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GREAT SOUTH LAND MINERALS PTY LTD

STRATIGRAPHIC SLIMHOLE DRILLING PROGRAM

SORELL #1

WELL PLAN

AUGUST 1997

SOREELL #1 WELL PLAN

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GREAT SOUTH LAND MINERALS P/L 65 Murray Street Hobart TAS 7000 TEL: (03) 6231 9339 FAX: (03) 6231 9338

SOREll #1 WELL PLAN

1. INTRODUCTION

Sorell #1 is located on the southern side of the Arthur Highway about 2.5km east of Forcett.

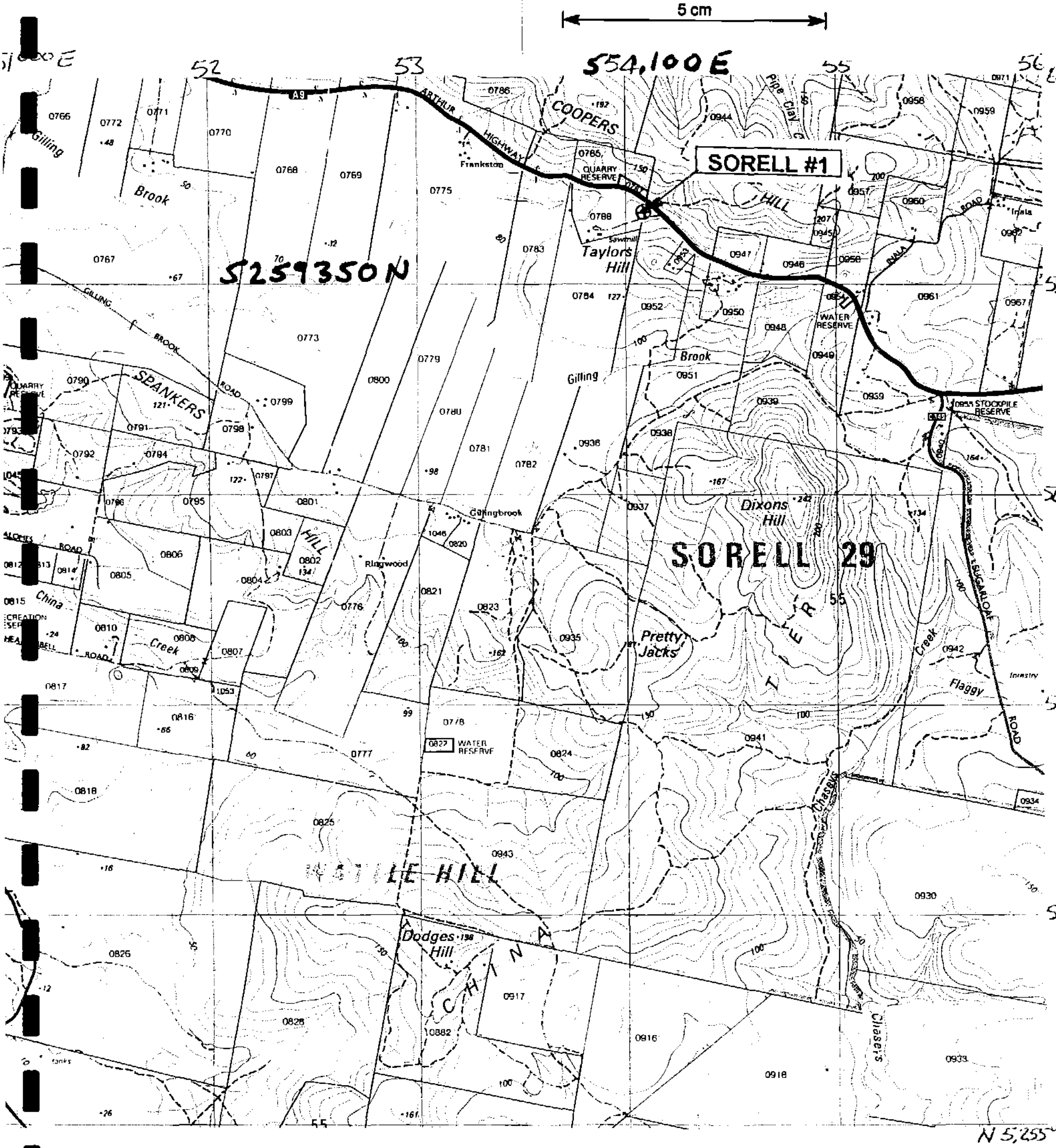
Further details can be found under *Geology* Section 2.1 *Well Prognosis.*

1.1 Well Data Summary

State:	Tasmania
Location:	Forcett
Municipality:	Sorell
Licence No:	EL 1/88
Well Name:	Sorell #1
Coordinates:	554,100 E 5,259,350 N
Elevation:	110m ASL
Datum:	Footclamps
Drill Rig:	Longyear 44
Planned Spud Date:	TBA
Planned Depth:	1200 m (see prognosis)

SORELL #1 WELL PLAN

1.2 Location Map from TASMAP 1:25000 Series



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SORELL #1 WELL PLAN

2.1 Well Prognosis - prepared by Dr. Clive Burrett, Chief Geologist, GSM

Geology

We intend to drill an approximately 1200m DDH into a faulted domal structure at Taylors Hill 2km from Forcett and about 11km ENE from Hobart Airport south of the Arthur Highway at grid reference EN541594 (see Carlton 5425, topographic 1:25000 map sheet). The geology of the area is well mapped by Gulline (1982) on the Sorell 1:50,000 map sheet and described in Gulline (1984). Dips on the dome range from 3-7 and average about 5 degrees. Tertiary basalt flows are nearby and some Tertiary basalt intrusions may be encountered at depth.

The stratigraphic sequence is expected to be:

Ferntree Mudstone Fm 130m approx.
Risdon Sandstone correlate 5m
Malbina Fm sandstones and siltstones and mudstones 70m
Cascade Gp fossiliferous calcareous siltstones and mudstones, limestone lenses 80m

Dolerite Sill about 350m thick (position unknown)

Faulkner Gp freshwater sandstones and siltstones 100m thick
Bundella Fm 60m
Woody Island Fm (with possibly Tasmanite Oil Shale) 80m
Truro Fm tillite 200m approx.

wwwwwwww unconformity wwwwwwwwwww

Mathinna Gp turbiditic sandstones and slates or Precambrian phyllites and quartzites

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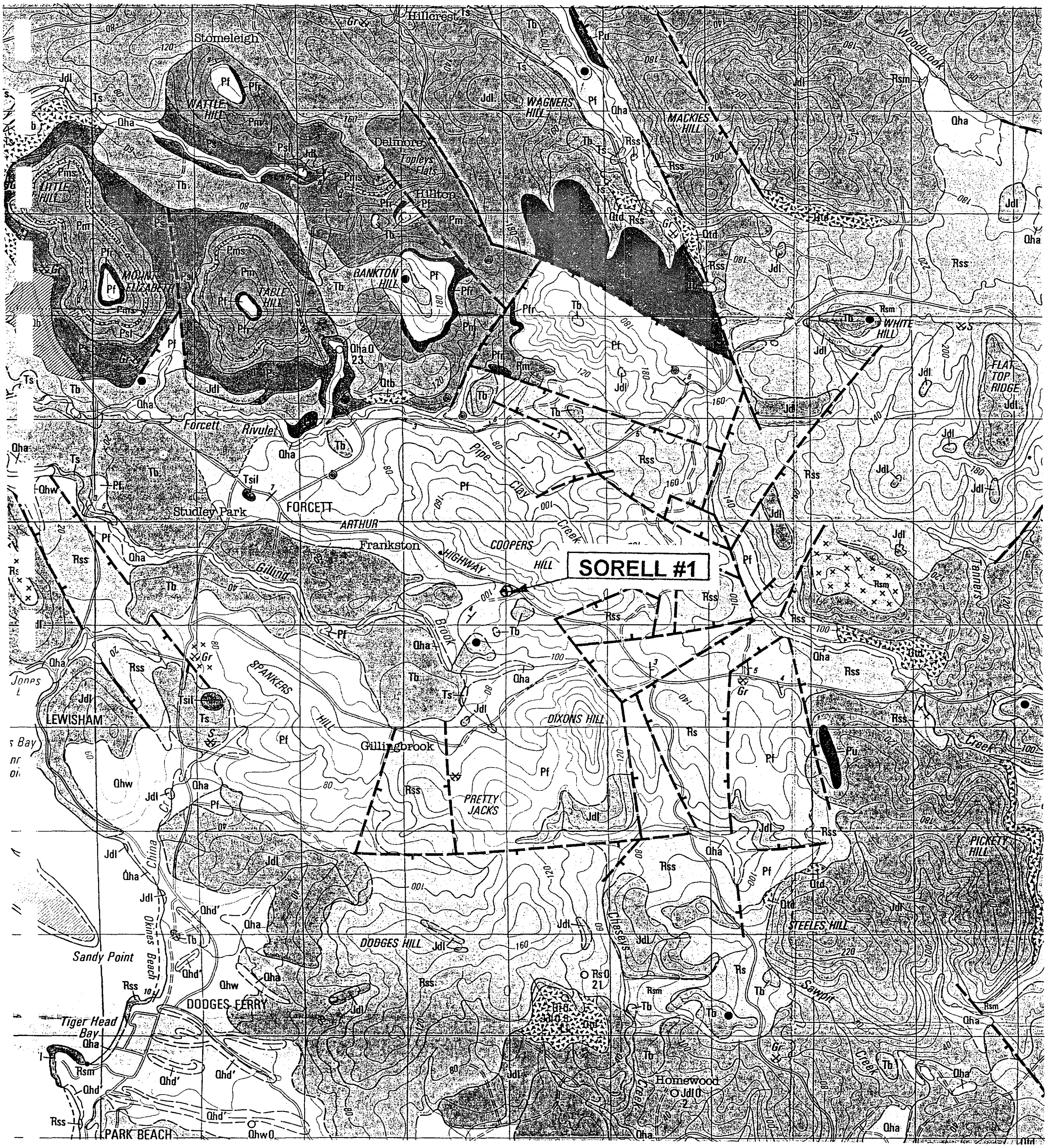
SORELL #1 WELL PLAN

2.2 Geological Map SORELL 1:50000 Series



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5 cm

3. ENVIRONMENTAL MANAGEMENT

Great Southland 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 APEA 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

Sorell #1 is situated on the private property 'High Park' belonging to Mr. Chris Collier. Initial discussions have been held with Mr. Collier, although no final agreement has been reached with respect to drilling operations.

3.2 Site Access

The planned drillsite is just inside the entrance to 'High Park' off the Arthur Highway. No vegetation would need to be cleared, and a gate would be installed in the existing fence line.

3.3 Wellsite Preparation

Mobilisation of the drilling equipment at Sorell #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 west 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.

3.4 Wellsite Operations

Water for drilling operations will be sourced from an existing farm dam, about 30m west of the proposed drillsite. Waste water run-off will be directed through silt traps to the small creek downstream of the dams. Based on previous experience, mud chemical use should be limited to liquid polymer for viscosity and caustic soda for pH correction, with the resulting fluid being environmentally friendly. Drill fluids are recirculated within a closed system.

Calcium and potassium 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.

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SORELL #1 WELL PLAN

4. DRILLING PROGRAM

All diamond drilling operations will be carried out using the Heavy Duty Longyear 44 drillrig currently in use at Lonnavale. The mast on this rig has been strengthened to carry a safe working load of 20 tonne, and the winch has been double reeved and fitted with a 20t snatch block. The power unit has been replaced with a 180 HP Cummins diesel, and a new Hydro Chuck fitted. This rig now has the capacity to drill a BQ hole to 1800m, an NQ hole to 1300m, and an HQ hole to 800m.

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

The hole will be pre-collared to a depth of up to 300m depending on the competence of rock encountered. This work will be carried out using a 6 inch down hole hammer, and will be cased with 100mm NB fully welded API rated pressure pipe. The hole will then be drilled 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 a planned total depth of around 1200m.

4.1 Outline Summary

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

The Longyear 44 drillrig will then be set up over the hole on a 2.1m high steel subframe and work will continue in accordance with the following program:

- Weld 4 1/16" 5M 6B flange to top of casing and nipple up BOP stack.
- Pressure test casing and BOP as per testing and safety procedures.
- Run in HQ string and drill out cement plug and casing shoe.
- 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 will be 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

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

The casing will be supplied in 12m lengths with bevel preparation at each end for full strength butt welds. The pipe will be 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 will then be attached at the top of the casing to allow circulation and flushing of the annulus. The casing will then be cemented using Normal Portland cement mixed at the rate of 35 bags per cubic metre, and circulated until grout of the same consistency emerges from the top collar. The area surrounding the wellhead will be 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 either Kerry Booth or John Trevitt of Baroid for advice.

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SORELL #1 WELL PLAN

4.4 Well Diagram and Volumes

Depth

6m

SURFACE CONDUCTOR 200mm
HOLE SIZE 225mm

300m

HW CASING 114.3mm
HOLE SIZE 139.7mm
CAPACITY 15.33 litres/metre
ANNULUS VOLUME 5.07 litres/metre
ROD CAPACITY 8.22 litres/metre
ANNULAR VELOCITY 25 metres/minute
PUMP RATE 127 litres/minute

800m

HQ RODS 88.9mm
HOLE SIZE 96.1mm
CAPACITY 7.25 litres/metre
ANNULUS VOLUME 1.04 litres/metre
ROD CAPACITY 4.75 litres/metre
ANNULAR VELOCITY 25 metres/minute
PUMP RATE 26 litres/minute

NQ RODS 70mm
HOLE SIZE 76mm
CAPACITY 4.53 litres/metre
ANNULUS VOLUME 0.70 litres/metre
ROD CAPACITY 2.86 litres/metre
ANNULAR VELOCITY 25 metres/minute
PUMP RATE 18 litres/minute

1200m

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SORELL #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 may 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.

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6. TESTING AND SAFETY PROCEDURES

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

Drilling Supervisor: David Tanner - IWCF Certificate S7253/AU260/0069 expires 17/5/98

Senior Driller: Dale Roberts - IWCF Certificate D4822/AU260/0023 expires 18/5/98

6.1 BOP Testing Procedures

(a) Following nippling 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 annulus 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 1500 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.

SORELL #1 WELL PLAN

7. COMMUNICATIONS AND REPORTING

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

David Tanner
Exploration Manager
Great Southland Minerals Pty Ltd
Level 3
65 Murray Street
HOBART TAS 7000

Telephone: (03) 6231 9339
Mobile Phone: 019 973 134
Facsimile: (03) 6231 9338

Operational reporting, including Daily Logs and goelogical reports will be forwarded to Mineral Resources Division of TDR on a regular basis.

SORELL #1 WELL PLAN

8. PLANT AND EQUIPMENT DETAILS

8.1 LONGYEAR 44 DRILL RIG DESCRIPTION

DRILL:	Skid-mounted Longyear 44 Hydraulic Chuck Diamond Drill with hydraulic jacking rams and full weatherproof enclosure.
MOTOR:	Cummins 6BT turbocharged diesel delivering 177 HP @ 2500 rpm
MAST:	2-Section 9m rod pull length with pipe stacking rack and hydraulic mast raising cylinder.
WIRELINE HOIST:	Hydraulic drum hoist with 2000m capacity of 6mm cable. Maximum line pull 5kN.
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)
RIG DIMENSIONS:	Collapsed for transport: 6m long x 2.5m wide x 3.5m high x 10 Tonne

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.

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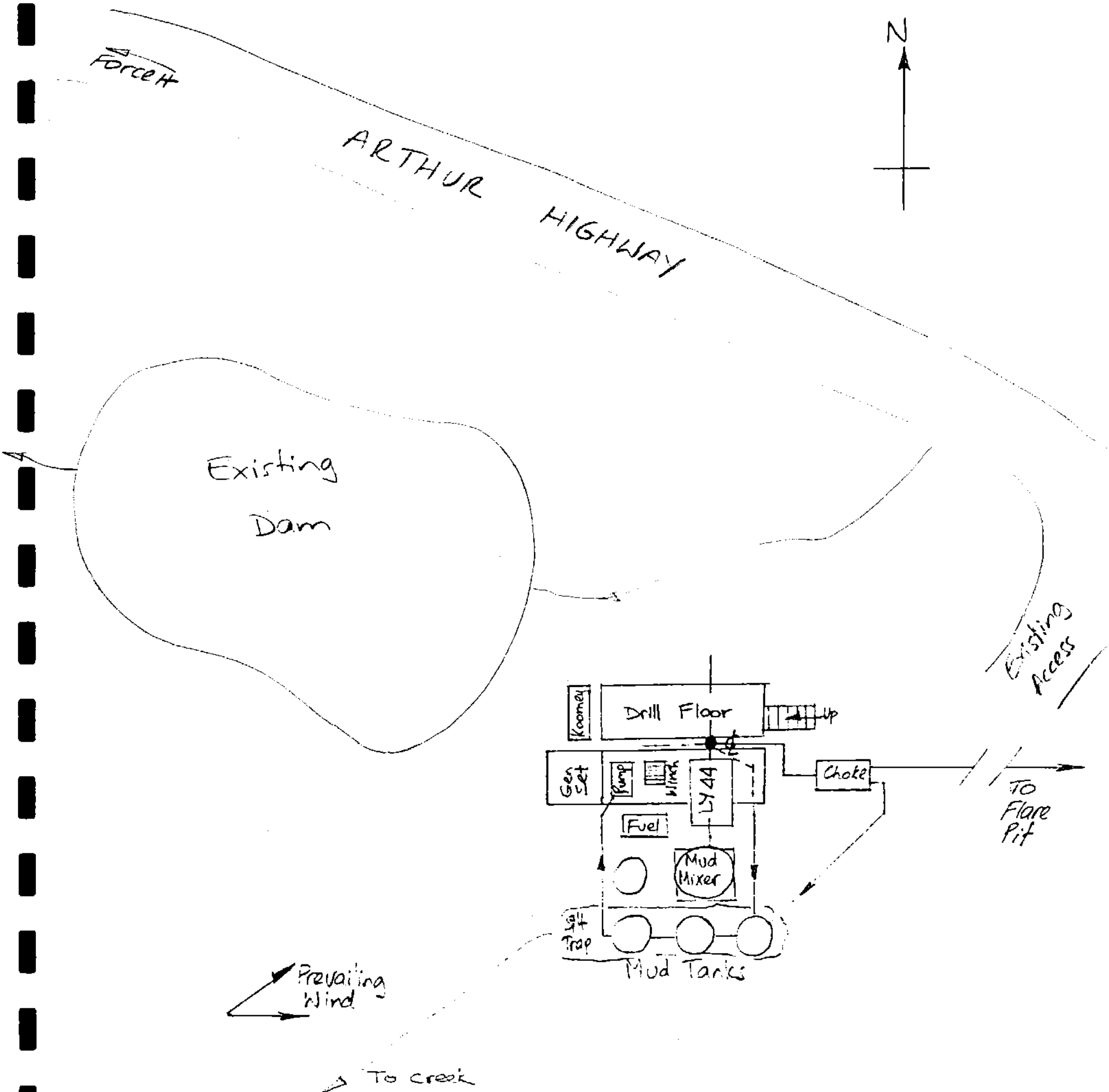
8.3 Site Plan



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Appendix 1

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GREAT SOUTHLAND MINERALS PTY LTD

STRATIGRAPHIC SLIMHOLE DRILLING PROGRAM

Standard Manual for

BLOWOUT PREVENTION AND WELL CONTROL
RIG SAFETY AND EMERGENCY RESPONSE

FEBRUARY 1997 EDITION

BLOWOUT PREVENTION AND WELL CONTROL

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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 which effectively prevents a situation from becoming unmanageable.

Where practical a well plan should identify those intervals in the well which have a history of abnormal formation pressure manifested either as lost circulation, as highly compacted and sloughing sediments or as highly pressured fluids which may cause a problem to the normal drilling activities undertaken. 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 the drilling programme, economy 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 on all operations to secure well control.

The first responsibility of a rig crew in an emergency is to preserve personnel at the site from injury or loss of life. 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 specification of equipment employed for safe handling of an emergency response as well as the necessity for communicating all appropriate details through correctly identified channels. Communication procedures for crews are those which 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 tor 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/cm^2 / metre and subnormal when less than this. Abnormal over-pressured formations may be in excess of 0.2353 kgf/cm^2 / 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 geo-tectonic 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 which may be employed when planning a well, and there are a series of well documented indicators tor 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 which 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 such a situation.

BLOWOUT PREVENTION AND WELL CONTROL

Primary indicators are:

1. Increase in pit volume
2. Increase in flow rate
3. Well still flowing after turning pump off

Other indicators are listed as follows:

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

Secondary indicators which may forewarn of a kick include:

increasing contamination of the drilling fluid by gas (gas cut mud)
variation in mud chlorides indicating water cut mud
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 which 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 hole.

Less frequently, and often together 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 for control 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 and they can damage zones for investigation.

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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 all assist the driller to calculate and confirm that the volumes to replace the displacement are correct.

An oil saver-wire line stripper connected to the top drill rod recovers mud from a travelling wire line and provides blow out protection when retrieving the inner core tube. However, this operation is carried out with flow check procedures outlined in the section Flow Checks for Core Drilling.

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 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 which may frequently arise in shallow or un-consolidated beds and in deeper rocks which 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. Lost circulation is particularly hazardous when zones with pressure higher than the hydrostatic pressure of the mud column which stabilises after the losses become exposed and push fluids into the well.

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.

If lost circulation occurs while a kick is being handled with pressure on the preventors, 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 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/cm^2 / metre.

If an 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.

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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 are 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 100m of annulus while drilling, or 24m 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 rate for 1-2 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 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 1-2 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 1-2 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 1-2 mins. via by-pass
ensure the well has stabilised before completing the flow check

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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 which characterises the operation from other wireline activities in conventional drilling practice. Two adopted procedures are designed to prevent accident when pulling core.

> A wireline Oil-saver 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 which 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 Preventers is 750 psi. An equipment list and diagrams for the BOP equipment are shown in the Appendices.

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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 which 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 which is useful for preparing a well kill data sheet, has 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 which 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 which describe the parameters used in these calculations.

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

CSPL = P(surface) + P(drill string) + P(core barrel) + P(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 lo 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 is described in the ODCAA Well Control Manual which is in the tool house at the location.

A well which has been shut in may be then 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 which 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 which plots the number of pump strokes and/or time vs 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.

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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 back pressure 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 back pressure 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 apply when selecting the method for controlling a well.

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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$\frac{1}{16}$" GKS 5000 Annular Preventer with 4$\frac{1}{16}$" 5M flange, complete with replacement element and seal kit. P/N 45931, S/N 63820

Gate Valve 4$\frac{1}{16}$" 5M API rated full opening GREYGATE flanged valve.

Drilling Spool 4$\frac{1}{16}$" x 2$\frac{1}{16}$" 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$\frac{1}{16}$" 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 preventor equipment to be tested in accordance with such regulations requires that annular type blowout preventors 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 preventors and rams shall be function tested on each round trip or 24 hour period, which ever 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 preventor.
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 preventor.
3. Closing unit shall be connected to the blowout preventors 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 preventor 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.

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RIG SAFETY AND EMERGENCY RESPONSE

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RIG SAFETY & EMERGENCY RESPONSE

Emergency Response

9:1:1. 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 which may arise out of contracting operations from time to time, and for the laying down of guide lines 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.

Company contractor personnel are then 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, have prepared an Emergency Response Manual which covers those 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 Company 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 Malcolm Bendall
Tel. 0362 25 0542 Mobile 018 120 659 After Hours 0362 25 0542

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

The Immediate Senior at the Contracting Company in these circumstances is Mr David Tanner
Tel. 0362 31 5677 Mobile 019 973 134 After Hours 0362 31 5677

Your immediate reports then are:
1. Operation Site Representative
2. Contracting Company Superior

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

RIG SAFETY & EMERGENCY RESPONSE

9:1:2. 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

Contracting Emergency Staff Team:

1. Drilling Manager	Mr David Tanner
2. Senior Drilling Supervisor	Mr Dale Roberts
3. Co-ordinator 24 hour contact	Mr David Tanner

9:1:3. 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.

Supply

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 detail an Emergency Response Co-ordinator to supervise the operations and it is important the Great Southland Minerals Pty Ltd emergency staff act through his instructions.

Emergency Response

This Co-ordinating Supervisor has ultimate responsibility and will be making the decisions which 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

9:2:1. 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, and preparation notices must always be requested for these activities so there is no breach of any regulation and so supervision is prepared for the job.

Sources for ignition

It is recognised that most of the hazards surrounding the occurrence of fires stems from lack of attention on the part of personnel to preparation and care on a job. Consideration for any sources of ignition during the carrying on of an activity and exclusion of the hazard potential through job preparation will lower the risk for accidental fire considerably. 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 grounding, or overloading.
5. Electrical faults; incorrect wiring or fuse placement
6. Electrical faults; short circuits or unprotected installations.
7. Smoking in non-designated areas.

9:2:2. 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

9:2:3. Rig Fire Prevention

It is the responsibility of the Operating Company Supervisor to ensure that fire prevention and safety procedures are carried out on a location to the satisfaction of his companies 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.

A Contracting Rig Supervisor should instruct crews of the following rig fire prevention responsibilities;

- Ensure that the fire prevention procedures are introduced and displayed at the rig and are given attention in Safety Meeting Agendas.
- Ensure that Fire Station notices are well prepared and displayed conspicuously around the rig. These notices contain equipment details and duty information for personnel.

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Rig Safety
Ensure that 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 are required to sign a log book to acknowledge that they have been instructed in fire prevention and rig safety in general.

All visitors to the rig are to be made aware of restriction notices and safety regulations operating at the site.

All fire extinguishers required under the regulations are to be correctly positioned at the site, are to be reported as inspected and operational at the commencement of drilling operations, and thereafter every three months.

Smoking is only permitted in designated areas.

Electrical installations are to be inspected by a qualified electrician before the commencement of drilling operations and then following the installation of any replaced or additional new electrical installation.

Compressed gas cylinders are not to be operated unless the are installed with gauge and pressure regulating equipment.

Spilled hydrocarbons are to be immediately recovered, even if it is necessary to curtail operations in doing 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 to be left around the location, but deposited in designated refuse containers on site.

9:2:4. Responsibility
The Contractor Supervisor and each service company senior representative is responsible for his unit and personnel safety.

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

This responsibility may be shared by the operator supervising staff 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 supervisor is required to inform the Operator and proceed to notify his company emergency staff that back-up equipment is required forthwith.

9:2:5. Cutting & Welding
Authorisation for welding jobs are provided by the contracting 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.

Ensure that the welder fully understands the work, that he is qualified to carry it out and that fire equipment is on hand.

RIG SAFETY & EMERGENCY RESPONSE

Rig Safety

9:2:6. Inspection
During pre-operation inspection, 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 which 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 should be thoroughly cleaned to remove as far as possible any residue which 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.

- 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.

- Make sure 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 will need to be sought from a higher authority.

9:2:7. Welding in Confined Spaces
Welding in confined spaces will require that the supervisor ensures;

- 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 other observer is in attendance while the job is in progress and that the welder has a life-line 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.

- Where-ever possible, positive closures such as blind flanges, bull plugs or locked valves are employed on pipe lines entering confined spaces while this work is in progress.

RIG SAFETY & EMERGENCY RESPONSE

Rig Safety

9:2:8. The Use of an Observer

Welding operations on the rig unit and within a 15 meter radius of the well head 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 occasion.

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

9:2:9. Electric Arc Welding

Inspection by the supervisor should ensure that:

- The welder on the job is experienced and qualified to carry on the work which has been planned.
- The welding equipment, leads, ground terminals and the environment where the work is to be carried on 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.

9:2:10. 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 are necessary and should cover the whole body below a mask.

Shirt sleeves are to be rolled down.

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 also be provided.

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

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RIG SAFETY & EMERGENCY RESPONSE

Rig Safety

9:2:11. Oxy - Acetylene Flame Cutting and Welding

Gas cylinders are to be stored outside a 15 metre radius of the well head 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 which have been in use and are to be transported off a 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 for jobbing to act 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 lea, not an inflammable solution. Don't permit any torch work using equipment which is leaking or defective in any other way.

Don't use oxygen as a source for 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 on the work. Supervise each job until inspection confirms correct procedures for handling the equipment are being observed, and that the work is being carried out in accordance with the job detail.

9:2:12. Safety Responsibility

It is the responsibility of the operating company to provide its emergency response programme for the handling of toxic hydrogen sulphide gas which 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 Contractor Rig Supervisor in any situation which involves its occurrence during drilling operations.

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RIG SAFETY & EMERGENCY RESPONSE

Production Testing

9:3:1. Production Testing
Well testing is supervised by the Operator, and crews for drill stem testing are supplied by service companies who supply down hole 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 down hole string with the assistance of a normal floor crew.

During the testing, the driller is retained to work the string. Reporting tor a drill stem test is from the time the string reaches the down hole 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 tor 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.

9:3:2. Procedures
The Contractor 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 supervisor is required to ensure that;

- adequate signs are placed on the rig to inform all 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 only,
- fire fighting equipment which has already been strategically positioned should also support the drill floor and the gas separator locations and
- all available water outlets and hoses need to be run tested before the test is commenced.

The Operator is often obliged to provide self sustaining breathing apparatus and gas masks on the location in many areas for test operations Great Southland Minerals Pty Ltd may be requested to provide this equipment in the event and should have access to and be able to supply the necessary items. Frequently one oxygen mask tor every three men working on the test will be required.

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

Drill stem tests are not scheduled to commence during hours of darkness and are programmed to be completed during daylight hours. This is not the case for wire line Formation Interval Testing however.

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

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RIG SAFETY & EMERGENCY RESPONSE

Basic First Aid

9:4:1. 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 additional professional medical assistance.

A First Aid Certificate is a valuable qualification to have and can result in the saving of a life. All crew personnel are encouraged to train for this certificate, and are assisted by contractors to obtain the 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.

Even 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 which involves such a claim.

9:4:2. 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 stopping any such infection from happening. 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 which 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.

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RIG SAFETY & EMERGENCY RESPONSE

Basic First Aid

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 which may be obviously removed. It is better to cover the wound, including foreign bodies, using a 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.

9:4:3. 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.

First Aid Treatment
Do not move the injured person more than is necessary.

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

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

Treat for Shock After the Injury
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.

Basic First Aid

9:4:4. 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 which is not clean
- don't use butter, oils or boric, tannic or picric acid based ointments
- don't but 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 2 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 pillow case.

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.

Basic First Aid

9:4:5. 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 and 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.

Treatment

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.

9:4:6. 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 Officer is responsible for carrying out first aid on any victim injured at the location, for dispatch of any seriously injured victim in an accident, and for the requesting of medical assistance for the victim of an accident.

This person is also responsible for reporting accidents and dispatching all correspondence associated with the mishap at the location.

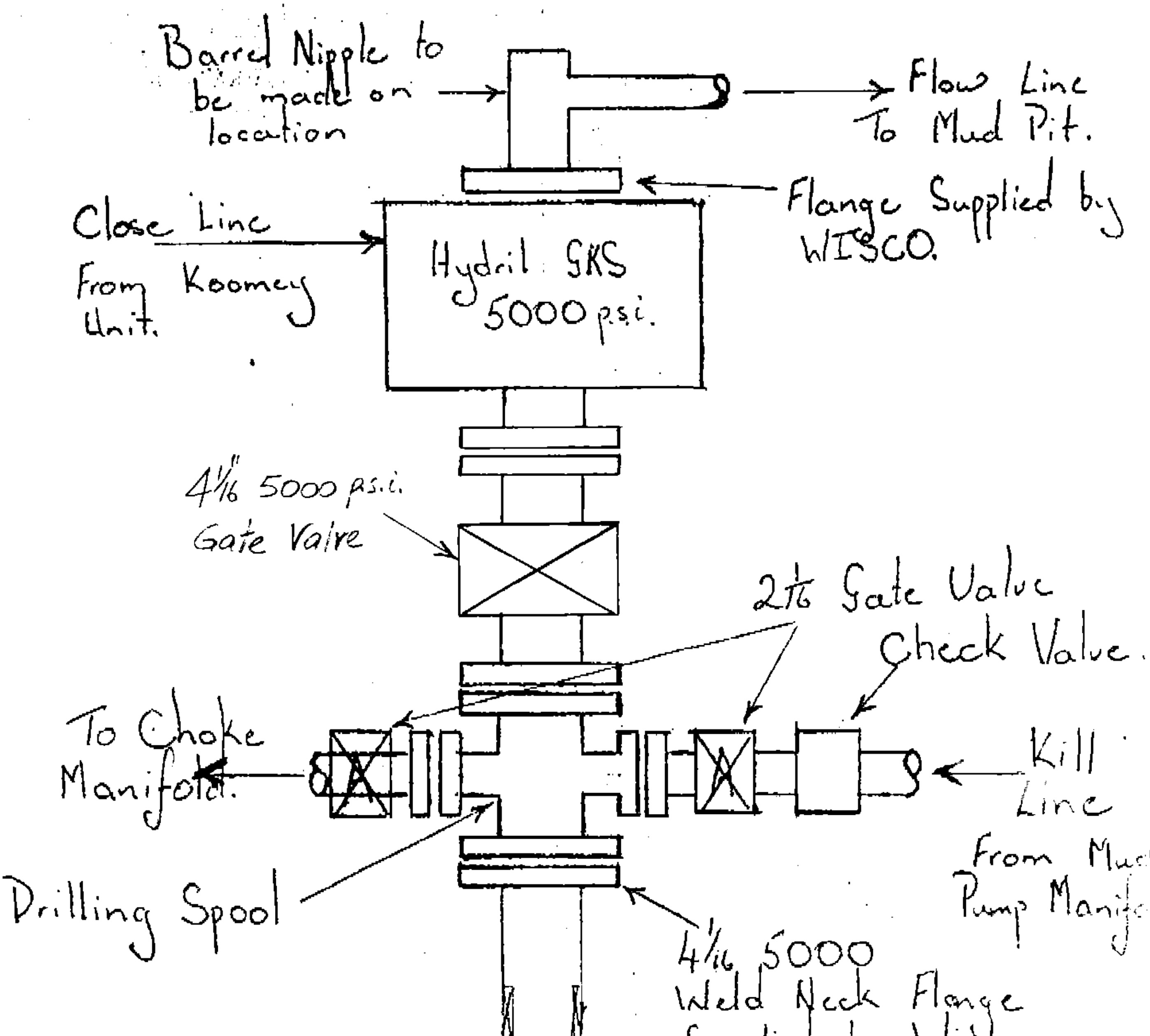
STRATIGRAPHIC SLIMHOLE DRILLING PROGRAM

BLOWOUT PREVENTION AND WELL CONTROL
RIG SAFETY AND EMERGENCY RESPONSE

APPENDICES

WORKING SKETCH OF BOP, DIVERTER & KILL LINE
DIAGRAMS OF HYDRIL BOP CLOSING UNIT
WORKING SKETCH OF CHOKE MANIFOLD

Well Head



All studs, nuts and ring gaskets to be supplied by WISCO.

HYDRIL®

TYPE GKS ANNULAR BLOWOUT PREVENTER/STRIPPER

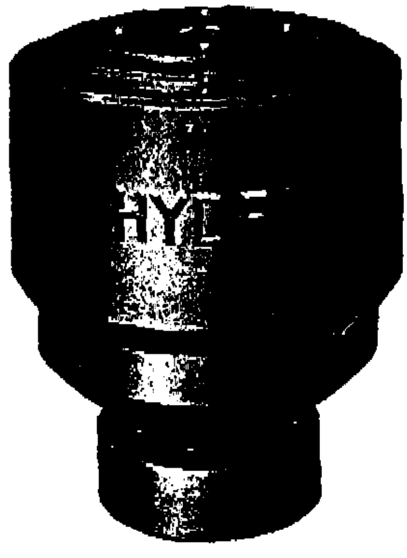


Figure 94
Exterior View of $2\frac{9}{16}$"-10,000 and $4\frac{1}{16}$"-5000 and 10,000 psi GKS BOP/Stripper

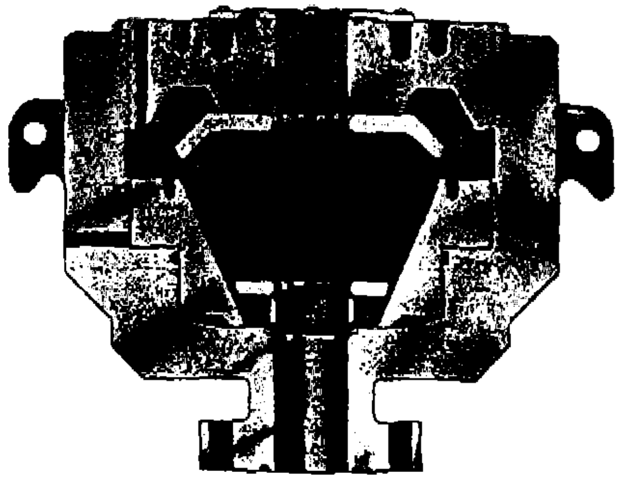


Figure 95
Cross-Section of $2\frac{9}{16}$"-10,000 and $4\frac{1}{16}$"-5000 and 10,000 psi GKS

OPERATION OF THE GKS

The GKS Annular BOP/Stripper is an annular BOP with particular application to workover operations. This BOP/Stripper is especially applicable for stripping, snubbing, stuffing, and wireline operations. The packing unit will seal off around any diameter within the bore or seal off the open hole to rated working pressure.

Hydraulic pressure applied to the closing chamber raises the piston squeezing the packing unit into a sealing engagement. Closing pressure should be proportionally reduced as well pressure is increased. Optimum packing unit life will be realized by using the lowest closing pressure required to effect a seal. Initial closing pressures are in Table 22. The GKS BOP is self opening, thus it reopens when all closing pressure is released.

When two GKS BOPs are used one above the other, as in a lubricator installation, higher closing pressure will be required to close the lower unit. The pressure required will equal the normal closing pressure plus the amount of pressure above the packing unit.

The GKS BOP has a screwed head. The top and bottom connections of the 2"-3000 and 2"-5000 are furnished with API $2\frac{7}{8}$" OD external upset female tubing thread. The $2\frac{9}{16}$"-10,000, $4\frac{1}{16}$"-5000 and $4\frac{1}{16}$"-10,000 BOPs are provided with an API studded top connector and API flanged bottom connector.

STRIPPING

Stripping, snubbing and stuffing pipe and tubing can be rotated and tool joints or tubing connections can be safely stripped through the sealed off GKS packing unit. The closing pressures should be low enough to permit a slight leakage of drilling/completion fluid as the tool joint or tubing connection passes through the closed packing unit. This fluid lubricates the packing unit to minimize wear.

As a larger diameter connection passes through the closed packing unit it expands. The hydraulic pressure surge caused by the packing unit expansion should be controlled by a responsive pressure regulator valve. Better pressure surge control may be achieved with the application of an accumulator to the closing line. Precharge the accumulator to one-half the required closing pressure. Controlling the rate of stripping connections through the unit will allow a pressure regulator valve to more effectively limit pressure surges.

TESTING/PISTON STROKE MEASUREMENT

Routine functional testing of the GKS BOP can be carried out with long packing unit life if proper operating procedures are followed. Table 22 gives the closing pressure (psi) required to establish initial seal off in GKS blowout preventers. The pressures given in these tables are guidelines. Maximum packing unit life will be obtained by using the lowest closing pressure that will effect a seal.

To obtain maximum packing unit life, use the recommended closing pressure and test pipe diameter. For example, on a GKS $4\frac{1}{16}$"-5000 BOP, use 450 psi on $3\frac{1}{2}$" drill pipe to establish initial seal off. Reduction of closing pressure after stabilization of test pressure reduces rubber stress and increases packing unit life.

The piston stroke has a direct correlation to the condition of the packing unit. Hydril Annular Blowout Preventers are equipped with a drilled passage in the head of the BOP through which piston stroke can be measured. The condition of the packing unit can be determined by measuring the piston stroke on a new packing unit, using the appropriate test pipe diameter, and taking subsequent measurements each time the BOP is tested. The remaining life of the packing unit is proportional to the amount of piston stroke left.

If full stroke of the piston is reached before a seal is obtained, the packing unit should be replaced since any further increases of closing pressure will not cause it to seal off.

Figure 96
Exterior View of 2"-3000 and 5000 psi GKS

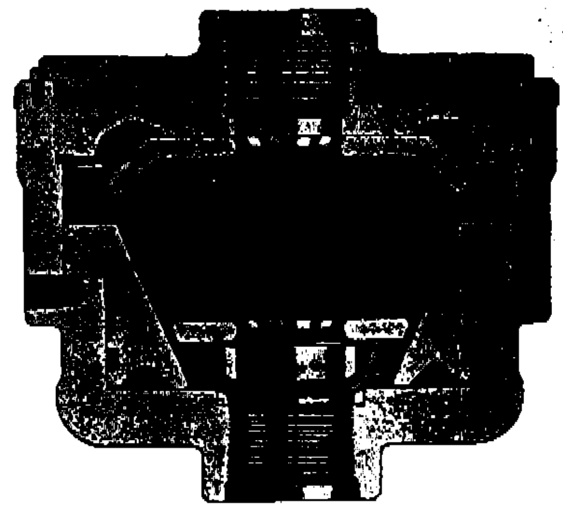


Figure 97
Cross-Section of 2"-3000 and 5000 GKS

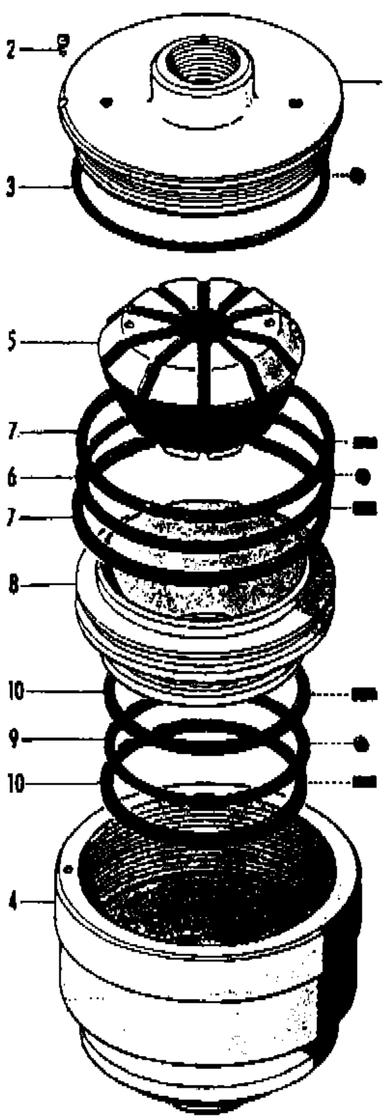


Figure 98
Exploded View of GKS BOP/Stripper

TABLE 22
INITIAL CLOSING PRESSURES (PSI) FOR GKS BOP/STRIPPER

Pipe OD Inches	2-3000, 2-5000	$2^{9}/_{16}$-10,000	$4^{1}/_{16}$-5000 $4^{1}/_{16}$-10,000
[redacted]	—	[redacted]	450
[redacted]	—	[redacted]	525
[redacted]	—	[redacted]	675
[redacted]	500	[redacted]	800
[redacted]	550	[redacted]	875
[redacted]	700	[redacted]	950
[redacted]	1150	[redacted]	1200

Note: For maximum service life of the Hydril Packing Unit, the closing pressures shown in the table above should be used. Higher pressures (never to exceed 1500 psi) will provide slightly faster closing speeds, but will reduce packing unit life. Test closures should be made to realize optimum packing unit life.

TABLE 23
ENGINEERING AND PHYSICAL DATA— GKS BOP/STRIPPER

Size and Working Pressure Rating, psi	Full Open Bore	Height	Body Diameter	Weight (Lbs.)	Piston Stroke, Inches	U.S. Gallons For Full Piston Stroke
[redacted]	$2^{9}/_{16}$"	[redacted]	$12^{15}/_{16}$"	[redacted]	$1^{9}/_{16}$	[redacted]
[redacted]	$2^{9}/_{16}$"	[redacted]	$13^{1}/_{2}$"	[redacted]	$1^{9}/_{16}$	[redacted]
[redacted]	$2^{9}/_{16}$"	[redacted]	$17^{1}/_{2}$"	[redacted]	$1^{3}/_{4}$	[redacted]
[redacted]	$4^{1}/_{16}$"	[redacted]	$25^{3}/_{4}$"	[redacted]	$2^{3}/_{8}$	[redacted]
[redacted]	$4^{1}/_{16}$"	[redacted]	28"	[redacted]	$2^{3}/_{8}$	[redacted]

TABLE 24
PARTS LIST—HYDRIL GKS BOP/STRIPPER

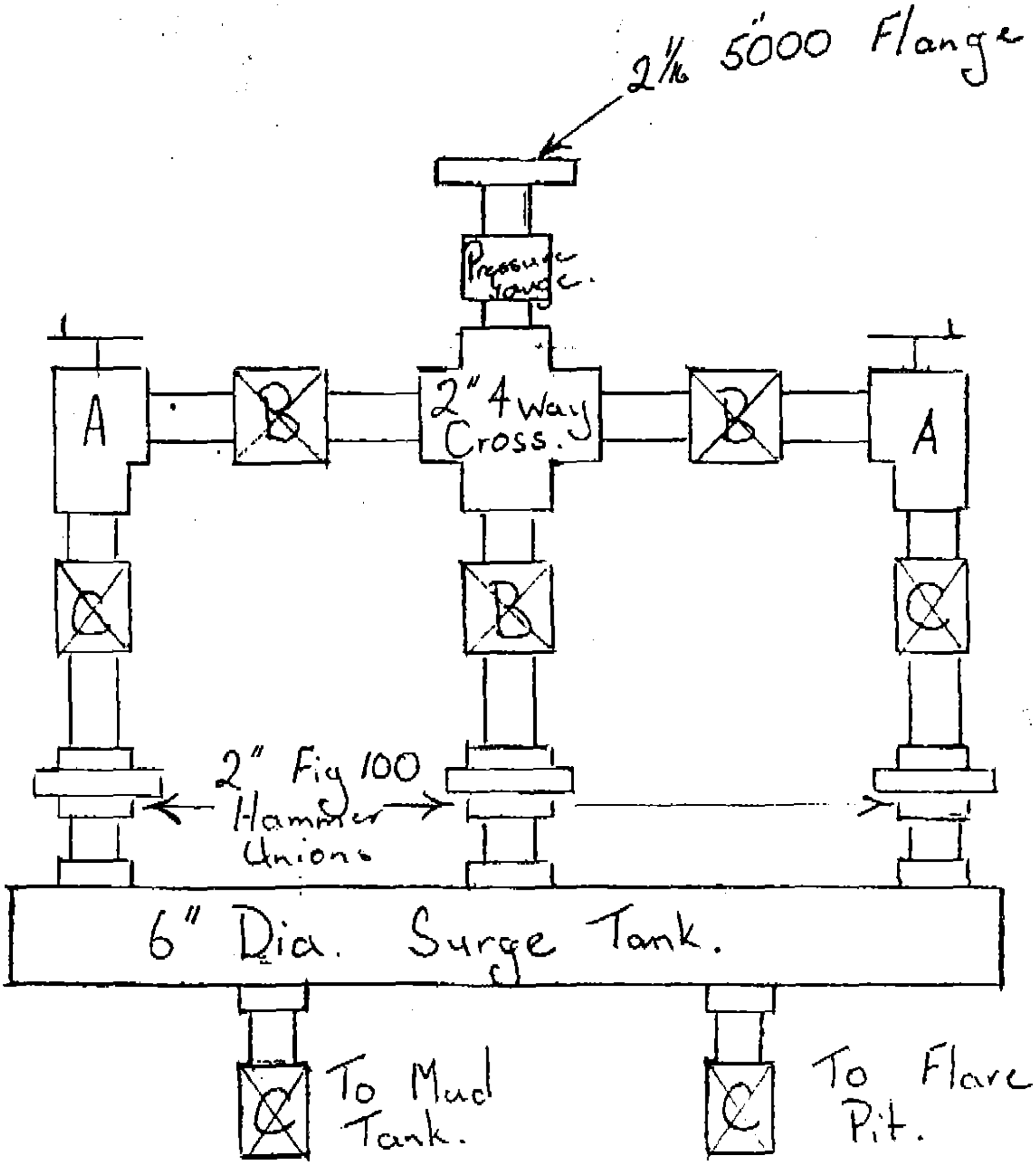
Item No.	Part Name	Qty. All Sizes
[redacted]	Stripper Head	[redacted]
[redacted]	Cap Screw	[redacted]
[redacted]	Head O-Ring	[redacted]
[redacted]	Stripper Body	[redacted]
[redacted]	Packing Unit	[redacted]
[redacted]	Upper Piston O-Ring	[redacted]
[redacted]	Upper Backup Ring	[redacted]
[redacted]	Piston	[redacted]
[redacted]	Lower Piston O-Ring	[redacted]
[redacted]	Lower Backup Ring	[redacted]

HOW TO ORDER THE GKS BOP

Specify the following:

1. Type: GKS
2. Nominal Size
3. Bore Size
4. Working Pressure
5. Connector
   a. Top
   b. Bottom
6. Packing Unit Material: Natural Rubber or Nitrile Rubber

2" 3000psi. Choke Manifold.



A - Adjustable Choke.

B. - 3000psi. 2 1/16" Gate Valves.

C - 500psi. 2" Ball Valves.