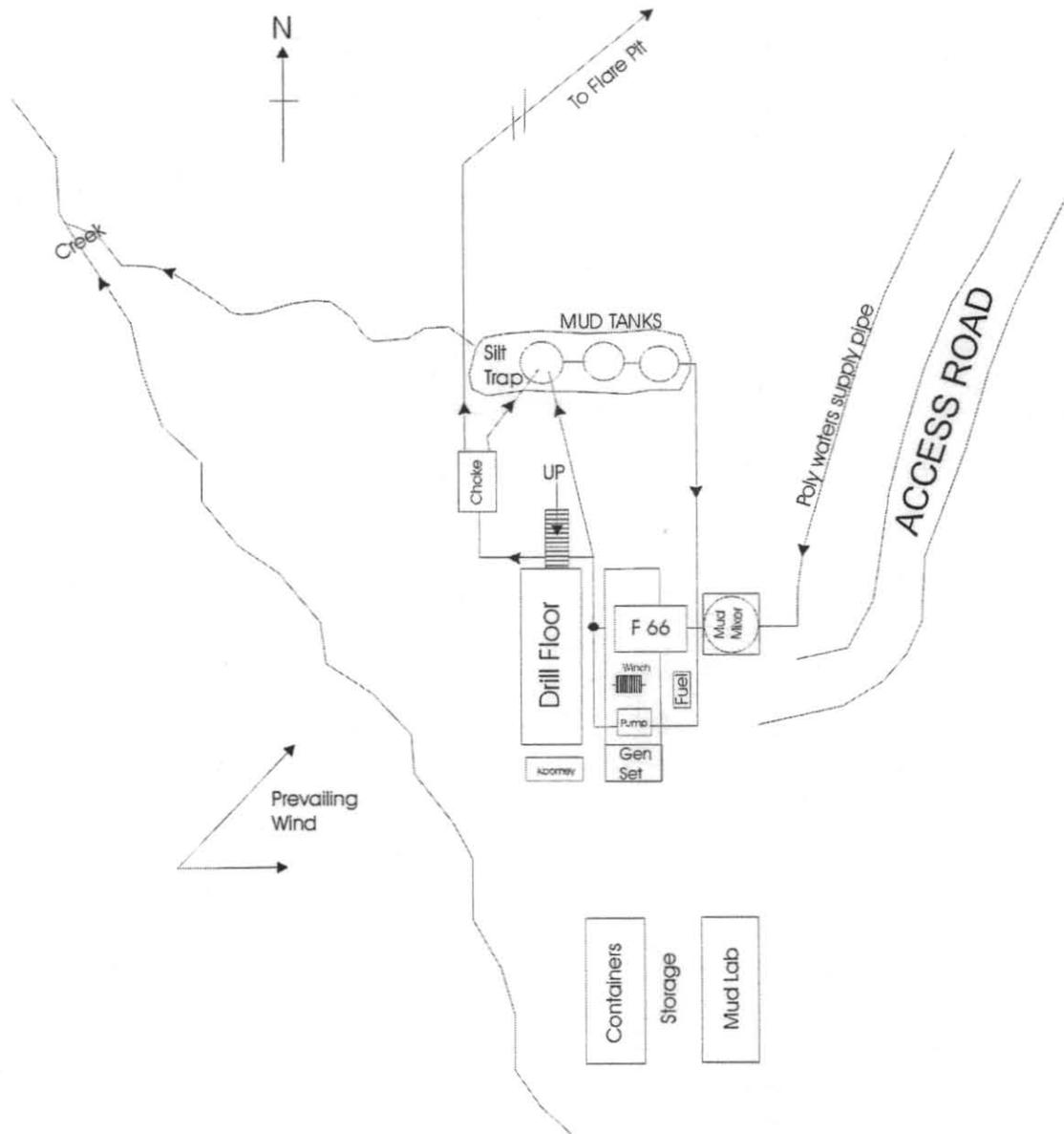
DRILL:	Mindrill F66 track mounted hydraulic over mechanical driven swivel head type drilling rig.
MOTOR:	Cummins 6BTA 5.9P turbocharged diesel delivering 141 (continuous) and 174 (maximum) HP @ 2200 rpm
MAST:	2-section 15 metre mast with 12m rod pull length with pipe stacking rack and hydraulic mast raising cylinder.
WIRELINE HOIST:	Hydraulic drum hoist with 2000m capacity of 8mm cable.
AUXILIARY POWER:	30 KVA Genset driven by Perkins 4108 diesel.
DRILL FLUIDS PUMP:	FMC 50 hp Bean Pump delivering 190 litres/min @ 10,000 kPa. Maximum rated pressure 12,500 kPa (1800 psi)

8.2 BLOWOUT PREVENTION EQUIPMENT

BOP	HYDRIL 4 ¹ / ₁₆ " GKS 5000 Annular Preventer with 4 ¹ / ₁₆ " 5M flange, complete with replacement element and seal kit. P/N 45931, S/N 63820
GATE VALVE	4 ¹ / ₁₆ " 5M API rated full opening GREYGATE flanged valve.
DRILLING SPOOL	4 ¹ / ₁₆ " x 2 ¹ / ₁₆ " 5M Drilling Spool.
CHOKE MANIFOLD	2" 3M Choke Manifold fitted with pressure gauge, dual choke lines and diverter connected to 6" surge tank.
KILL LINE	2" 3M Kill Line fitted with gate valve and check valve.
FLANGES	4 ¹ / ₁₆ " 5M Socket Weld Flanges
ACCUMULATOR	NL Shaffer 3 Station Koomey Unit with 11 gallon accumulator bottle, hydraulic tank, regulator gauges, BOP connection hose and duplex charging pump driven by Kohler engine and control unit. Model No. GED 1000053S, S/N 12483.
CHIKSAN HOSES	2" 3M Chiksan Hoses with hammer unions for connection to kill line and choke line.

HUNTERSTON #1 WELL PLAN

8.3 Site Plan



HUNTERSTON#1 SITE LAYOUT
Not to scale

5 cm

GREAT SOUTH LAND MINERALS LIMITED
STRATIGRAPHIC SLIMHOLE DRILLING PROGRAM

Standard Manual for

BLOWOUT PREVENTION AND WELL CONTROL

BLOWOUT PREVENTION AND WELL CONTROL**CONTENTS**

	Page
PRESSURE CONTROL ENGINEERING	
Introduction to Pressure Control Engineering	3
Origins of Abnormal Formation Pressure	3
Indications of Abnormal Formation Pressure	3
Causes of Loss of Control of Abnormal Pressure	4
Insufficient Mud Density	4
Failure to Keep the Hole Full of Fluid	5
Swabbing	5
Lost Circulation	5
Abnormal Over-Pressure	6
Equipment Failure	6
 ABNORMAL PRESSURE DETECTION	
Introduction	7
Flow Check Pressure	7
 ABNORMAL PRESSURE CONTROL	
Introduction to Abnormal Pressure Control	8
Friction Pressure loss in the Circulating System	9
Methods for Kick Control	10
Pressure Control Worksheet	10
Pumping to Displace Mud in the Drill String	11
Pumping to Displace Mud in the Annulus	11
Well Shut in Procedures	12
Blowout Prevention Equipment	13
Blowout Prevention Test Schedule	14
Blowout Prevention Well Head Diagram	see appendix

BLOWOUT PREVENTION AND WELL CONTROL

Introduction to Pressure Control Engineering

Necessary rapid response to emergency situations may best be accorded when drilling crews are trained to react instinctively to implement actions that effectively prevent a situation from becoming unmanageable.

Where practical a well plan should identify those intervals in the well that have a history of abnormal formation pressure manifested either as lost circulation, as highly compacted and sloughing sediments or as highly pressured fluids that may cause a problem to the normal drilling activities. The investigation should seek to anticipate such problems for well intervals and so assist in designing casing strings as well as drilling procedures to provide efficiency and safety in operations.

Supervisors need to provide regular crew drills to enact these procedures so each person on a location is fully practised as to his responsibilities and actions during such an emergency. Drilling crews are reminded that the first response is most often a responsibility of the Contract Drilling Company performing operations at the site and that in the normal course of drilling, the contractor's personnel will carry out all operations to secure well control.

The first responsibility of a rig crew in an emergency is to prevent loss of life or injury to personnel at the site. The consideration that the most common cause for loss of life and property on oil and gas drilling rigs in the past has resulted from human error and not through equipment failure, should indicate the importance of carrying out regular drills in safety training on a location.

Our priority is to educate crews in understanding the principles, procedures and specifications of equipment employed for the safe handling of an emergency as well as the necessity for communicating all appropriate details through correctly identified channels. Communication procedures for crews are those that have been identified with the operating company representative at the site during the course of a contract drilling programme.

The following section, 'Abnormal Formation Pressure', identifies the origins and indications for abnormal borehole pressure, causes for loss of control in a well bore when encountering abnormal pressure, and procedures for carrying out flow checks to detect a kicking well.

Thereafter, 'Well Control Procedures', for handling HW/HQ/NQ rod strings are described, together with Well Kill Methods which include the 'Driller's Method' and the 'Wait and Weight Method' to shut in and kill the well to prevent a blowout.

Origins of Abnormal Formation Pressure

Formation pore pressure has often been classified as normal where it is equivalent to a normal sea water gradient of 0.1073 kgf/cm²/metre and subnormal when less than this. Abnormal over-pressured formations may be in excess of 0.2353 kgf/cm²/metre in some sedimentary basins of the world. In such extreme cases the over-pressure arises out of a condition in which formation pore fluids are supporting part or all of the rock overburden. The reasons for this condition are not always fully understood but most explanations argue that incomplete diagenetic compaction during burial of the sediments or geotectonic pressuring after compaction and burial is responsible.

Indications of Abnormal Formation Pressure

There are a number of seismic and wireline methods for predicting abnormal pressure in formations that may be employed when planning a well, and there are a series of well documented indicators for the onset of abnormal pressure that may be observed when drilling a well. A number of warning signs can be observed at the surface when drilling that will indicate the onset of a kick. It is the responsibility of crew members to recognise these warning signs and act correctly and promptly to recover from such a situation.

BLOWOUT PREVENTION AND WELL CONTROL

Early indicators are listed as follows:

1. an increase in the pit volume
2. a sudden increase in the drilling rate
3. an abrupt increase in bit torque
4. a reduction in pump pressure
5. an apparent increase in drill string weight
6. complete or partial loss of circulation
7. decreasing shale density

Secondary indicators which may forewarn of a kick include contamination of the drilling fluid by:

- gas cut
- water cut
- variation in mud chlorides indicating water cut above
- increasing mud temperature
- increasing trip gas and connection gas

Causes of Loss of Control of Abnormal Pressure

Kicks, lost circulation or blowouts may occur where formation pressure in the formation drilled is higher than or less than the hydrostatic pressure of the drilling fluid in the well bore. Such an imbalance may permit formation fluids to invade the well and produce a kick at the surface that may develop into a blowout of the well. In circumstances where the formation pressure is less than hydrostatic pressure an under-balanced condition exists and if porous or cavernous rock is being drilled, fluid may be lost to the formation. The loss of hydrostatic pressure arising out of this condition may permit the escape of formation fluids from higher formations into the well bore and similarly cause a well kick or blowout.

Present drilling practice requires maintaining near balanced mud densities and at the same time ensuring hydrostatic pressure is sufficient to control formation pressure. A rule of thumb often employed has been to control mud density to that required for balancing formation pressure plus enough weight to provide for the trip margin.

Australian land drilling operations are frequently complicated where formation pressures will not support the hydrostatic pressure exerted by a drilling fluid and partial or total loss of returns occurs in porous or cavernous surface and intermediate holes.

Less frequently, and often associated with a lost circulation event, complications to drilling operations arise through formation pressure exceeding the mud hydrostatic pressure in a well. The causes for kicks are listed below:

1. insufficient mud density
2. failure to keep the hole full of fluid
3. swabbing
4. lost circulation
5. abnormal over-pressure
6. equipment failure

Insufficient Mud Density:

The condition may occur when drilling into a zone with a drilling mud that is providing less hydrostatic pressure than the formation fluid. Where the formation is permeable, fluids will flow into the well bore. The fluids (gas or water and hydrocarbons) will cut the density of the drilling fluid and compound the condition. Increasing the density of the drilling mud will not always be a satisfactory remedy since high mud densities may exceed formation fracture gradients and cause lost circulation. Excessive mud densities reduce penetration rates and can lead to the differential sticking of the drill rods as well as damage to formations.

BLOWOUT PREVENTION AND WELL CONTROL

Failure to Keep the Hole Full of Fluid:

Most blowouts recorded have occurred during the pulling of pipe from the hole. Blowouts have resulted through not filling the hole with sufficient mud to replace the drill string volume that is withdrawn from the hole. The influence of swabbing while tripping together with the reduction of hydrostatic pressure from incorrect filling of the hole is the most common cause for rig misfortune and tragedy. The situation is avoided through care to make sure that the correct volume of fluid is being returned to the well after pulling a set quantity of pipe. Tripping practice to change a bit should include the correct handling of a trip sheet and this should be signed and maintained with drilling tour reports.

The theoretical accumulated volume displacement should be compared through a trip with actual accumulated volumes that are returned to or from the well as the drill string is withdrawn or run back in the hole. When the hole is not taking the correct volume this should alert the driller that invading fluid may be flowing into the well bore.

Pump stroke counts and measuring the pit volume will assist the driller to calculate and confirm that the volumes to replace the displacement are correct.

An oil saver wireline stripper connected to the top drill rod recovers mud from a travelling wireline and provides blow out protection when retrieving the inner core tube. This operation is carried out with flow check procedures outlined in the section Flow Check Procedure (page 7).

In some areas during tricone rotary drilling, it may become useful practice to slug the pipe with a barite plug before commencing to trip out of the hole. This will assist in stabilising the hole when the drill string is at the surface.

Swabbing:

Swab pressure is created while pulling the drill string or inner core barrel from the hole. Suction arises, since mud does not re-enter the hole as fast as it is displaced. Where the hydrostatic pressure of a mud column is only slightly above the formation pressure, the resulting pressure loss from swabbing may allow formation fluids to flow into the well. The pressure reduction from swabbing is a function of hoisting speed, clearance between the well bore and the drill string, mud properties and bit water course size.

The most critical period of influence from swabbing will occur while pulling the first few stands of the drill string off bottom. A check to ensure that formation fluid is not being swabbed into the hole at the early stages of a trip will often be advisable.

Lost Circulation:

There are numerous causes for lost circulation that may frequently arise in shallow or un-consolidated beds and in deeper rocks that may fracture because the hydrostatic pressure exerted by the mud column exceeds the fracture pressure of a formation, or because a formation is naturally fractured or cavernous.

When the hydrostatic pressure in the well bore exceeds the fracture pressure of the formation, the formation will break down and mud will be lost to that zone.

Frequently circulated returns are lost and the fluid level will stabilise at some point down hole where the hydrostatic pressure balances the formation pressure in the lost circulation zone. On other occasions only partial losses are experienced to a zone and circulation may be restored after treatment to plug the formation.

Lost circulation is particularly hazardous when zones with pressure higher than the hydrostatic pressure of the mud column that stabilises after the losses become exposed and push fluids into the well.

If lost circulation occurs while a kick is being handled with pressure on the preventers, an underground blowout may occur. The zone of lost circulation must then be repaired before normal well control procedures are carried out. Sometimes it is possible to spot a heavy slug of high density mud below the thief zone in the zone of high pressure and this effect allows repairs to the zone of lost circulation.

BLOWOUT PREVENTION AND WELL CONTROL

On other occasions it will become necessary to repair the thief zone with a thixotropic cement squeeze and possibly then case out the two zones after drilling to a suitable formation in which the casing can be secured.

Abnormal Over-pressure:

As stated, abnormal over-pressured formations are frequently defined as those formations with a pressure gradient in excess of a normal column of sea water. This normal formation pressure gradient is 0.1073 kgf/cm²/metre.

If a high pressured formation is penetrated with insufficient mud density, then a kick situation is likely to develop. The response will usually depend on whether the permeability and porosity in the formation is sufficient to permit fluids to flow freely from the highly pressured formation into the well bore.

Under other conditions, the formation may be pressured because compaction in the rock cannot sustain the overburden, and although porosity and permeability are not sufficient to allow the escape of large quantities of fluid into the well bore, there may be deformation and accelerated erosion to the well bore. Increasing the mud weight will often prevent or reduce the sloughing and caving of sediments in these formations.

Equipment Failure:

Failure to correctly test, maintain and operate equipment on the rig has in the past been a cause for concern in the industry and has been the reason for loss of life and property in times of blowout. The schedules for function testing surface well head and mud line equipment, the necessity for reporting testing to statutory authorities and training programmes for rig personnel have all assisted in reducing the problem, but extra care needs to be given to required operational training in the use of this equipment.

BLOWOUT PREVENTION AND WELL CONTROL

Introduction to Abnormal Pressure Detection

The drillers and drilling crews are instructed to recognise and report any signs indicating the onset of abnormal pressure or those conditions indicating that the well is flowing. The crews are drilled regularly to make flow checks and shut in the well when necessary.

Flow Check Procedure

In order that drilling crews take all necessary precautions to prevent a kick situation arising, it is recommended that flow checks be carried out at specific times during drilling operations:

1. while drilling and in the event of indication of a kick
2. prior to tripping the drill string
3. in circumstances of indication of a kick while tripping
4. while out of the hole
5. while retrieving core

Rapid closing of the well is necessary if excessive surface pressure is to be avoided. Unnecessary and improper closing in procedures can however cause equipment damage and hole problems.

When one or more indicators that a well is kicking are recorded, a flow check should be conducted immediately to confirm the presence of formation fluids entering the well bore. However, this flow check must be kept as short as possible in order to minimise the potential influx of hydrocarbons and hence kick size. A large kick is more difficult to kill and circulate out. This is of particular importance in slimhole drilling because of the small annulus volume; for example a 40 litre kick in a BQ hole would occupy 100 metres of annulus while drilling or 24 metres of drill pipe while retrieving core.

General procedures to be observed are as follows:

1. While Drilling:

- stop rotary, then hoist to position tool joint at surface
- shut off pump and call alert
- observe well and if flowing shut annular preventer
- line up well to closed choke manifold and monitor stand pipe and casing pressures

2. Before Tripping the Drill String:

- position tool joint above footclamps and call alert
- divert the flow line to record flow rate and volume
- record the flow volume for 1 to 2 minutes
- if no flow is noted, trip out of the hole
- if the well is flowing, shut it in immediately

3. While Tripping the Drill String:

- position the tool joint above footclamps and call alert
- install stabbing valve in open position then close
- ensure the hole is full then shut down pump
- divert flow to record flow rate and volume for 1 to 2 minutes
- if the well is flowing, shut it in immediately

4. While Out of the Hole:

- ensure the hole is full then shut down pump
- divert flow to record flow rate and volume for 1 to 2 minutes
- continue to monitor the flow each half hour

5. While Retrieving Core:

The well flow check procedures are those established for carrying on wireline operations in conventional drill string assemblies.

- call alert
- shut in the wireline oilsaver packer stripper
- monitor the flow for 1 to 2 minutes via by-pass
- ensure the well has stabilised before completing the flow check

BLOWOUT PREVENTION AND WELL CONTROL

Introduction to Abnormal Pressure Control

General to the procedures for well control and well kill operations in HW/HQ/NQ core drilling are those features of the drill rig and system controls which permit safe handling when drilling in over pressured formations.

Drill fluids suppliers have mud weighting materials compatible for use with wireline core drilling tooling and weighted mud systems are now regularly provided for slimhole operations.

Wireline coring drill holes are considerably downsized to conventional oil and gas holes. The surface mud volumes used and pump circulation rates to drill these wells are also much reduced. Fewer, smaller drill cuttings are produced while coring, which reduces formation contamination of the drill fluid. A driller works above the hole and can monitor all aspects of the circulating system from his position at the rig console.

It is critical to operations that drill fluid rheological properties and particularly yield and gel strengths are readily controlled to maintain optimum conditions for pressure control management in these wells. The annular mud volumes in core hole geometries are only about 15% of those in conventional oil and gas wells, while the circulation system is only about a third of that used by conventional oil field rigs. In these circumstances less time and fewer mud materials are necessary to build weight, condition the mud and control a kick.

While all other response times may be considered equal, the opportunity for detection of a more exact and smaller variation in pit volume is possible in these circumstances. Attention to this opportunity can provide a lead time for response in such an event.

While wireline coring tools are lighter than conventional rotary drill strings it may be pointed out that in a closed well situation with a HQ core drilling assembly in 4.33" hole locked in under a top drive UDR rig, in excess of 3,000 psi could be contained. This is without the necessity of closing a shear ram. By comparison, the same situation in a 7 3/4" production hole with a fluted kelly, would require 132,000 lb of string weight to prevent drill pipe from moving up the hole.

While tripping rods, it should also be noted that in spite of these rods having a large bore and a narrow bit kerf area, the calculated resistance to flow (and its resultant implication for swabbing) when pulling a rotary tricone roller bit string will be found to be greater than in the case of the core string.

Wireline core retrieval has no unique feature that characterises the operation from other wireline activities in conventional drilling practice. Two adopted procedures are designed to prevent accident when pulling core:

A wireline oilsaver packer stripper, rated to anticipated pressure control requirements (3,000 psi in this manual), is installed on top of the drill rod string. In the event of a kick, the packer may be closed. In this event the core inner barrel becomes suspended in a pressured chamber. Mud that is allowed to rise while retrieving the core inner barrel is directed back into the hole via a fast acting mud by-pass valve in the drill string. This valve is also shut in the event of a kick. When stable, read the shut in casing and shut in drill pipe pressures and record the volume gain.

Equipment Rated Pressure:

Well data calculated for carrying out well kill procedures uses rated working specifications for the pressure control equipment and recommended property specifications for the drilling fluids employed. The rated shut in pressure of the Blowout Preventer Well Head is 5,000 psi. The rated pressure of the Annular Blowout Preventer is 5,000 psi. The operating pressure of the Blowout Preventer is 750 psi. An equipment list and diagrams for the BOP equipment are shown in the Appendices.

BLOWOUT PREVENTION AND WELL CONTROL

Friction Pressure Loss in the Circulating System:

The following procedures programme identifies the fundamental concern for the handling of friction pressure losses in these geometries when planning to control and kill a kick.

A friction factor derived for conventional rotary drilling with a drill pipe to annulus ratio of 0.28 will be smaller than the friction factor derived where this ratio is in the order of 2:1 as is the case in wireline drilling geometries. As a result, 92% of circulating system friction pressure losses are derived in the annulus in these down hole configurations, whereas annulus pressure losses in conventional rotary drilling geometries will generally only be to the order of 10% of circulating system pressure losses. As a consequence, a kick event in the well may be anticipated to evacuate:

- the annulus while drilling
- the drill string while tripping
- the drill string while operating wireline tools.

As a further consequence of this distribution for friction pressure losses in a CHD circulating system, it may normally be expected while core drilling that equivalent mud densities will be higher than those in wells that are drilled using conventional oil-well rotary drilling practices.

For clarification of the following well shut in and kill procedures, a description of pressure control equipment and well data to support the drilling practices that are useful for preparing a well kill data sheet, have been included in the appendices.

Friction Pressure Calculations:

The Power Law model for fluid flow behaviour has been employed in calculating friction pressure losses in the circulating system. The equations used to calculate the friction pressure loss are described in the IDF Drillfluids Manual that is held at the location in the tool room. The circulating system pressure data obtained when drilling Comalco's Ungoolya I in the Officer Basin of South Australia and the Pittston Minerals (Aust.) Sandfire Flat (SD1) mineral hole in the Canning Basin (described in the Slimhole Drilling Technology Manual) are empirical data sets used as models for applying these friction pressure loss equations at the location.

HW/HQ/NQ well geometries and drilling fluid properties are recorded on the kill sheet that describes the parameters used in these calculations.

The circulating system pressure loss in a well is the sum of friction pressure losses:

$$CSPL = P(\text{surface}) + P(\text{drill string}) + P(\text{core barrel}) + P(\text{annulus})$$

When a kick is detected and the well has been shut in, it is well to wait for a few minutes to allow the pressure to stabilise. If a gas bubble has been encountered it will begin to migrate up the hole, and it is not good practice to wait too long before commencing remedial action. The driller may respond in two prescribed ways to control the pressure.

He may use the recorded surface pressures to plan for kill procedures and fill in the Pressure Control Worksheet at this time, or he may wish to circulate the well through the choke using the constant pump stroke method and displace all the invading formation fluids before commencing to kill the well.

The latter, which initially controls the over-pressure by circulating the hydrostatically under-balanced well through the choke, and displaces any invading fluid from the well is called 'The Driller's Method' and will provide more reliable data to calculate mud weight to control the abnormal pressure. The method requires a minimum of two complete circulations to kill the well.

The former is known as 'The Wait and Weight Method' and is designed to kill a well with one circulation and because of simplicity it is most often the preferred procedure.

BLOWOUT PREVENTION AND WELL CONTROL

Methods for Kick Control:

This method and a worksheet for controlling a well are described in the ODCAA Well Control Manual that is in the tool house at the location.

A well, which has been shut in, may then be circulated while the driller controls the 3,000 psi diverter line ball cock valve with the original mud weight to displace an invading fluid in the annulus. A constant bottom hole pressure is maintained while circulating at the slow pump rate to control further entry of formation fluid. It is useful to complete a Well Control Worksheet before commencing the procedure.

Circulation is commenced by cracking the diverter line ball cock valve and simultaneously bringing the pump rate to the desired slow pump rate. While pumping at the constant pump rate the drill string pressure is held constant by adjustment at the choke. An initial pump pressure is obtained by adding the circulating system pressure loss to the shut in drill string pressure.

When all the invading fluid has been pumped from the hole, clean uncut mud will appear and the well may be shut in once more. The shut in casing pressure and the shut in drill string pressure should now be equal and a Pressure Control Worksheet may be completed using this recorded data.

It is possible to continue circulating the well at any time while weighting up operations are in progress using this constant pump stroke - constant drill string pressure method and maintain control of the well.

Regardless of the two methods employed, to kill a kicking well is the same in both cases when displacing old mud with newly weighted mud of sufficient density to effectively control the over pressure.

The operation may proceed after the initial shut in without displacing the invading fluid using the 'Wait & Weight Method' or it may proceed to circulation using the 'Drillers Method' to control the kick. In both cases the shut in pressures are used to fill out the Pressure Control Worksheet and mud density is increased in the pits to effectively control the abnormal pressure.

The Pressure Control Worksheet:

This work sheet is used for recording shut in data and is kept up to date during drilling operations to maintain the pre-recorded information which includes the circulating system pressure loss with the pump and well data.

Record the shut in drill string and the shut in casing pressure together with the kick volume. The initial circulating pressure required is found by adding the shut in drill string pressure to the system pressure loss.

The new mud density required to balance the formation pressure may be calculated from the shut in drill string pressure. This pressure is converted to an equivalent mud density in units of specific gravity using the equation described on the worksheet. Adding the result to the original mud density will provide the new mud specific gravity that is required to balance the formation.

It is necessary to displace the original drilling mud in the drill string and annulus with newly weighted mud while pumping with a controlled pump rate and making adjustments at the diverter ball cock choke valve to maintain a regulated pressure. The pressure is regulated to reduce the pump pressure from the Initial Circulating Pressure to the Final Circulating Pressure as the old mud is pumped out of the drill string. Calculate the Final Circulating Pressure using the equation shown in the worksheet, and then prepare a graph plan that plots the number of pump strokes and/or time versus the decrease in pumping pressure while the new mud is being pumped from the surface to the bottom of the drill string. This Final Circulating Pressure is then maintained by controlling the choke while pumping the new mud up through the annulus.

Remember when making these calculations:

the drill string hydrostatic pressure + the circulating system pressure - the friction pressure
is always equal to

the annulus hydrostatic pressure + the casing pressure + friction pressure in the annulus.

BLOWOUT PREVENTION AND WELL CONTROL**Pumping to Displace Mud in the Drill String:**

Displacement is effected by pumping new mud at the controlled slow pump stroke rate and maintaining choke adjustment to control the pump pressure. This is the Initial Circulating Pressure at the commencement and is reduced to the Final Circulating Pressure when the new mud reaches the bit.

While making this choke correction it can be seen that pump strokes may increase as the pump pressure falls, and to return the well to balance it is necessary to close the choke until pressure and pump rate return to their designated values. Should the pump pressure increase and the pump stroke rate begin to fall, then it is necessary to gradually open the choke to restore balance.

Pumping to Displace Mud in the Annulus:

When pumping to displace the annulus the final circulating pressure becomes the controlling factor. The new mud is pumped through the annulus while controlling backpressure on the choke to maintain this final pump pressure.

The casing pressure will vary considerably while displacement proceeds and the maximum pressure will be recorded when the gas bubble (if any) first reaches the surface.

The highest pressure recorded at any point in the well (eg. the casing shoe) will occur when the top of any such gas bubble reaches that point.

Once new mud is returned to the surface, the well is once more balanced and backpressure required at the choke will be reduced to zero. The well may then be shut in once more to determine if the new weight is effectively controlling the formation pressure.

The higher annulus pressure associated with the driller's method for controlling a kick may become of serious concern if an inner casing string has a low pressure rating or if it is set at a shallow depth where fracture pressure in a formation is less than the probable annulus pressure that will occur when a gas bubble reaches the shoe. For this reason, cautious evaluation of well parameters needs to be applied when selecting the method for controlling a well.

BLOWOUT PREVENTION AND WELL CONTROL**Well Shut in Procedures:**

If the well is flowing, the drill crew should shut in the well and make the necessary arrangements to begin killing operations. The position of the drill string at the time of this decision determines which of the following procedures to use for the shut in. Both of the 3,000 psi ball cock valves on the kill and diverter lines are maintained in the closed position at all times while drilling or coring.

1. Shut in While Drilling:

- call alert
- stop rotary, hoist to place tool joint above slip area
- shut down pump
- check both ball cock valves are open
- close annular preventer
- slowly close 3,000 psi ball cock valves without exceeding allowable operating pressure
- when stable, read the shut in casing and shut in drill pipe pressures and record the volume gain

2. Shut in While Tripping:

- call alert
- position upper tool joint above slip area
- set pipe in slips & release elevators
- install 3,000 psi stabbing ball cock valve open, then close
- check both ball cock valves are open
- close annular preventer
- slowly close the diverter ball cock valves without exceeding allowable casing pressure
- make up top drive rotary to top connection
- open 3,000 psi ball cock stabbing valve
- allow well to stabilise
- when stable, read the shut in casing and shut in drill pipe pressures and record the volume gain

3. Shut in While Out Of Hole:

- call alert
- check both 3,000 psi diverter line ball cock valves are open
- close the 5,000 psi gate valve
- slowly close diverter line ball cock valves without exceeding allowable operating pressure
- allow well to stabilise
- read the shut in casing pressure and volume gain

4. Shut in While Retrieving Core:

The well shut in procedures are those established for carrying on wireline operations in conventional drill string assemblies.

- call alert
- check both 3,000 psi diverter line ball cock valves are open
- close in the packer stripper valve and by-pass valve
- slowly close diverter line ball cock valves without exceeding allowable operating pressure
- allow well to stabilise.

BLOWOUT PREVENTION AND WELL CONTROL**Blowout Prevention Equipment**

The following equipment was supplied and tested by Wisco International , Houston, Texas, USA in September 1995:

BOP	HYDRIL 4 ¹ / ₁₆ " GKS 5000 Annular Preventer with 4 ¹ / ₁₆ " 5M flange, complete with replacement element and seal kit. P/N 45931, S/N 63820
Gate Valve	4 ¹ / ₁₆ " 5M API rated full opening GREYGATE flanged valve.
Drilling Spool	4 ¹ / ₁₆ " x 2 ¹ / ₁₆ " 5M Drilling Spool.
Choke Manifold	2" 3M Choke Manifold fitted with pressure gauge, dual choke lines and diverter connected to 6" surge tank.
Kill Line	2" 3M Kill Line fitted with gate valve and check valve.
Flanges	4 ¹ / ₁₆ " 5M Socket Weld Flanges
Accumulator	NL Shaffer 3 Station Koomey Unit with 11 gallon accumulator bottle, hydraulic tank, regulator gauges, BOP connection hose and duplex charging pump driven by Kohler engine and control unit. Model No. GED 1000053S, S/N 12483.
Chiksan Hoses	2" 3M Chiksan Hoses with hammer unions for connection to kill line and choke line.

Further descriptive information for this equipment is provided in the Appendix.

BLOWOUT PREVENTION AND WELL CONTROL**Blowout Preventer Test Schedule:**

Pressure test policy requires that the BOP's and associated well control equipment is tested to operation pressures recommended by the manufacturers.

Testing may be carried out with the least number of valve manipulations and in accordance with the instructions of the operating company.

In the event that a test indicates that the equipment is not operating correctly, operations shall not be continued until the deficiencies have been corrected to the satisfaction of the operating company.

All preventer equipment to be tested in accordance with such regulations requires that annular type blowout preventers shall be tested to 70% of the manufacturers rated pressure.

A complete BOP test is carried out at the installation of the equipment, before drilling out after setting each casing string, every 7 days while drilling and after each time repairs are made that require removal of a pressure seal in the assembly. The gate valve shall be tested at the times stipulated in the above paragraph, providing that after installing each casing string, the gate valve shall be pressure tested to the operating pressure provided above.

The annular preventers shall be function tested on each round trip or 24-hour period, whichever is the greater period of time.

In conjunction with BOP tests, pressure tests of the inside BOP's and rig mudlines require attention at this time. The pressure test for the rig mud lines and pump manifold is 1800 psi.

Closing Unit:

1. Accumulators shall have sufficient capacity at all times to close, open and re-close the annular type blowout preventer.
2. Rig hydraulic pump shall be capable of rebuilding fluid pressure in the closing unit within a period of three minutes to a sufficiently high level to close the annular type blowout preventer.
3. Closing unit shall be connected to the blowout preventers with lines of working pressure at least equal to the working pressure of the unit.

Closing Unit Tests

Tests are performed at installation or every 15 days, whichever is the shorter period of time. Regardless of the arrangement of a blowout preventer stack to be tested, a set of drawings is most useful when conducting this procedure. Tests are carried out with the least number of valve manipulations.

The test diagrams are prepared after the drill rig plumbing inspection is concluded at the location. All BOP testing is carried out using water after mud is flushed from the stack and lines. Low pressure tests must be applied for 3 minutes before increasing to the full test pressure on the NPT mudline, the diverter and kill line ball cock valves, gate valve and annular BOP.

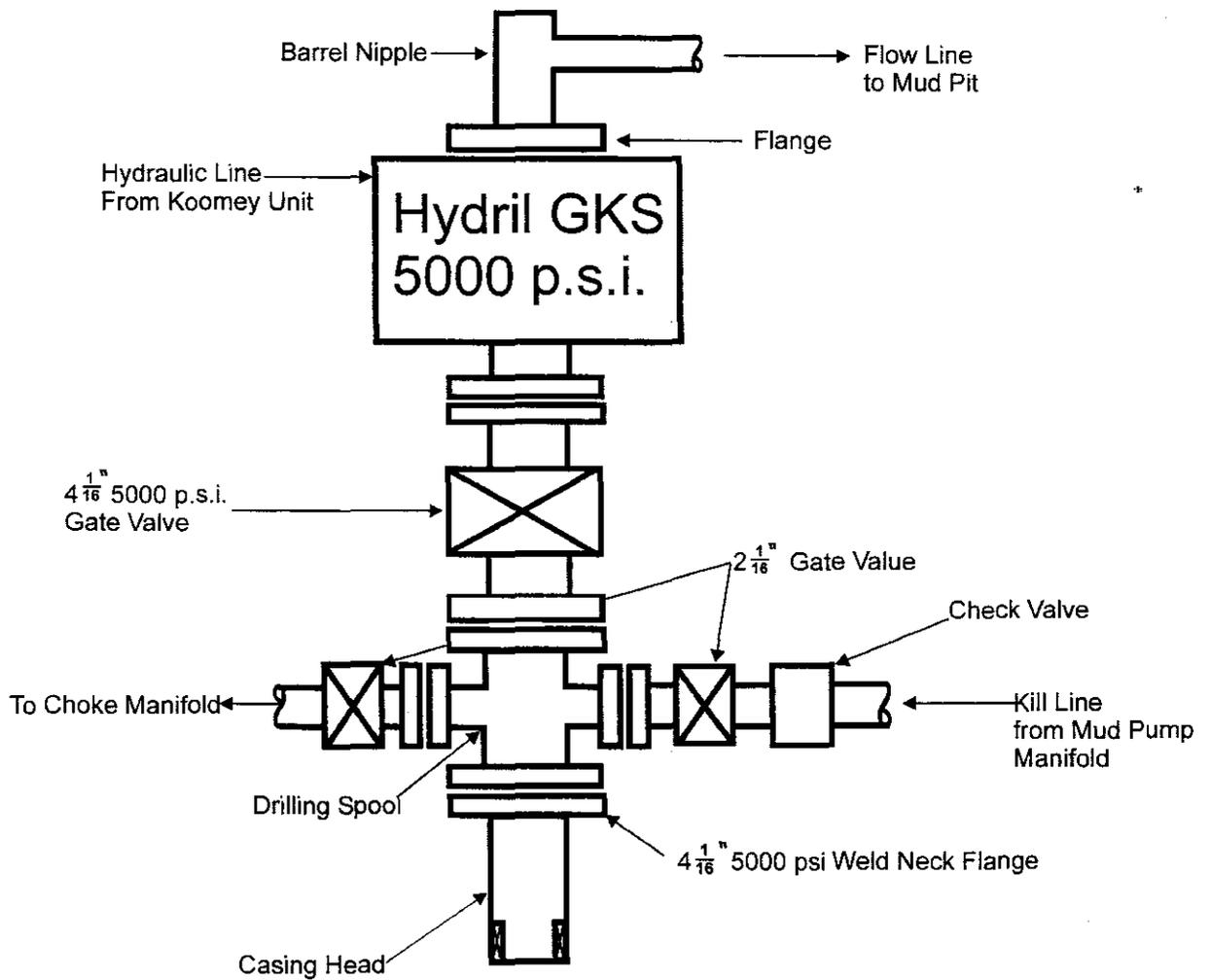
BOP Inspection Test Check List:

- Make frequent inspection to your satisfaction that you have;
- Ensured the BOP's are correctly installed and braced.
 - Replaced hand wheels.
 - Ensured the 3,000 psi ball cock valves on the diverter and kill lines are closed.
 - Sufficient mud weighting chemicals to meet location requirements
 - Hydraulic properties recorded daily in the Pressure Control Worksheet
 - Drills and Safety Meeting requirements fully observed.
 - Tested the stand pipe, pump lines, valves and mud line hose.

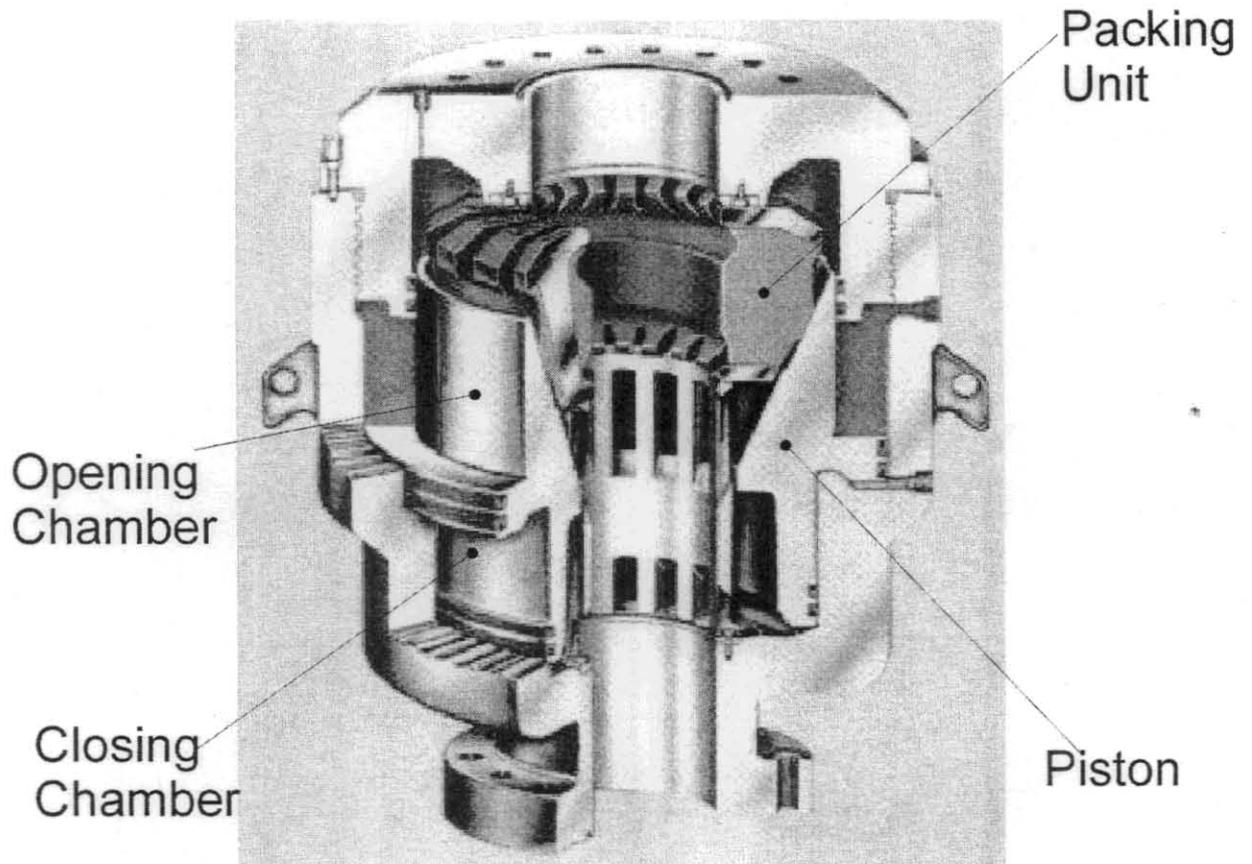
STRATIGRAPHIC SLIMHOLE DRILLING PROGRAM**BLOWOUT PREVENTION AND WELL CONTROL****APPENDICES**

- A. Working sketch of BOP, Diverter & Kill Line
- B. Cross section of Hydril BOP closing unit
- C. Working sketch of Choke Manifold
- D. Pressure Control Worksheet
- E. Standard Manual for Rig Safety and Emergency Response

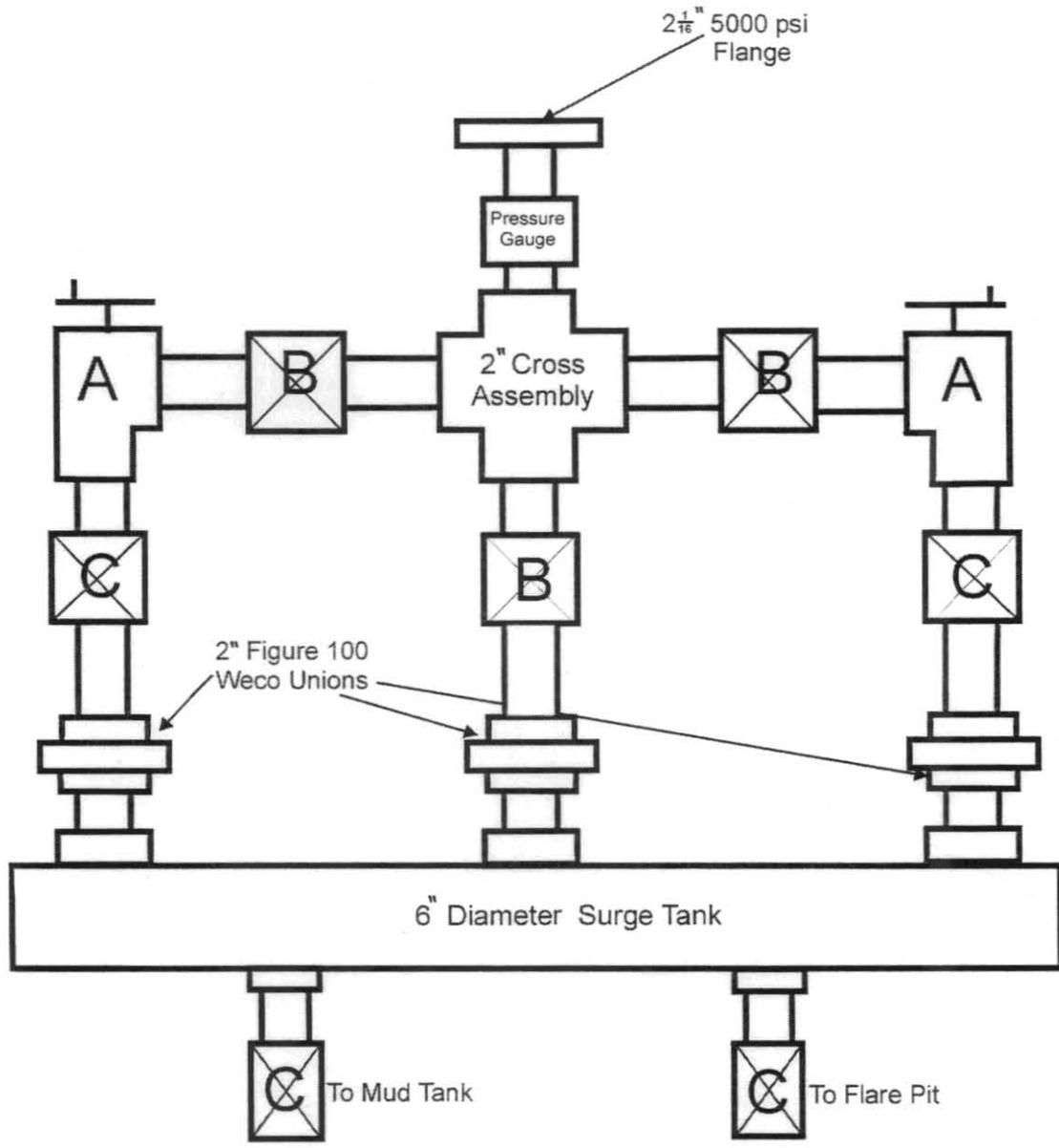
BOP Diverter and Kill Line



GKS 4 $\frac{1}{16}$ " Hydril Blowout Preventer



2" 3000psi Choke Manifold



- A - Adjustable Choke
- B - 3000psi 2 1/8" Gate Valves
- C - 500psi 2" Ball Valves

5 cm

PRESSURE CONTROL WORKSHEET

DATE : _____
 NAME : _____
 UNITS : FIELD

FORMATION STRENGTH DATA :
 SURFACE LEAK-OFF PRESSURE FROM
 FORMATION STRENGTH TEST (A) psi
 DRILLING FLUID DENS. AT TEST (B) ppg
 MAX. ALLOWABLE DRILLING FLUID DENSITY =
 (A) psi ÷ 0.052 ÷ SHOE TVD + (B) ppg = (C) ppg
 ÷ 0.052 ÷ + = (C)
 INITIAL MAASP = ((C) ppg - CURR DENS) x SHOE TVD x 0.052
 = (..... -) x x 0.052
 = psi

CURRENT WELL DATA :

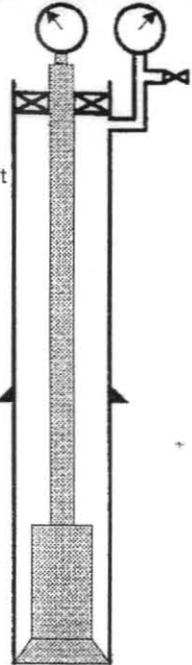
DRILLING FLUID DATA
 DENSITY _____ ppg
 GRADIENT _____ psi/ft

CASING & SHOE DATA

SIZE _____ in
 M. DEPTH _____ ft
 T.V. DEPTH _____ ft

HOLE DATA

SIZE _____ in
 M. DEPTH _____ ft
 T.V. DEPTH _____ ft



PUMP NO. 1 DISPL.	PUMP NO. 2 DISPL.
bbl / stk	bbl / stk

SLOW PUMP RATE DATA	DYNAMIC PRESSURE LOSS	
	PUMP NO. 1	PUMP NO. 2
SPM	psi	psi
SPM	psi	psi

PRE - RECORDED VOLUME DATA :	LENGTH ft	CAPACITY bbl / ft	VOLUME bbl	PUMP STROKES stks	TIME minutes
DRILL PIPE	x	=		VOLUME PUMP DISPLACEMENT	PUMP STROKES SLOW PUMP RATE
HEVI WATE	x	=	+		
DRILL COLLAR	x	=	+	(E) stks	min
DRILL STRING VOLUME			(D) bbl		
DC x OPEN HOLE	x	=		stks	min
DP/ HWDP x OPEN HOLE	x	=	+		
OPEN HOLE VOLUME			(F) bbl		
DP x CASING	x	=	(G) +	stks	min
TOTAL ANNULUS VOLUME			(F+G) = (H) bbl	stks	min
TOTAL WELL SYSTEM VOLUME			(D+H) = (I) bbl	stks	min
ACTIVE SURFACE VOLUME			(J) bbl	stks	
TOTAL ACTIVE FLUID SYSTEM			(I+J) bbl	stks	

CALCULATIONS CAN BE MADE USING EITHER DRILLING FLUID DENSITY OR DRILLING FLUID GRADIENT

REV 5/01

GREAT SOUTH LAND MINERALS PTY LTD

STRATIGRAPHIC SLIMHOLE DRILLING PROGRAM

Standard Manual for

RIG SAFETY AND EMERGENCY RESPONSE

RIG SAFETY AND EMERGENCY RESPONSE**CONTENTS**

	Page
EMERGENCY RESPONSE	
Introduction	3
Emergency Alert Plan	3
Rig Emergency Procedure	4
Contractor Emergency Staff Response	4
RIG SAFETY	
Introduction to Fire Fighting Procedures	5
Classification of fires and methods for their control	5
Rig Fire Prevention	5
Responsibility	6
Cutting & Welding	6
Inspection	6
Welding in Confined Spaces	7
The Use of an Observer	7
Electric Arc Welding	7
Operator Safety	7
Oxy-Acetylene Flame Cutting and Welding	8
Safety Responsibility	8
RIG SAFETY	
Production Testing	9
Procedures	9
FIRST AID	
First Aid at the Rig Site	10
Basic First Aid for Wounds	10
Fractures	11
Burns and Scalds	12
Treatment of Shock	13
Responsibility	13

RIG SAFETY & EMERGENCY RESPONSE**EMERGENCY RESPONSE****Introduction**

The Safety and Emergency Response Program is prepared for the benefit of the Contracting drilling crews and management to ensure the correct response to emergencies that may arise out of contracting operations, and for the laying down of guidelines for safe procedures when working on or around the drilling site.

Drilling supervisors are responsible to ensure that all personnel employed on the site are fully conversant with the content of this manual, and are instructed in safe working practices on these operations.

Contractor personnel are expected to sign the Safety Book to acknowledge they are fully aware of and will abide by these instructions.

The Operating Company, Great Southland Minerals Pty Ltd, has prepared an Emergency Response Manual that covers contingencies for the drilling programme being conducted.

Should an emergency arise, nothing in the contents, instructions or regulations provided in this programme shall be so construed as to prevent the "person-in-charge" from taking the most effective action in his judgement for rectifying the conditions causing the emergency, or action deemed necessary for the saving of life and property.

Emergency Alert Plan

An emergency is considered to be an unexpected event that may result in harm to life, environment or property and which calls for immediate action.

Examples:

1. An event that results in loss of life, serious injury or causes a potential hazard to life and property.
2. Hydrocarbon or chemical spill or other emission harmful to the environment
3. A fire causing equipment or property damage.
4. Explosion, rupture or well blow out.

The Senior Contractor Employee at the scene will contact the Operating Company Representative on site or at his location and report the emergency, including details of:

- where it occurred
- when it occurred
- what action is being taken to control the situation
- what progress is being achieved in rectifying the emergency.

The Operating Company Representative in these circumstances is Mr David Tanner
Tel. 03 6231 9339 Mobile 0417 354 412 After Hours 03 6231 5677

The Senior Contractor Employee is then responsible for reporting the emergency to his immediate senior at the Contracting Company Head Office.

Your immediate reports are thus:

1. Operating Company Representative
2. Contracting Company Superior

A list of operating company personnel to whom you may report emergencies will need to be prepared and kept handy in the supervisor's office. Make sure that the contact level for these situations is fully established for each drilling program.

RIG SAFETY & EMERGENCY RESPONSE

Rig Emergency Procedure

The circumstances that will be encountered in any particular emergency are very often unpredictable. No comprehensive set of plans can be formulated to meet all emergencies. However, normal preparations can be made in response to:

1. Fire, explosion or blow out
2. An urgent need for medical assistance

Contractor Emergency Staff Response

1. Alert all members of the team.
2. Contact the senior member of the Operator's emergency staff.
3. Base the emergency team at the radio contact room.
4. Liase with the Operator's Rig Supervisor.
5. Liase with the Contractor Rig Supervisor at the location.
6. Ensure names and addresses of personnel on the rig are known.
7. Prepare response for the State Regulators.

As advised by the Operator,

1. Prepare warehouse personnel responsible for materials dispatch.
2. Mobilise and dispatch any materials requested to the rig.
3. Ascertain if any injured personnel are in need of evacuation.
4. Prepare mobilisation for any evacuation.
5. Advise the local Police Department of the emergency.
6. Request Police assistance if necessary.
7. If necessary advise the most accessible medical facility.
8. Arrange medical assistance in transit if necessary.
9. Arrange emergency accommodation if necessary.
10. Maintain a record of evacuees, their location and condition.
11. Report back all Operator advised action.

Operator's Representative

The Operator will nominate an Emergency Response Co-ordinator to supervise the operations and it is important the Contractor Emergency Staff act through his instructions.

Emergency Response Co-ordinator

The Emergency Response Co-ordinator has ultimate responsibility and will be making the decisions that are remedial for the emergency at the site and contingent to safe passage of any evacuees for medical purposes.

The Contracting organisation is responsible to act promptly on any proposed operation detailed and requested by this representative and to keep him fully informed as to the outcome of the actions. Further, they are to advise him in all matters pertaining to the emergency, either requested or otherwise.

RIG SAFETY & EMERGENCY RESPONSE

RIG SAFETY

Introduction to Fire Fighting Procedures

In the petroleum industry and particularly for exploration, fire is an ever-present hazard to life and property. It is necessary that the required fire fighting equipment on the rig is correctly serviced and maintained at convenient, designated locations, and that personnel are fully instructed and understand procedures for extinguishing any conflagration.

Burning and welding are two notable hazards that require attention and control at the location. Preparation notices must always be requested for these activities so that supervision is prepared for the job and there is no breach of any regulation.

Sources of ignition

It is recognised that most of the hazards surrounding the occurrence of fires stem from lack of attention on the part of personnel to preparation and care on a job. Consideration of sources of ignition during the carrying out of an activity and exclusion of the potential hazards through job preparation will considerably lower the risk of accidental fire. Think hard on this and your own past experience!

Ignition may result from;

1. An explosion, naked flame, molten sparks or spontaneous combustion.
2. Welding, cutting and sparks generated through cutting or grinding.
3. Electrical faults; loose connections or incorrect grounding.
4. Electrical faults; incorrect fuse selection, or unprotected installations.
5. Electrical faults; incorrect wiring, short circuits or overloading.
6. Smoking in non-designated areas.

Classification of fires and methods for their control

Fires have been classified as follows;

- Solid Fires - extinguished using water, foam or any type extinguisher.
- Liquid Fires - extinguished using foam, carbon dioxide or dry chemical.
- Electrical Fires - extinguished using carbon dioxide or dry chemical.

DO NOT USE WATER OR FOAM TO EXTINGUISH ELECTRICAL FIRES

Rig Fire Prevention

It is the responsibility of the Operating Company Representative to ensure that fire prevention and safety procedures are carried out on the location to the satisfaction of his company's set policy.

It is the responsibility of the Contracting Company Supervisor to ensure that his crew is performing duties in accordance with instructions provided by the Operator.

The Contracting Rig Supervisor should instruct crews in all areas of rig fire prevention and their responsibilities:

The Contracting Rig Supervisor should ensure that:

- Fire prevention procedures are introduced and displayed at the rig and are given attention in Safety Meeting Agendas.
- Fire Station notices are well prepared and displayed conspicuously around the rig. These notices contain equipment details and duty information for personnel.
- New crew members taking up duties on the location are fully briefed in fire prevention and their responsibilities in an emergency situation.
- Rig crews commencing operations at a site sign a log book to acknowledge that they have been instructed in fire prevention and rig safety in general.

RIG SAFETY & EMERGENCY RESPONSE

- Visitors to the rig are made aware of restriction notices and safety regulations operating at the site.
- Fire extinguishers required under the regulations are correctly positioned at the site, are inspected and operational at the commencement of drilling operations, and thereafter every three months.
- Smoking is only permitted in designated areas.
- Electrical installations are inspected by a qualified electrician before the commencement of drilling operations and then following the installation of any new or additional electrical fitting.
- Compressed gas cylinders are not operated unless they are installed with gauge and pressure regulating equipment.
- Spilled hydrocarbons are immediately recovered, even if it is necessary to curtail drilling operations in order to do so.
- Engine oil is drained and stored in drums at the site. It is not permitted that drained oil is held in sumps under motors.
- Waste oil rags, sacks, rope, plastic containers are not left around the location, but deposited in designated refuse containers on site.

Responsibility

The Contracting Company Supervisor and each service company senior representative is responsible for his unit and personnel safety.

The Contracting Rig Supervisor is the person-in-charge of fire fighting on the rig.

This responsibility may be shared by the Operating Company Representative or a deputy where operator liabilities are involved ie. danger or damage to life, the well, the reservoir or property. In the event of fire, all precautions will be taken to eliminate danger to life and property even if drilling operations have to be curtailed as a result.

Responsibility for manning and operating fire stations will be properly delegated. Back up equipment and personnel are to be mobilised quickly.

If a fire cannot be brought under control on the rig with the resources at hand, then the Contracting Rig Supervisor is required to inform the Operating Company Representative and proceed to notify his company's emergency staff that back-up equipment is required forthwith.

Cutting & Welding

Authorisation for welding jobs are provided by the Contracting Rig Supervisor or a member of the crew delegated by him, and each job needs to be detailed for his approval on a Welder's Job Sheet.

Cutting and welding operations need to be properly supervised and an inspection of the work area should be carried out to determine if the work is necessary and safe to carry out.

The Contracting Rig Supervisor must ensure that the welder fully understands the work, that he is qualified to carry it out and that fire equipment is on hand.

Inspection

During pre-operation inspection, the Contracting Rig Supervisor must ensure that;

- No spark, flame, or hot slag is likely to be blown or fall onto combustible material or equipment which could be ignited and cause damage.
- No combustible vapours are present in open or confined spaces that could be ignited, and adequate ventilation is provided while the work is in progress to prevent the accumulation of combustible or noxious fumes. Good ventilation is essential when cutting or welding alloy metals, plated steel or painted metal since harmful vapours will be produced.
- If hydrocarbons are present on the metal surface, it has been thoroughly cleaned to remove as far as possible any residue that could foreseeably cause ignition.
- Where welding or cutting is to be performed around any timber, the wood is well watered down before work commences, and that periodic wetting is kept up while the work is in progress.

RIG SAFETY & EMERGENCY RESPONSE

- Welding equipment is never used in the vicinity of asbestos material.
- Any welding work to be carried out on service or connecting pipe is not commenced until inspection ensures that the pipe has been bled to atmospheric pressure, that it has been purged and cleaned and that there is no possibility of pressure rebuilding in the pipe during the operation.
- All connecting valves are correctly closed and any flanges to be used are correctly installed.
- If work is to be performed on any structural member, no damage to the specification of the equipment will result so that the strength or efficiency of the member is in any way reduced.
- Where any work of this nature is to be performed and the supervisor is unsure of the consequences of the job, another opinion has been sought from a higher authority.

Welding in Confined Spaces

Welding in confined spaces will require that the Contracting Rig Supervisor ensures that;

- Any welding to be conducted in a tank compartment of any kind and regardless of its features, is not commenced before it has been inspected and ascertained that it is safe to proceed with the job.
- A person who is designated to carry on the job is familiar with the work and that the compartment is free of any noxious or inflammable vapours.
- Air blowers are placed strategically to pick up and discharge any produced fumes.
- Ready access to and from the place of work is freely available.
- At least one observer is in attendance while the job is in progress and that the welder has a lifeline to signal for rescue should difficulties arise.
- No person is permitted to enter the compartment if there is the slightest doubt that sufficient air to support life without self-contained breathing apparatus is available.
- Service or connecting pipe is inspected and is to the requirements stated in the above.
- Wherever possible, positive closures such as blind flanges, bull plugs or locked valves are employed on pipelines entering confined spaces while this work is in progress.

The Use of an Observer

Welding operations on the rig unit and within a 15 metre radius of the wellhead shall not be permitted unless an observer is present to watch for flying sparks and falling slag so that no fire hazard is permitted from such an operation.

Where welding operations are to be permitted within a 15 m. radius of the wellhead while drilling is in progress, the welder and his observer are to arrange a system of signals that will provide for a job to be shut down in the event that a hazardous situation arises.

Electric Arc Welding

Inspection by the Contracting Rig Supervisor should ensure that:

- The welder on the job is experienced and qualified to carry on the work that has been planned.
- The welding equipment, leads, ground terminals and the environment where the work is to be carried out are satisfactory for the completion of the work.
- A ground return connection is not made through a conductor such as a pipe or other object which may contain inflammable liquids or gases, and the connection is similarly not to be made through other cables, conduits, chains, wire rope or carriers of this nature.

Operator safety

The welder and his assistant observer are required to be correctly attired and equipped for the duties of carrying on welding operations.

Clothing which is protective of sparks, hot slag, and ultra violet rays is necessary and should cover the whole body below a mask.

Shirt sleeves are to be rolled down.

RIG SAFETY & EMERGENCY RESPONSE

Welding masks and goggles for electric welding and flame torch welding and cutting as well as gloves are to be supplied for the welder and his observer with any welding rig.

Shielding to protect other crew members from any harmful effects arising from welding practice must be provided.

The work area should be cleared on completion of the job, and it is important to dispose of any rod ends that have been discarded.

Oxy - Acetylene Flame Cutting and Welding

Gas cylinders are to be stored outside a 15 metre radius of the wellhead and should be handled in a cradle to prevent the possibility of damage.

The cylinders should be stored and secured in an up-right position and capped unless they are in use. Ensure that cylinders that have been in use and are to be transported off location, have been recapped for transport.

The storage area at the location should be one that is free from grease or other lubricants, since these materials on the bottles and hoses will present a fire risk.

Cylinders should be stored in a protected location on the rig, out of the direct rays of the sun, outside any fire risk area, away from corrosive chemicals and out of work areas where they may be exposed to sparks or naked flames.

The cylinders are never to be used as rollers or supports for other equipment.

It is important to match regulators and gauges correctly for the gas rig. Never allow an oxygen regulator to be used on an inflammable gas bottle, and ensure the rig personnel are familiar with colour codes for the appliance.

Never force threads or connections when breaking down or assembling the regulators. Always keep the thread area on bottles and regulators clean and away from harm when they are not in use. If leaks are to be explored, use a soap solution to detect any leak, not an inflammable solution. Don't permit any torch work using equipment that is leaking or defective in any other way.

Don't use oxygen as a source of compressed air or permit acetylene to escape into an enclosed space.

Ensure that the welder is experienced in the work that has been scheduled and that he is qualified to carry out the work. Supervise each job until inspection confirms that correct procedures for handling the equipment are being observed, and that the work is being carried out in accordance with the job detail.

Safety Responsibility

It is the responsibility of the operating company to provide its emergency response programme for the handling of toxic hydrogen sulphide gas that may be vented while drilling. The occurrence of the gas is to be fully reported in the daily log, and a full written report is to be made of each incident involving detection of the gas. The operating company may delegate duties for the safe handling of the gas to the Contracting Company Supervisor in any situation that involves its occurrence during drilling operations.

RIG SAFETY & EMERGENCY RESPONSE

PRODUCTION TESTING

Production Testing

Well testing is supervised by the Operator, and crews for drill stem testing are supplied by service companies who supply downhole tooling and specialise in these operations.

Contractor personnel are provided to assist in the operation, and the supervisor and or driller are generally required to run the downhole string with the assistance of a normal floor crew.

During the testing, the driller is retained to work the string. Reporting for a drill stem test is from the time the string reaches the downhole location in the well, until the test tool is brought back and laid down on the surface.

Some Operators have especially prepared emergency response procedures for test operations and these may be distributed on the location.

The supervisor will inform crews of their assigned duties in the event of any emergency.

Procedures

The Contracting Rig Supervisor is required to notify all crew and operator personnel that the tool is positioned down hole, and that testing is to commence.

The Contracting Rig Supervisor is required to ensure that;

- adequate signs are placed on the rig to inform personnel that all welding operations are suspended for the duration of the test, the signs should also warn that no naked flame is permitted on the location during this period.
- no smoking is permitted on the location during the test, either in or away from designated areas, smoking is confined to enclosed accommodation areas.
- fire fighting equipment that has already been strategically positioned should also reach the drill floor and the gas separator locations.
- all available water outlets and hoses have been run tested before the test is commenced.

The Operator may be obliged to provide self-sustaining breathing apparatus and gas masks on the location for test operations. Frequently one oxygen mask for every three personnel working on the test may be required.

Great care is required by crews working on the rig floor in order to ensure that no articles of equipment are permitted to slip down the hole. Maintain the drill floor so that all tools and other test tool items are handled away from the wellhead.

Drill stem tests are not scheduled to commence during hours of darkness and are programmed to be completed during daylight hours. An exception to this is allowed for wireline Formation Interval Testing.

Only persons directly connected with the test are permitted in the area of testing or on the drill floor. Test supervisors and service personnel conducting these tests are frequently working under difficult conditions, and are grateful for quiet assistance offered by drill crews.

RIG SAFETY & EMERGENCY RESPONSE**FIRST AID****First Aid at the Rig Site**

Personnel at the rig site are trained to perform First Aid in the event of an accident during operations, to assist an accident victim prior to any requirement for professional medical assistance.

A First Aid Certificate is a valuable qualification to have and can result in the saving of a life. All field personnel are encouraged to train for this certificate.

Emergency procedures (including communications with head office) need to be fully explained by the person in charge at a location and strictly adhered to.

All minor injuries should be treated and reported on an accident report form. It is important the accident victim complete a Workers Compensation Report Form as soon as possible after any accident that involves such a claim.

Basic First Aid for Wounds

Any break in the skin can become infected if it is not promptly treated and the first aid treatment should be aimed at preventing any such infection. Wash your hands before attempting any first aid.

Minor or Superficial Cuts, Scrapes or Scratches

Cleanse the wound with a clean gauze pad or cotton wool using warm soapy water or a mild disinfectant, making sure to wash away from the wound and not towards it.

Rinse after cleaning with clean water and dry.

Apply antiseptic spray, cream or lotion to cover the wound and hold a gauze pad firmly to cover the damage.

Tape or bandage the gauze firmly but not so tight as to interfere with circulation.

Do not use skimpy dressings but make sure the wound and surrounding area is adequately covered. Do not use cotton wool or adhesive tape directly to any part of the wounded area.

Deep or Extensive Wounds

Control the bleeding using a clean gauze pad and pressure over the wound.

If one pad becomes saturated place another on the top of the first pad and continue to apply pressure.

When the bleeding stops bandage the wound firmly but not too tightly.

If bleeding from a wound on a limb continues unabated, apply pressure to the artery that supplies the limb.

Should this fail it may be necessary to apply a tourniquet. Once a tourniquet is applied it is not removed until a doctor has been called to the victim. It may be loosened for short periods from time to time on the advice of a doctor before he reaches the victim in order to permit circulation to the rest of the limb. A tourniquet is made of flat material about 5 cm. in width and is applied to the normal skin about 2.5 cm above the wound.

Obtain medical assistance as soon as possible.

Watch for any impending sign of shock and treat immediately if signs become obvious.

RIG SAFETY & EMERGENCY RESPONSE**Deep Puncture Wounds**

Encourage bleeding by applying pressure around the wound.

Rinse the wound with clean water and cover with a sterile pad held in place with tape or a bandage.

Seek medical assistance.

Wounds with Foreign Bodies - Metal, Sand or Glass etc.

Do not attempt to probe for foreign bodies but pick off any particles that may be obviously removed. It is better to cover the wound, including foreign bodies, using sterile gauze held in place with tape or a bandage.

Seek medical assistance as soon as is practical.

Injuries Caused by Crushing.

Lay the injured person down and cut away the clothing from the injury.

Control bleeding with gauze pads and treat the victim for shock.

Wrap the injury with gauze pads and bandage well. Keep the injured part of the body elevated.

If a fracture exists, splint the limb before moving the victim.

Request immediate medical attention.

Fractures

Fractures may be either simple or compound. In the case of the simple fracture a bone may be broken but the skin is not pierced.

Compound fractures are generally more serious and involve broken bones with piercing of the skin. In these cases there is likely to be a wound above the break with bleeding, and the bone end may protrude from the skin.

Fractures may be recognised;

- where a victim heard the bone snap and can feel grating,
- where pain or tenderness exists in the region of the break,
- where partial or complete loss of the use of the limb exists,
- where there is deformity in the limb or
- where the limb is abnormally positioned or shows swelling or discolouration.

If a fracture is suspected, treat it as the real thing, unless a doctor tells you otherwise.

Where possible place a bag of ice over the fracture and seek immediate medical assistance.

Do not move the injured person more than is necessary.

If the injured person needs to be moved, it is first necessary to apply splints to immobilise the limb. Handle slowly and gently onto a stretcher.

In case of a compound fracture, the wound is covered with gauze or a clean cloth and pressure is applied to control the bleeding before any required splinting is applied. Never attempt to push a protruding bone back into place.

RIG SAFETY & EMERGENCY RESPONSE**Burns & Scalds**

Burns and scalds are classified in degrees of severity.

- First Degree Burns are where the skin is reddened
- Second Degree Burns are where blistering occurs
- Third Degree Burns are where skin is charred or cooked.

First aid in the treatment of burns should be aimed at relieving pain, preventing infection and preventing or treating for shock.

There are a number of important 'DON'TS' associated with the treatment of burns:

- don't touch the burn with anything that is not clean.
- don't use butter, oils or boric, tannic or picric acid based ointments.
- don't put absorbent cotton or blankets directly on a burn with broken skin.
- don't break or drain blisters.
- don't delay first aid treatment for shock in cases of serious burns.
- don't delay obtaining professional medical assistance.

Treatment of First Degree Burns

Apply antiseptic- analgesic burn ointment, cover with a sterile gauze pad and bandage firmly

Treatment of Second Degree Burns

Administer first aid for treating shock

If the victim is conscious and thirsty and there are no abdominal wounds it is advisable to give, freely, a weak saline and bicarbonate of soda solution. Prepare the solution using half a teaspoon of bicarbonate and two heaped teaspoons of salt in a litre of water.

Remove clothing from the burn, being careful to cut around any cloth sticking or fused to the burn.

Cover the burn area with sterile gauze or a suitable substitute such as a freshly laundered sheet or pillowcase.

Make the victim comfortable and warm while seeking immediate professional medical assistance.

Third Degree Burns

Immediately administer treatment for shock.

Do nothing to the burn but cover it with sterile gauze pads or cloth.

Seek immediate professional medical treatment for the victim.

RIG SAFETY & EMERGENCY RESPONSE

Treatment for Shock

Shock is a serious depression of vital functions that can often accompany even moderate injury.

In all cases of severe injury, first aid for shock should be given immediately. It is important not to wait for shock to develop but to act immediately by keeping the victim lying down, warm and with an adequate supply of fluids.

All or any of the following symptoms may be present immediately following an accident, or may develop over a period of time after the event:

- weakness, faintness, mental sluggishness or collapse,
- paleness with cool or clammy skin,
- drooping eyelids, eyes vacant and dull or dilation of pupils,
- rapid and shallow breathing,
- nausea and/or vomiting,
- rapid, irregular or weak pulse, or pulse too weak to feel, or
- unconsciousness.

Lay the victim on his back with the face upward.

Loosen clothing and elevate the feet about 30 to 50 cm. or, for a head injury elevate the head instead of the feet. For chest injuries and breathing difficulties elevate head and shoulders

Keep victim comfortable and warm with top and bottom blankets.

In hot weather do not make the victim uncomfortably warm.

Conscious victims without abdominal wounds should be provided as much fluid as is comfortable for them to take, provided they are not nauseous or vomiting.

A teaspoon of baking soda with half a teaspoon of salt in a litre of water is suitable as a fluid, or orange juice and other soft fluids may be used.

No alcohol or stimulants should be administered.

Attend any injuries and keep the victim quiet and comfortable while waiting for professional medical assistance.

Responsibility

First Aid practiced at a drilling location is the responsibility of the Rig Safety Officer who is trained as a First Aid Orderly.

The Rig Safety Officer is responsible for carrying out first aid on any victim injured at the location, for the dispatch of any seriously injured victim in an accident, and for the requesting of medical assistance for the victim of an accident.

The Rig Safety Officer is also responsible for reporting accidents and dispatching all correspondence associated with the incident at the location.