APPENDIX

GUIDELINES FOR ONSHORE PETROLEUM GEOPHYSICAL SURVEYING

1. INTRODUCTION

The following guidelines are designed to help petroleum exploration companies and contractors maintain suitable standards that minimise environmental damage. The guidelines define the consultation that is required to enable exploration to be undertaken while, at the same time, accommodating the needs of conservation and other land use issues. Adherence to the guidelines would also ensure:

(i) that disturbed tracts are constructed and rehabilitated in a manner which will encourage regeneration as soon as practicable after completion of operations;

(ii) compliance with all relevant requirements for those Acts listed hereunder and any rules, regulations, by-laws or directions applicable to Shires or Districts in which operations are to be performed; and

(iii) operations are organised and conducted with due regard to good oil field and exploration practice thus minimising any disturbance to wildlife, livestock, flora and sites of natural, historical and cultural significance.

The guidelines are for exploration work and are not intended to cover feasibility or developmental stages of resource projects.

2. LEGISLATIVE REQUIREMENTS

Onshore exploration for petroleum in Western Australia is only permitted by way of a title or authority issued under the Petroleum Act 1967.

While the title or authority remains in force it authorises the permittee, subject to any conditions imposed, to carry out all operations necessary to search for petroleum on Crown Land and private land within the relevant area.

Most petroleum exploration work is conducted under an exploration permit in accordance with the specified conditions. The permittee must apply in an approved form for approval to conduct each specific exploration operation.

2.1 Crown Land

Crown Land is all land other than private land, which has not been reserved or leased (except that pastoral and timber leases are regarded as Crown Land).

2.2 Reserved Land

Provision exists for reserved land to be declared as Crown Land for the purposes of the Petroleum Act. The decision to proclaim the reserve as Crown Land for the purposes of the Petroleum Act rests with the Governor in Executive Council.

((2))
If an explorer's operations require entry onto reserved land (which has not previously been proclaimed as Crown Land), the proponent must, prior to 30 days before wishing to enter the reserve, apply to the Department of Mines to have the area declared Crown Land.

2.3 Private Land

There is provision for private land owners/ocupiers to seek compensation for loss of earnings and fire damage to the surface or to any improvements on private land. Similarly compensation is payable to pastoral lessees for loss of earnings, damages to improvements and consequential damage.

Approved operations shall not be conducted on private land until agreement has been reached with the land owner/occupier with regard to compensation (if any). If agreement cannot be reached, either party may apply to have the matter determined in the Local Court. The title holder must give the land owner and occupier three (3) months notice that the title holder intends to commence operations on the private land.

2.4 Other Land Uses

Some of the legislation related to other land uses which could impact on petroleum operations includes:

- Aboriginal Heritage Act 1972;
- Aboriginal Affairs Planning Authority Act 1972;
- Aboriginal Communities Act 1979;
- Agricultural and Related Resources Protection Act 1976;
- Bush Fires Act 1954.
- Conservation and Land Management Act 1984;
- Environmental Protection Act 1986;
- Explosives and Dangerous Goods Act 1961;
- Mining Act 1978;
- Petroleum Act 1967-81;
- Petroleum Pipelines Act 1969;
- Rights in Water and Irrigation Act 1914;
- Soil and Land Conservation Act 1945 - 1988;
- Wildlife Conservation Act 1950.

It needs to be appreciated that petroleum explorers are only one of the bodies which may have authority to utilise the land. At times competing and conflicting interests may occur and it is the explorers' responsibility to conduct their operations in a manner which will not prejudice their future interests and that of others.

A positive way in which to help overcome problems of competing interests is to improve communication and allow sufficient time for problems to be resolved. In this regard applications for operations should be made in a timely manner. An application for a seismic survey affecting reserved land should be made at least three months prior to the commencement date and in areas of largely Crown Land at least two months prior to commencement.

3. OPERATIONAL PLANNING AND MANAGEMENT

The first step in operational planning is to initiate and maintain liaison with all landholders and through the Department of Mines, with regional land management authorities affected by the exploration activities. Such Authorities include the Department of Conservation and Land Management, the Department of Agriculture, Local Shires and Land Conservation District Committees. The scope of the exploration plan should be discussed with them using line location maps and/or air photographs or field visits. These discussions should take place prior to detailed planning to identify potential problem areas.

The possibility of requiring expert environmental advice should be anticipated early in the planning process.

The design of seismic grids, access roads, campsites and airstrips should include measures that minimise adverse effects to the environment. Environmental constraints should be considered and included in specifications for survey contracts.

3.1 The exploration programme should incorporate methods that minimise adverse effects to the environment and ensure no long-lasting evidence of activities. Particular attention should be given to:

- reference to topographic and survey maps, air photographs and literature relevant to the region's ecological system;
- incorporation of a programme of environmental protection and restoration.

3.2 Plans should be made to:

- minimise vegetation and topsoil disturbance;
- avoid wind and water erosion;
- avoid alteration to drainage;
- minimise interference to existing land use;
- prevent undesirable third party access;
- limit disturbance to native fauna and flora, especially Gazetted rare species.
- prevent the spread of noxious weeds and plant diseases such as dieback;
- prevent pollution; and
- avoid sites of Aboriginal, historical and heritage significance.

3.3 It is important during planning that a full appreciation of any contentious issue is conveyed in writing and acknowledged by the parties involved. A well prepared survey layout and a description of environmental practices will assist in ensuring that good practices will be employed.

3.4 Subsequent to the completion of the survey a final inspection should be made with the landholder or managing authority of all roads, gates, fencelines, campsites and operational sites to ensure that they have been left in an acceptable condition.

4. MANAGEMENT OF IMPACTS

Seismic line construction has the most obvious impact on the landscape. Before construction the operator must check with power, water and pipeline authorities, landholders and representatives of land management authorities to ascertain the presence of features requiring special consideration. Habitats such as flat sandplains and spinifex may present few problems whereas Permian outcrops in the Kimberley, Minilya and Gascoyne areas are extremely friable and erode with little disturbance.

Seismic operators should, wherever practicable, adopt the following practices and standards:

4.1 Line Orientation

- While line orientation is a function of subsurface geology, line layout should be designed to avoid erosion and interference to natural drainage patterns.

- Bladed lines should be avoided wherever possible. In particular they should avoid salt lakes, salt flats, clay pans and adjacent dunes as regeneration is slow.

- Oblique traversing of sand dunes, steep cutting and filling that may cause landslides, erosion or slump problems should be avoided, i.e. dunes should be approached at right angles and interdunal corridors should be used wherever possible. Dune crests should be cut at an angle to prevent deep cuts.

- Where practical, interruptions to the line of sight should be planned to reduce the visual impact of seismic lines.

- Springs and surface seepages, and associated vegetation should be avoided.

4.2 Line Construction

- Lines should be constructed to encourage rapid natural regeneration. Care should be taken not to plug drainage ways or culverts with earth fill. Existing drainage patterns should be maintained and clearance of vegetation along stream banks or deep gullies should be avoided. Windrows should be avoided, however, where they do occur windrows obstructing sheet flows in arid environments should be removed.

- All seismic traverses and access routes should be designed to minimise the removal of soil and vegetation. Preference should be given to using equipment which leaves root stock intact. Whenever practical the vegetation should be rolled flat without disturbing the soil.

- Towed rollers and/or stickrakes should be used where practical and blading with heavy earth moving equipment such as bulldozers avoided particularly on silcrete, gibber plain and claypans.

- The maximum width of a seismic line must not exceed six metres. However, a single track with passing points is preferable. Where blading is necessary, the bladed width should be minimised.

- If soaks and drainage lines cannot be avoided disturbance should be minimised.

- In prescribed environmentally sensitive areas, the formation of windrows should be avoided. Where they occur they should be levelled by back-grading onto the cleared line taking care to preserve survey markers.

- Windrows should be broken at approximately 100 metre intervals in flat country and more frequently in hills or undulating terrain to prevent concentration of runoff.

- To prevent erosion of the soil on slopes, construction of check banks and spur drains may need to beundertaken.

- Isolated trees and significant stands of vegetation should be left undisturbed wherever possible, especially in the vicinity of drainage channels.

4.3 REHABILITATION

- Borrow pits no longer in use should be left in a neat condition, with sides battered to a slope of no more than 1 in 5 to allow regrowth and prevent entrapment of stock and wildlife.

- Topsoil must be stripped, retained and finally respread over borrow pits or other excavated areas.

- Vegetation cleared prior to excavation for borrow pits should be returned as brush to the surface of the excavated area after topsoiling.

- To avoid importing soil from a different environment, soil to be used as fill should be taken from an area close to the operation where practicable.

- Tracks, lines and ramped dunes no longer required for access and to which a clay surface has been added should be rehabilitated to re-establish drainage and encourage restoration of the topography. Ripping should be carried out parallel to topographic contours. Deep cuts in dunes should first have their sides battered and brushed to minimise wind-scour and capped dune crests should have drainage bars with spur drains to prevent gully erosion.

- Expert advice should be sought to determine whether compacted soil should be ripped to provide seed and water catchment for native vegetation.

All areas affected by the operation should be restored as near as possible to their natural state. Unless specifically requested, seismic lines should not be left for the landholder to use as fence lines or future tracks, nor should campsite pads be left for future shed pads.

4.4 Access Tracks

- Lines should be concealed and rendered inaccessible from public lands. A dog-leg in the line where it crosses roads or tracks is practical and any vegetation removed should be pushed back to screen the dog-leg on completion of the work. Dog-legs should be clearly pegged and taped to prevent equipment operators accidently ignoring the dog-leg. Blading should not be used adjacent to any public access. Line of sight should be broken when in public view, e.g. on dune crests.

- Site access roads should by-pass or minimise traversing long slopes.

- Traffic in dune fields, the margins of drainage ways, around salt lakes and in wetlands should be restricted.

- Vehicular traffic should be confined to marked roadways, firebreaks around fence lines or to existing seismic lines. The disturbance of windward dune slopes and the removal of vegetation should be kept to a minimum.

4.5 Fire Control

. In periods where fire danger is high a water truck with a 2,000 litre tank, plus fire fighting equipment should be with the crew at all times. Also, each 4-wheel drive vehicle should carry a knapsack spray unit, shovel, axe and rake. All conditions of the Bush Fires Act must be complied with.

. Ensure equipment is adequately cleaned prior to deployment to prevent the introduction of noxious weeds or pathogens.

4.6 Disease and Weed Control

. Where required by the Agricultural Protection Board, all equipment and vehicles should be washed down to the satisfaction of an Agricultural Protection Board officer prior to leaving the area. The officer will then issue a signed APB112 form "Quarantine -Authority to Move".

. When operating in the Perth Basin current information should be obtained from CALM in order to limit the spread of dieback pathogens.

4.7 General

. Litter, fuel, oil drums, used grease cartridges, detonator wires, explosives cases and reels should be removed.

. Where possible, colour photographs should be taken before and after the seismic operation. These photographs should be properly identified and catalogued.

. Care must be taken when preparing seismic lines where there are power lines, coaxial cables, pipelines and other surface and sub-surface conduits.

. Any damage to land improvements should be reported promptly to the land manager, both verbally and in writing. Repairs should be effected without delay.

5. SHOTHOLES AND ENERGY SOURCE

. Vibrators will not be allowed to work within 20m of any gas, oil or water pipeline, electric cable or other utilities or installations.

. All operations involving the use of explosives shall be in accordance with the Explosives and Dangerous Goods Act 1961-1984 and Explosives Regulations 1963.

- All shotholes must be drilled off the cleared part of the seismic line.

- A shothole cap must be placed immediately above the highest explosive charge and the shothole backfilled and tamped to surface.

- The Department of Mines is to be notified immediately of any petroleum or artesian water resulting from shothole drilling or the use of explosives.

- Prior to shooting in areas where there are gas or water pipelines, the pipeline owner should be advised.

- Above ground blasting shall not be conducted within 150m of any perennial surface water, residence, well, bore or spring development and in the absence of specific instructions from a utility the following charge-distance chart shall apply:

SUGGESTED MINIMUM DISTANCES FROM FIXED IMPROVEMENT TO EXPLOSIVE SOURCE

BURIED* EXPLOSIVE ENERGY SOURCE
(Charge per shot shown in kilograms)

Fixed Improvement	Under 2.0Kg	2.0 to 3.9Kg	4.0 to 8.0Kg	8.0 to 15.0Kg	16.0 to 37.0Kg
Pipeline (less than 15cm dia.)	60m	75m	90m	120m	180m
Pipeline (15 - 30cm dia)	90m	120m	150m	180m	240m
Pipeline (greater than 30cm dia.)	120m	150m	180m	240m	300m
Telephone Line	12m	17m	23m	29m	35m
Rail Line or Main Paved Highway	45m	65m	85m	107m	130m
Electric Power Line	90m**	90m**	90m**	90m**	90m**
Water Well, Buildings	180m	210m	240m	270m	300m

* Standards have not been established for explosions on the surface.

** This distance may increase to 120 metres when Primacord is used to detonate the charge.

Source: G.S.I. Field Safety Handbook

- Wherever practical shotholes should be sited away from caves, breakaways and other sensitive environments.

- Shot-holes, cave-ins and damage caused by explosives must be suitably plugged with dry, unconsolidated fill and the disturbed area restored as near as possible to its original state. Particular attention should be paid to areas frequented by livestock.

- Groundwater encountered must be protected from contamination or waste by adequate down-hole cementing.

6. CAMPSITES

- Campsites should be located well away from major water courses, creeks, mound springs, wells and pastoral property infrastructure (such as bores, dams and homesteads).

- Disposal pits will be constructed above water table level, away from water courses, creeks and waterholes and will be of an adequate size to contain all of the waste and to allow for deep burial.

- Kitchen and ablution waters must empty into earth drains that allow rapid infiltration, prevent discharge to creeks and surface waters and be of an adequate size to ensure that water is directed away from areas frequented by camp personnel and vehicles.

- Adequate and properly maintained fire fighting equipment will be present at the campsite and all fires and ignition sources will be controlled to prevent bushfire.

- Litter, rubbish and other wastes that have not been buried must be removed from campsites within one week of abandonment and the sites put in such a condition as to encourage rapid rehabilitation.

- Rubbish dumps, sewage drains, etc shall be filled to ensure a minimum cover of 1 metre, in such a manner as to restore the land surface and to avoid surface contamination and disturbance by animals. During construction topsoil should be stockpiled and returned after filling to encourage regeneration.

- There should be no burial of sensitive areas. All rubbish should be removed and disposed of in a satisfactory manner.

Restoration of Lands	642	Following the completion of production activities and within 2 years after the surrender of a production licence, the land surrounding or affected by production facilities and wells shall be restored as far as practicable to its original condition to the reasonable satisfaction of the Director.

BIBLIOGRAPHY

AMERICAN PETROLEUM INSTITUTE 1975. API Recommended Land Drilling Operating Practices for Protection of the Environment. API Division of Production, PR52.

AUSTRALIAN PETROLEUM EXPLORATION ASSOCIATION 1977. APEA Code of Environmental Practice. APEA Ltd, Sydney.

AUSTRALIAN PETROLEUM EXPLORATION ASSOCIATION 1983. (Revised 1988) APEA Code of Environmental Practice: Onshore and Offshore. APEA Ltd, Sydney.

CHAMBER OF MINES OF WESTERN AUSTRALIA n.d. Exploration Guidelines for Field Personnel. Pocketbook Brochure, 10 pp.

DELHI PETROLEUM PTY LTD, SANTOS LTD, SOUTH AUSTRALIAN DEPARTMENT OF MINES AND ENERGY 1984. Code of Environmental Practice Regulating Petroleum, Seismic and Drilling Operations in PELs 5 and 6, South Australia.

KLEPACKI, N.M., BLACK, S.J. and MARCHANT, M.H. 1985. Impact of Petroleum Exploration Activity on Range Resources and Pastoral Pursuits in the West Kimberley. W.A. Dept. Agric., Division of Resources Management. Tech. report 41, 72 pp.

GEOPHYSICAL SERVICES INCORPORATED FIELD SAFETY HANDBOOK.

SANTOS LTD 1988. Environmental guidelines for line clearing - Dozer Manual.