Santos Ltd

ABN 80 007 550 923

ANNUAL ENVIRONMENT REPORT FOR SA COOPER BASIN OPERATIONS

1 JULY 1999 – 30 JUNE 2000

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INTRODUCTION

This *Annual Environment Report for SA Cooper Basin Operations* covering wells, borrow pits and production facilities has been produced as required under Alternative Arrangement 4 as described in correspondence from the Director of the Petroleum Group of PIRSA of 8 June 2000 (Ref No. SR28/1/3). This letter granted Santos Ltd approval to undertake its South Australian Cooper and Eromanga Basin operations subject to complying with the six stated alternative operating arrangements. This approval to operate under six alternative arrangements was granted pursuant to Regulation 16 (2) of the Petroleum Regulations, 1989, until the 30 June 2001 or until such time as the proposed new Petroleum Act comes into effect.

A. WELL SITE OPERATIONS

(EXCLUDING BORROW PITS)

Section 1: Well site, camp site and access track construction and restoration activities

1.1 Summary of Activities

Activities associated with well site, camp site and access track scouting, construction and restoration undertaken in the South Australian section of the Cooper Basin during the period 1 July 1999 to 30 June 2000 (the reporting period) are summarised as;

- Thirty-seven well leases and associated access tracks were constructed (refer Appendix 1).
- Six plugged and abandoned (P&A) wells were restored (refer Appendix 2).
- Thirty two cased and suspended (C&S) wells underwent production lease backfill (ie partial restoration of the well lease and full restoration of camp sites and pits such as sewage disposal pits and drilling sumps) (refer Appendix 2).
- Fourteen restored P&A well sites were inspected (refer Appendix 3).
- Forty-three unrestored or partially restored locations were inspected (refer Appendix 3).

A summary of construction and restoration of borrow pits associated with well site construction activity is presented in Section 7 of this report.

1.2 Scouting and Risk Assessment

Prior to construction, all well leases are scouted in accordance with the *Environmental Procedures for Well Lease Location, Construction and Restoration* (Santos Ltd 1997a) with reference to the *Field Guide to the Common Plants of the Cooper Basin* (Santos Ltd 1997b) made to determine plant clearance priorities if required. These procedures have been developed to ensure that the objectives of minimising environmental disturbance and protecting sites of Aboriginal heritage significance, as contained in the PIRSA approved *Code of Environmental Practice – Drilling and Workover Operations* (Santos Ltd 1998b), are achieved.

When preliminary identification of a site of possible Aboriginal heritage significance is made during scouting activities, the site is flagged and documented in accordance with the *Environmental Procedures for the Management of Aboriginal Heritage Sites* (Santos Ltd 1998a).

Scouting activities are performed by personnel who have undertaken Aboriginal heritage and site identification training provided by a consultant Archaeologist. A new lease or access track location is selected to ensure adequate clearance and protection if a site is identified.

Disturbance to the environment and accidental disturbance of Aboriginal heritage sites are minimised by ensuring that all operations associated with well site construction and restoration are contained to the minimum required area. A standard well lease was developed by Santos in 1998 to provide specific and standardised measures of the area required to undertake well lease operations.

Where sites of possible heritage significance are identified by field personnel and verification is required, then a consultant Archaeologist is commissioned to undertake an inspection of the area.

1.3 Non-conformances detected against SABU EMS and Environmental Objectives

1.3.1 Plugged and Abandoned Wells

Fourteen plugged and abandoned (P&A) well sites were audited during the reporting period as part of the *Environmental Audit of Recently Drilled Wells* (Santos Ltd 2000a). Appendix 3 to this report provides a complete list of wells audited and a summary of the audit findings. Well sites were audited against the objectives contained in the Santos *Code of Environmental Practice – Drilling and Workover Operations* (Santos Ltd 1998b) and the *Environmental Procedures for Well Lease Location, Construction and Restoration* (Santos Ltd 1997a). It should be noted however, that not all of these sites were constructed and/or drilled during the reporting period.

In general, the rehabilitation of P&A well sites was undertaken to a high standard and performance against the objective of minimising disturbance to the environment was achieved. Of the locations audited, the objective of minimising disturbance was not achieved at two locations (14%). This was largely due to inappropriate restoration practices applied at locations where large quantities of clay stabilising material had been used to construct the lease and access track. The need to improve restoration practices for those wells where large quantities of clay are used for the purpose of stabilisation has been highlighted within the audit report. Further assessment of restored sites will determine if appropriate levels of restoration have been adopted.

A Management System non-conformance for well site construction and restoration practices was noted at one location. PIRSA was not advised of the GPS reference for an access track which had been restored. Notification procedures had previously been agreed with the Department (refer PIRSA correspondence of 30 March 1999, ref DME 16/90 and Santos correspondence of 8 April 1999, ref Env 102). This non-compliance is considered to be minor and will be remedied in subsequent restoration reports that are forwarded to PIRSA on a regular basis.

1.3.2 General Well Site Construction and Partial Restoration

In addition to the above mentioned P&A well sites, 43 well leases constructed since April 1998 were audited during the reporting period against the objectives contained in Santos' *Code of Environmental Practice – Drilling and Workover Operations* (Santos Ltd 1998b) and the *Environmental Procedures for Well Lease Location, Construction and Restoration* (Santos Ltd 1997a).

Well sites audited comprised all categories of wells with the exception of restored P&A wells (ie. unrestored P&A, unrestored or partially restored cased and suspended (C&S) and plugged and suspended wells (P&S) well sites were audited). It should be noted however, that not all of these sites were constructed and/or drilled during the reporting period.

Management System non-conformances against objectives for these locations which were identified by this audit are contained in Appendix 3. In general, there was a high standard of construction and where appropriate, partial restoration of well sites. This is indicated by the performance against the major objectives of a) minimising disturbance to the environment (99% based on audit results) and b) avoiding sites of Aboriginal heritage significance (100% based on audit results) as described in Appendix #2 of the *Code of Environmental Practice – Drilling and Workover* (Santos Ltd 1998b).

In summary, twelve Management System non-conformances were identified from the 43 well sites audited. These are identified below along with the proposed corrective actions.

- Variations in lease scouts provided to Environmental Services were noted for 6 locations of the 43 sites audited. In most cases these variations were minor and related to the location of the campsite. These shifts in location were typically instigated to minimise disturbance to the environment. While greater attention will be exercised to ensure minor amendments are documented, no formal corrective action request (CAR) has been generated.
- Environmental Services were not advised that the production lease backfill of 4 locations had been undertaken. This non-conformance is considered relatively minor but increased attention needs to be placed on data management to ensure that regular restoration reports are accurate. The matter has been discussed with Field Services personnel. The annual *Environmental Audit of Recently Drilled Wells* (Santos Ltd 2000a) provides the opportunity to assess the restoration status of such wells.
- Surface tolerances for the scouting and location of well sites were not provided to Environmental Services for 2 of the 43 locations audited. Although tolerances were not specifically stated for these locations, where possible and if required many locations are moved during scouting following consultation between the field and office personnel in order to minimise environmental disturbance or avoid sites of heritage significance while achieving geological objectives.

  In addition, a standard tolerance of up to 25 metres radially from the proposed location has been agreed between Environmental Services and the Exploration Manager to facilitate the movement of proposed well leases.

The areas where stated environmental objectives were not achieved are described below together with the corresponding corrective action(s).

- There were nine locations where there was no evidence of topsoil having been stockpiled for rehabilitation purposes. This requirement has been formally raised with the relevant departments and costs associated for this work are now included in the funding for the well. A follow up audit will be conducted within the next 12 months and compliance with this objective will continue to be assessed.

- The obstruction of a significant drainage channel was noted at one location. This issue was raised with field personnel with the requirement to not impede surface water flows emphasised.
- For 14 locations it appeared that partial restoration had resulted in areas considerably larger than the 50x80m production lease area which is required remaining. Restoration/production requirements will be reassessed and appropriate procedures highlighted as applicable.
- Erosion and gullying of the lease was noted at four locations. This erosion ranged from minor to significant and corrective actions have been assigned where required.
- The apparent use of large quantities of clay and the associated inappropriate restoration of the campsite and lease access road was noted at one location. These actions culminated in a level of disturbance that was considered greater than necessary. As a result, the objectives for well lease restoration were not achieved at this location. Restoration practices at such locations should be undertaken in a manner that reflects the use of greater volumes of clay therefore ensuring that environmental objectives are still fulfilled.

1.4 Major Environmental Incidents and Spill Site Analysis

There were no major or reportable environmental incidents resulting from well site, camp site and access track construction activities undertaken during the reporting period. There have been no major oil spill incidents associated with these activities and consequently no Total Petroleum Hydrocarbon (TPH) analysis have been undertaken or included in this section of the report.

1.5 Quarterly Meeting to Discuss Compliance Issues

Quarterly meetings were held with PIRSA to discuss a range of issues associated with the environmental management of Santos' SA Cooper Basin operations. Actions arising from these meetings are presented in Appendix 4 of this report. No major issues relating to the construction and restoration of well sites were raised during this reporting period.

Section 2: Drilling and Workover Activities

2.1 Summary of Activities

2.1.1 Drilling

There were 38 wells drilled in the South Australian sector of the Cooper Basin during the reporting period. Reference should be made to Appendix 5 for a list of these wells and their locations. Of these wells, 36 were cased and suspended (C&S), 1 plugged and suspended (P&S) and 1 plugged and abandoned (P&A).

2.1.2 Workover and Connection

Workover, fracture stimulation and connection operations were carried out on 25 wells during this reporting period. Reference should be made to Appendix 6 of this report for detailed information. Of these 25 wells, 19 were completed and connected as mono-bores and 6 as conventional wells.

2.2 Risk Assessment of Proposed Activities

All drilling operations are conducted in accordance with the procedures contained in the *Santos Drilling Management System, Drilling Operations Manual (DOM) Version 0* (Santos Ltd 2000c). These procedures are based on relevant Australian and industry standards. Prior to implementing any change to these procedures, a risk assessment is carried out in accordance with the *NSCA Risk Score Calculator* (NSCA 1997) which takes into account human safety, environmental and third party considerations.

2.3 Non-conformances detected against SABU EMS and Environmental Objectives

Forty-three well sites that were either drilled and/or worked over since April 1998 were audited during the reporting period. These well sites were audited against the objectives for drilling and workover operations as described in Santos' *Code of Environmental Practice – Drilling and Workover Operations* (Santos Ltd 1998b). Well sites audited comprised all categories of wells with the exception of restored P&A wells. It should be noted however, that not all of the audited sites were drilled or subjected to workover operations during the reporting period.

In general, the standard of environmental management of drilling and workover operations was acceptable as supported by the findings of the *Environmental Audit of Recently Drilled Wells* (Santos Ltd 2000a) which is performed on completion of operations. A table detailing numbers of Management System non-conformances and objectives for these locations are contained in Appendix 3 of this report. The findings of the audit are summarised below.

2.3.1 Management System Non-conformances

There were no Management System non-conformances identified in the *Environmental Audit of Recently Drilled Wells* (Santos Ltd 2000a) related to drilling and workover operations.

2.3.2 Environmental Objectives

The areas where environmental objectives were not achieved during drilling, workover or subsequent construction or production operations are summarised below. Proposed and implemented corrective actions are also presented briefly.

- At twenty-four of the forty-three locations inspected, rubbish and miscellaneous equipment remained at well leases following completion of operations.

  In most cases this involved the flare line and particularly excess pipe remaining on the well lease. In addition, Turkey's nest liners had not been removed and drums and buckets were present in flare pits and other small quantities of miscellaneous rubbish were noted on several locations. While these are relatively minor issues it is the responsibility of all operations to ensure that all non-essential equipment and any scattered rubbish is removed from leases at the completion of activities. This can be remedied by the education of all personnel and site inspections by site/operations supervisory personnel prior to departing the site. Corrective Action Requests have been raised for those areas where it is considered to be warranted.

- Off lease driving was noted at eight of the forty-three locations inspected. Off-lease driving results in increased environmental disturbance at each location and increases well site restoration costs. This practice is actively discouraged.

- In two cases it was noted that open drilling sumps had not been fenced securely. At one location cattle had pushed through an inadequate fence whereas a fence had not been constructed around the sump on another location. As a result of these and other instances of cattle accessing drilling sumps, a *Stock Proof Fencing Standard* (Santos Ltd 2000b) was developed and implemented. The responsible department was notified of these non-conformances to ensure prompt and appropriate fencing of these locations was undertaken.

2.4 Major Environmental Incidents and Spill Sites

There were no major incidents reported for drilling and workover operations conducted during the reporting period. Historically there have been no major oil spill incidents relating to these activities for which ongoing monitoring is required and consequently no TPH analysis reports have been prepared.

2.5 Quarterly Meeting to Discuss Compliance Issues

Quarterly meetings were held with PIRSA to discuss a range of issues associated with the environmental management of Santos' SA Cooper Basin operations. Actions arising from these meetings are presented in Appendix 4 of this report. The major issue relating to drilling and workover operations was the discussion and provision of formal comments on the draft *Statement of Environmental Objectives for Drilling and Workover Operations* prepared by PIRSA.

2.6 Statement Regarding Casing Design and Setting

Cuttapirrie 7 was plugged and abandoned in accordance with the Petroleum Regulations, 1989 and Santos' *SABU Drilling Management System, Drilling Operations Manual (DOM) Revision 1* (Santos Ltd undated).

Pondrinie North 2 was plugged and suspended on 19 May 2000 (lower section P&A, upper section C&S) in accordance with the South Australian Petroleum Regulations, 1989 and the *Santos Drilling Management System, Drilling Operations Manual (DOM) Version 0* (Santos Ltd 2000c).

Section 3: Suspended and Producing Wells

3.1 Summary of Activity

At the end of the reporting period there were 675 suspended and producing wells operated by Santos within the SA Cooper Basin. The following is a summary of activities relating to suspended and producing wells:

- A total of 39% of all wells underwent casing annuli pressure testing.
- A total of 96% of all producing wells, and 94% of producing and C&S wells, were subjected to casing integrity and corrosion monitoring.
- Additional maintenance or repairs were undertaken on 3 wells.

3.2 Monitoring and Risk Assessment of Activities

3.2.1 Monitoring of casing annuli pressures

Petroleum Engineering Moomba Standard Procedure 1-13 *Well maintenance top ups and pressure testing* (Santos Ltd undated) is used as the basis for monitoring the integrity of gas wells.

The criteria for well maintenance top ups and pressure testing is based on visiting and conducting a well maintenance suite of work on a 12 to 18 month interval. This procedure is currently being updated and revised. In addition to pressure testing, the Production Operations department attempts to visit each well on a 3-6 month basis to monitor casing annuli pressures. The results of this monitoring program are summarised in Table 1 below.

Table 1: Summary of testing for wells with pressure on production casing string (675 wells)

Pressure on Production Casing	Wells tested	Proportion
Can be blown down	212	31 %
Plunger lift	17	3 %
Cannot be blown down	37	5 %
Total	**266**	**39 %**

Of the 37 wells in which the Production Casing pressure is unable to be bled off, 12 are considered to be of "High" priority and are monitored accordingly.

3.2.2 Casing integrity and corrosion monitoring programs

The current Well Maintenance Program results indicate that > 90% of wells have met the criteria for monitoring casing integrity. As indicated in Table 2 below, a number of C&S wells have been difficult to reach due to the location and condition of access roads. Generally, where scheduled testing of producing wells has not been completed it has been a result of access constraints caused by recent flooding and rainfall events. A prioritised program has been instigated to ensure that these wells are tested as soon as practicable.

Table 2: Summary of wells not monitored for casing integrity and corrosion in last 18 months (of 675 wells)

Priority	# of wells	Proportion
No pressure survey conducted	43	6 %
less C&S wells	17	
Total not monitored	**26**	**4 %**

The results of each test are entered into a specific database. Assessment of the testing results is carried out on the basis of *AS 2885–Risk Assessment* (Standards Australia, Standards New Zealand, 1998). This risk assessment takes into account the impact on:

- personnel;
- third parties;
- environment;
- loss of asset; and
- loss of revenue.

By evaluating the frequency and potential severity of an occurrence, an overall rating of the integrity of the well is determined. The results of the testing conducted are summarised in Table 3 below. Seven wells require further testing prior to assigning a risk score.

Table 3: Summary of casing integrity risk scores for all C&S and producing wells (of 675 wells)

Risk Score (max = 3.0)	Priority	# of wells	Proportion
2.0 – 3.0	High	10	1.5 %
1.2 – 1.9	Intermediate	99	14.7 %
0.6 – 1.1	Low	177	26.2 %
0.0 – 0.5	Negligible	382	56.6 %
Undetermined	Undetermined	7	1.0 %
	Total	**675**	**100%**

3.2.3 Crossflow monitoring

During the reporting period, 18 wells were tested by Memory Production Logs. These logs are presented in Appendix 7 of this report. Selection of these wells was based on continual monitoring of:

- water samples;
- production rate variation;
- field reviews; and
- liquids evaluation tests.

3.2.4 Maintenance or repair

The following repairs or maintenance activities were undertaken during the reporting period.

- Bookabourdie 10 – plug set to tailpipe to minimise any further deterioration of mechanical integrity of well bore tubulars.
- Moomba 2 – repair to 7" production casing string.
- Toolachee 3 – leaking wellhead ring groove repaired during tubing change-out.

3.3 Non-conformances detected against SABU EMS and Environmental Objectives

A total of 17 suspended wells and 26 producing wells were audited during this reporting period. These wells were principally audited against objectives and procedures for well lease construction, drilling and workover operations and restoration activities as discussed in Sections 1 and 2 of this report.

3.4 Major Environmental Incidents and Spill Site Analysis

There were 11 major or reportable incidents reported at suspended and/or producing wells throughout the reporting period. All important or reportable incidents that occurred throughout the reporting period are presented in Appendix 8 which includes a summary of those corrective and preventative actions undertaken as a result of these incidents.

3.5 Quarterly Meeting to Discuss Compliance Issues

Quarterly meetings were held with PIRSA to discuss a range of issues associated with the environmental management of Santos' SA Cooper Basin operations. Actions arising from these meetings are presented in Appendix 4 to this report.

Section 4: Downhole Well Abandonment

4.1 Summary of Activities

4.1.1 P&A Wells

Cuttapirrie 7 was the only location plugged and abandoned during the reporting period. Details are presented in Appendix 5 to this report.

4.1.2 Depleted Well Abandonment

During the reporting period Brumby 9 was the only depleted well abandoned in the SA Cooper Basin. Discussions with PIRSA on this matter are continuing.

4.2 Non-conformances detected against SABU EMS and Environmental Objectives

A total of 14 P&A wells were audited during the reporting period to assess rehabilitation of surface facilities as detailed in Section 1 of this report. Earth works required to rehabilitate the surface following the abandonment of Brumby 9 will be completed in the subsequent reporting period.

4.3 Risk Assessment of Proposed Activities

All well abandonment operations are carried out in accordance with the procedures contained in the *Santos Drilling Management System, Drilling Operations Manual (DOM) Version 0* (Santos Ltd 2000c). These procedures are based on relevant Australian and industry standards. Prior to any change in these procedures a risk assessment is carried out in accordance with the *NSCA Risk Score Calculator* (NSCA 1997) which takes into account human safety, environmental and third party considerations.

All depleted well abandonment is undertaken in accordance with the SABU Petroleum Engineering *Draft Well Abandonment Procedures* (Santos Ltd 2000) and the *SA Petroleum Regulations*, 1989. SABU Petroleum Engineering have since received comments from PIRSA and are currently in the process of incorporating these changes into the final document.

4.4 Major Environmental Incidents and Spill Site Analysis

There were 11 major incidents reported at suspended or producing wells throughout the reporting period. All important or reportable incidents that occurred throughout the reporting period are presented in Appendix 8 of this report, including a summary of corrective and preventative actions undertaken following the incident.

No ongoing monitoring of these spill sites has been performed and consequently no reports on TPH analysis have been prepared.

4.5 Quarterly Meeting to Discuss Environmental Issues

Quarterly meetings were held with PIRSA to discuss a range of issues associated with Santos' SA Cooper Basin operations. Actions arising from these meetings are presented in Appendix 4 to this report. The SABU Petroleum Engineering Well Abandonment Procedures (Santos Ltd July 2000) were developed and submitted to PIRSA as a result of these meetings. SABU Petroleum Engineering has since received comments from PIRSA and is currently in the process of incorporating these changes into the final document.

B. PRODUCTION FACILITY OPERATIONS
(EXCLUDING FLOWLINES/PIPELINES)

Section 5: Production Facility Construction, Operation and Restoration

5.1 Summary of Activities

The following is a summary of production facility operations conducted throughout the reporting period.

- Thirty-four projects involving modifications to existing production facilities located within the South Australian sector of the Cooper Basin were initiated or completed. None of these projects required additional earthworks or resulted in any environmental impacts. These projects are summarised in Appendix 9.
- There were 3 production facility construction projects undertaken during the reporting period. These involved the relocation of the Dullingari LP Compressor to Toolachee West, installation of a compressor within the Merrimelia gas satellite for Meranji gas and the installation of Phase 2 Moomba North Compression (refer to Appendix 9).
- No production facilities were restored during the reporting period.

5.2 Scouting and Risk Assessment

The safety and operability of new installations and/or relocated facilities are reviewed using recognised Hazop study techniques that are formally documented as a component of the SABU Management System. All proposed modifications are reviewed prior to implementation using formal and documented Process and Instrument Design change procedures.

5.3 Statement in Accordance with Relevant Standards

Design, construction and operation of all production facilities is undertaken in accordance with Santos' Management System Procedures and more specifically the Operations Support Department Guides and Specifications. These guides and specifications are based on Australian and/or industry standards with a list of the relevant guides and specifications presented in Appendix 10.

5.4 Non-conformances detected against SABU EMS and Environmental Objectives

No production facilities were audited during the reporting period, however an audit of field nodal compressors was undertaken in January 1999 while producing oil wells were audited in February 1999 as part of Santos' ongoing Audit Schedule. The results of these audits have been summarised below.

5.4.1 Nodal Compressor Audit

An audit of all nodal compressor facilities in the SA Cooper Basin was undertaken in February 1999 to ensure that operations were undertaken in accordance with the *Code of Environmental Practice – Production* (Santos Ltd 1991) (now superseded). The major issue arising from this audit was soil contamination by hydrocarbons due to:

- engine oil from overflowing or cut away drips trays;

- oil/solvent/water mix from washdown activities;
- liquid hydrocarbon carryover to the gas vent; and
- overflowing engine drain tank sumps.

As a result of this audit, 8 corrective action requests (CARs) were raised. Closeout of each of these CARs is pending the results of a trial on the use of a system of drip trays to prevent oil contamination of surrounding soil.

5.4.2 Producing Oil Wells

An audit of producing oil wells was undertaken in January 1999 in order to assess the progress of rehabilitation works identified in previous audits undertaken in 1996 and 1997. Well sites were assessed in accordance with the requirements of the *Code of Environmental Practice – Drilling and Workover* (Santos Ltd 1997a), *Code of Environmental Practice – Production and Processing* (Santos Ltd 1991), and the *Environmental Procedures for Well Lease Location, Construction and Restoration* (Santos Ltd 1997a).

The audit found that the standard of restoration and maintenance had improved markedly with only 2 of the 54 well sites audited assigned a high rehabilitation priority and 26 a moderate priority. The major issues identified in the audit included:

- new leases where significant earthworks had been undertaken and which required restoration;
- leases located in environments where they required continual maintenance to repair eroded edges or access tracks (ie on the top or slopes of sand dunes) and
- leases where chronic leaks have resulted in soil contamination.

Follow up on these actions has not been assessed to date.

5.5 Major Environmental Incidents and Spill Site Analysis

There were 13 major reportable (important) incidents recorded at production facilities throughout the reporting period. Please refer to Appendix 8 to this report for details of these incidents and the corrective actions instigated.

There are two major spill sites at production facilities that require ongoing soil sampling and analysis. These sites are:

- Strzelecki Satellite; and
- Dullingari Oil Satellite.

Analysis reports for half yearly monitoring of these sites are included in Appendix 9 to this report.

5.6 Assessment of Restoration of Work Sites

There has been no assessment of the standard of restoration of work sites undertaken during this reporting period.

5.7 Quarterly Meeting to Discuss Compliance Issues

Quarterly meetings were held with PIRSA to discuss a range of issues associated with the environmental management of Santos' SA Cooper Basin operations. Actions arising from these meetings are presented in Appendix 4 to this report.

The major issue raised in association with production activities was the development of end point criteria for oil spill remediation/bioremediation. Santos has drafted a position paper on this issue, which will be submitted to PIRSA prior to the next quarterly meeting.

Section 6: Produced Formation Water Disposal Operations

6.1 Summary of Activities

Santos operates 41 active formation water disposal facilities in the South Australian sector of the Cooper Basin. Activities associated with formation water disposal facilities in the SA Cooper Basin are summarised as:

- No new facilities were constructed during the reporting period.
- No facilities were decommissioned or restored during the reporting period.
- The Wancoocha and Mudlalee oil facilities were 'mothballed' during the reporting period pending a decision on future production or abandonment as appropriate.

6.2 Risk Assessment of Proposed Activities

A risk assessment has been undertaken for produced formation water disposal activities within the SA Cooper Basin in accordance with the *NSCA Risk Score Calculator* (NSCA 1997). This assessment is outlined in Table 4 below, and identifies that the greatest risk is the potential for cattle to access contaminated water, particularly on those properties with Organic Beef Certification. This risk has been minimised by the introduction of a *Stock Proof Fencing Standard* (Santos 2000b) and the development of agreements with pastoralists regarding access to facilities for stock watering purposes.

Table 4: Risk assessment scores for formation water disposal facilities

Risk Situation	Consequence	Risk Category	Risk Score
Cattle access to contaminated water	Contaminated carcass, loss of OBE accreditation by pastoralist. Compensation issues.	substantial to high	200
Interceptor pond lining breached	Soil contamination	substantial to high	190
Oil on pond past interceptor pit	Soil contamination	moderate to substantial	55
Seepage from evaporation pond	Salinisation of soil, water	moderate to substantial	55
Bund wall erosion	Soil, water contamination	moderate	30
Overflowing interceptor pit	Soil, water contamination	low to moderate	24
Water pipeline corrosion	PFW leak, contamination of soil, water	low	1

Any risk scenario with a score exceeding 50 requires attention as soon as practical following the release of the audit findings. Corrective Action Requests (CARs) are raised for any location with an activity with a level of risk greater than 50.

6.3 Non-conformances detected against SABU EMS and Environmental Objectives

6.3.1 Annual Formation Water Monitoring Results

As required under the operating approvals granted by PIRSA, SABU undertakes an annual formation water monitoring program in which water from the final stage of the disposal facility is sampled and analysed for a range of parameters. For the 1999 monitoring program a total of 41 active sites were sampled.

Collected samples were analysed for a reduced list of 50 parameters as previously agreed with PIRSA. The 1999 monitoring results are presented in Appendix 10 to this report.

Analysis results were compared to the 1992 ANZECC Water Quality Guidelines and 70% compliance was achieved (from 2050 analysis results). The areas of non-conformance were mainly due to high concentrations of specific heavy metals and nutrients present in several samples. The concentrations of certain organic compounds and physio-chemical parameters were also exceeded in samples collected from various water disposal facilities. A large number of non-conformances can be attributed to the extremely low concentrations of substances stipulated by the ANZECC Water Guidelines for fresh water bodies. Santos considers that these are inappropriate given the circumstances and environments in which produced formation water is disposed of, however in the absence of any appropriate alternatives the Company has been prepared to adopt the concentrations provided in these Guidelines. The development of risk based water quality guidelines for formation water disposal in the Cooper Basin is currently being addressed by the SABU through the implementation of the *Formation Water Action Plan* (Santos Ltd 2000d) as endorsed by PIRSA. The next annual monitoring program will be conducted in September or October 2000.

6.3.1 Santos Annual Facility Inspection

As a component of the SABU Environmental Management System, SABU Environmental Services personnel undertake an annual inspection of formation water disposal facilities in conjunction with the annual evaporation pond monitoring survey. The purpose of these inspections is to ensure conformance with the environmental objectives for formation water disposal as stated in the *Code of Environmental Practice – Production and Processing* (Santos Ltd 1999). All non-conformances are noted in the audit report with a Corrective Action Request (CAR) raised for all non-conformances assigned a moderate to high level of associated risk (as discussed in Section 6.2). A total of 28 CARs were raised following the 1999 audit which are summarised below.

- One instance of damage to the interceptor pond lining with the potential for significant soil contamination. A CAR was raised to undertake repairs to this liner.
- Oil staining or oil on the surface of holding or evaporation ponds was noted at fourteen locations indicating flow of product from the interceptor pit. CARs were raised to undertake water monitoring to determine the oil content of water and remove any free oil from these ponds.
- Water seepage through evaporation pond walls was noted at three locations. The integrity of bund walls is subject to ongoing assessment.

- Failure of lagging on pipe work between interceptor and evaporation ponds was noted at two locations. A CAR was raised and the Corrosion Group assess the integrity of all piping at these facilities.
- Unstrained fences allowing cattle access was noted at three locations. CARs were raised to ensure that these fences were restored to an appropriate standard.
- The interceptor pit lining was exposed at one location increasing the likelihood of deterioration by ultra violet radiation. A CAR was raised to replace the clay covering the liner.
- Disused interceptor pits requiring rehabilitation were noted at four locations. A CAR was raised to progress rehabilitation of these facilities. Sediment/sludge samples were recently collected from a number of facilities to determine the most appropriate restoration methods.

To date, required actions have been completed for 14 (50%) of the CARs raised and work is ongoing to finalise the remaining CARs with lower associated risks.

6.4 Major Environmental Incidents and Spill Site Analysis

There were 2 major reportable (important) incidents at formation water disposal facilities during the reporting period. Please refer to the table contained in Appendix 8 for details of these incidents and corrective actions undertaken.

The Spencer Interceptor Pit spill is the only major spill site at a formation water disposal facility requiring ongoing soil sampling and analysis. The analysis reports for half-yearly monitoring at this site are included in Appendix 9 to this report.

6.5 Quarterly Meeting to Discuss Compliance Issues

Quarterly meetings were held with PIRSA to discuss a range of issues associated with environmental management of Santos' SA Cooper Basin operations. Minutes of these meeting are presented in Appendix 4 to this report. The development of the *Formation Water Action Plan* (Santos Ltd 2000d) is a result of discussions on formation water disposal activities conducted during quarterly meetings.

C. EARTHWORKS

(WITH EXCEPTION OF WELL SITE CONSTRUCTION)

Section 7: Borrow Pit Construction and Restoration

7.1 Summary of Activities

Activities pertaining to borrow pit operations undertaken during the reporting period are summarised as follows:

- 58 borrow pits were constructed in association with well lease, camp site and access track construction activities (refer Appendix 1).
- 7 borrow pits were restored in association with well lease restoration activities (refer Appendix 2).

7.2 Scouting and Risk Assessment

All borrow pits are constructed and restored in accordance with the procedures outlined in *The Environmental Procedures for Borrow Pit Management* (Santos Ltd 1997c).

Prior to construction, proposed borrow pit locations are scouted for sites of Aboriginal heritage significance in accordance with the *Environmental Procedures for the Management of Aboriginal Heritage Sites (*Santos Ltd 1998a).

Major risks identified with the construction and restoration of borrow pits are associated with operations undertaken by the pastoral industry. Many borrow pits are left to prevent a bogging hazard to stock and as a water source on the request of the pastoralist. No agreements were signed with pastoralists during the reporting period as all borrow pits were constructed within Petroleum Production Licences (PPLs). These locations are not restored initially as they are often required for future use. Where required, agreements with pastoralists will be made at the time of relinquishment.

7.3 Non-conformances Detected against SABU EMS and Environmental Objectives

Borrow pits were included in the audit of recently drilled well sites. The audit indicated that a high standard against the objectives of minimising environmental disturbance had been achieved. No record or observations of any accidental disturbance to any sites of Aboriginal heritage significance during borrow pit construction were identified.

7.4 Assessment of Restoration

An assessment of the level of borrow pit restoration was undertaken for those borrow pits associated with well lease construction operations. These locations were assessed against the objectives outlined in the *Code of Environmental Practice – Production and Processing* (Santos Ltd 1999). These pits were inspected during the *Environmental Audit of Recently Drilled Wells* (Santos Ltd 2000a). All borrow pits assessed had been restored to an acceptable standard.

7.5 Quarterly Meeting to Discuss Compliance Issues

Quarterly meetings were held with PIRSA to discuss a range of issues associated with the environmental management of Santos' SA Cooper Basin operations. Actions arising from these meetings are presented in Appendix 4 of this report. No major issues relating to borrow pit construction and restoration were raised during these meetings.

Section 8: Road and Access Track Construction and Restoration

8.1 Summary of Activities

There were two new roads constructed during the reporting period (with the exception of well lease access tracks).

- Moomba #104 Oil Facility (4.4km of new road).
- Meranji Manifold Access (300 metres of new road).

No restoration of access tracks or roads was undertaken during this reporting period.

8.2 Scouting and Risk Assessment

Road and access track construction is carried out in accordance with the *Roadworks Design Standards Guide No 1500-40-G001 Rev 0* (Santos Ltd undated) and *Excavation and Backfilling Guide No 1500-120S002* (Santos Ltd undated).

As with well site construction activities, new track locations are scouted in accordance with the *Environmental Procedures for Well Lease Location, Construction and Restoration* (Santos Ltd 1997a), the *Environmental Procedures for the Management of Aboriginal Heritage Sites* (Santos Ltd 1998a), the *field Guide to the common Plants of the Cooper Basin* (Santos Ltd 1997b), and the *Environmental Procedures for Borrow Pit Management* (Santos Ltd 1997c).

8.3 Non-conformances Detected against SABU EMS and Environmental Objectives

Neither of these roads has been subject to independent inspection following completion of construction and restoration activities.

8.4 Assessment of Restoration

There have been no assessments undertaken within the reporting period of restoration standards for road and access track construction and restoration activities as no restorative works have been initiated.

8.5 Quarterly Meeting to Discuss Compliance Issues

Quarterly meetings were held with PIRSA to discuss a range of issues associated with the environmental management of Santos' SA Cooper Basin operations. Actions arising from these meetings are presented in Appendix 4 of this report. No major issues relating to road and access-track construction and restoration were raised during this reporting period or in these meetings.

References

NSCA. 1997
NSCA Risk Score Calculator. (NSCA)

Santos Ltd. 1991
Code of Environmental Practice – Production. Santos Ltd.

Santos Ltd. 1997a
Environmental Procedures for Well Lease Location Construction and Restoration. Santos Ltd.

Santos Ltd. 1997b
Field Guide to the Common Plants of the Cooper Basin. Santos Ltd.

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Environmental Procedures for Borrow Pit Management. Santos Ltd.

Santos Ltd. 1998a
Environmental Procedures for the Management of Aboriginal Heritage Sites. Santos Ltd.

Santos Ltd. 1998b

Code of Environmental Practice – Drilling & Workover Operations. Santos Ltd.

Santos Ltd. 1999
Code of Environmental Practice – Production & Processing Operations. Santos Ltd.

Santos Ltd. 2000a
Environmental Audit of Recently Drilled Wells. Santos Ltd.

Santos Ltd. 2000b
Stock Proof Fencing Standard. Santos Ltd.

Santos Ltd. 2000c
Santos Drilling Management System, Drilling Operations Manual (DOM) Version 1. Santos Ltd.

Santos Ltd. 2000d
Formation Water Action Plan. Santos Ltd.

Santos Ltd. 2000
SABU Petroleum Engineering Well Abandonment Procedures Version 1. Santos Ltd.

Santos Ltd. undated
Petroleum Engineering Moomba Standard Procedure 1-13 *Well maintenance top ups and pressure testing.* Santos Ltd.

Santos Ltd. undated
SABU Drilling Management System, Drilling Operations Manual (DOM) Revision 1. Santos Ltd.

Santos Ltd. undated
Roadworks Design Standards Guide No 1500-40-G001 Rev 0. Santos Ltd.

Santos Ltd. undated
Excavation and Backfilling Guide No 1500-120S002. Santos Ltd.

Standards Australia. 1997
HB 105-1998 Guide to pipeline risk assessment in accordance with AS 2885.1, 1997. Standards Australia.

Appendix 1: Well Lease Construction Activity

WELL NAME	No.	WELL STATUS	Drill MTH	Drill YR	B/PITS	B/F MTH	B/F YR	PHOTOS	KM ROAD
BECKLER	2	C&S	3	0	1				1.1
BIG LAKE	64	C&S	1	0	1				1.6
BIG LAKE	67	C&S	7	0	1				0.7
CUTTAPIRRIE	6	C&S	2	0	7				5.4
CUTTAPIRRIE	7	P&A	4	0	1				1
DELLA	19	C&S	10	99	1	7	99	YES	0.5
DELLA	20	C&S	2	0	0				1
DELLA	21	C&S	2	0	1				0.7
DELLA	22	C&S	2	0	1				1
EPSILON	10	P&A	11	99	1				1.2
JACK LAKE	3	C&S	12	99	2	6	0	YES	1.6
MERANJI	19	C&S	2	0	2				1.5
MERANJI	20	C&S	2	0	1				0.7
MERANJI	21	C&S	2	0	1				0.9
MERANJI EAST	1	C&S	11	99	1				1.8
MOOMBA	104	C&S	11	99	1				0.6
MOOMBA	105	C&S	12	99	1				1
MOOMBA	107	C&S	2	0	2				2.3
MOOMBA	108	C&S	1	0	3				1.3
MOOMBA	112	C&S	4	0	2				1.1
MOOMBA	113	C&S	4	0	2				2.2
MOOMBA	115	C&S	7	0	2				1.3
MOOMBA	116	C&S	6	0	1				0.4
MOOMBA	106	C&S	1	0	2				2.3
MOOMBA	109	C&S	3	0	1				0.6
MOOMBA	110	C&S	6	0	2				1.3
MOOMBA	111	C&S	3	0	2				0.7
MOOMBA	114	C&S	7	0	2				1.3
MOOMBA	117	C&S	6	0	2				1.2
MOOMBA	118	C&S	6	0	1				0.7
MOOMBA	119				1				0.6
NEPHRITE STH	2	C&S	12	99	1	10	99		0.9
PONDRINIE NTH	1	C&S	7	99	1	11	99	NO	3.9
PONDRINIE NTH	2	P&S	6	0	1				1.3
PONDRINNIE	16	C&S	2	0	1				1.6
PONDRINNIE	17	C&S	7	0	1				1.8
SWAN LAKE	4	C&S	8	99	1	7	0	YES	0.4
TOOLACHEE WEST	1	C&S	6	0	3				2.7
									52.2

Appendix 2: Well Lease Backfill and Restoration

WELL NAME	No.	WELL Status	Drill Month	Drill Year	B/PITS	B/F Month	B/F Year	PHOTOS	ROAD km	Access Rest GPS Points (where appropriate)
ALLUNGA TROUGH	1	C&S	5	98		7	99	YES		
BARINA	4	C&S	1	2000		6	0	YES		
BARINA	5	C&S	1	2000		6	0	YES		
BIG LAKE	61	P&A	4	98		7	99	YES	0.5	Start S28 13' 35.3" E140 13' 52.2" End S28 13' 39.6" E140 17' 1"
BIG LAKE	62	C&S	5	98		6	99	NO		
BIG LAKE	63	C&S	6	99		6	0	YES		
CABERNET	1	C&S	4	98		9	99	YES		
CABERNET	3	C&S	12	98		8	99	YES		
DELLA	19	C&S	10	99	1	7	99	YES	0.5	
DIRKALA	4	P&A	1	99		9	99	YES	1.4	Start S28 30' 39.3" E140 2' 12.3" End S28 30' 57.5" E140 2' 8.6"
DOUBLEJAY	1	P&A	1	99		8	99	YES	9.6	Start S26 56' 9.9" E139 51' 20.3 End S27 51' 20.3" E139 49' 5.1"
FICUS	1	C&S	7	98		10	99	YES		
JACK LAKE	3	C&S	12	99	2	6	0	YES	1.6	
KERNA	7	C&S	3	99		12	99	YES		
LUJOEL	1	P&A	2	99		11	99	YES	12.5	
MERANJI	15	C&S	10	95		10	99	NO		
MERANJI	16	C&S	4	98		10	99	NO		
MERANJI	18	C&S	5	99		10	99	NO		
MERANJI	17	C&S	1	99		10	99	NO		
MERLOT	1	C&S	12	98		7	99	YES		
MICA	1	C&S	12	98		10	99	YES		
MOOLION EAST	1	P&A	2	99		12	99	YES	3.5	
MOOMBA	91	C&S	11	97		7	99	YES		
MOOMBA	92	C&S	12	97		7	99	YES		
MOOMBA	95	C&S	1	98		7	99	YES		
MOOMBA	103	C&S	1	99		10	99	YES		
MOOMBA	105	C&S	12	99	1				1	
MOOMBA	96	C&S	2	98		7	99	YES		
MOONANGA	1	C&S	10	98		8	99	YES		
MUDERA	5	C&S	10	96		3	99	YES		
NEPHRITE STH	2	C&S	12	99	1				0.9	
PONDRINIE NTH	1	C&S	7	99	1	11	99	NO	3.9	
PONDRINNIE	15	C&S	3	99		5	0			
PONDRINNIE	14	C&S	12	98		11	99	NO		
RAVEN	1	C&S	1	99		8	99	YES		
SHIRAZ	1	C&S	7	98		7	99	YES		
SWAN LAKE	4	C&S	8	99	1	7	0	YES	0.4	
TERRACE	1	P&A	1	99		10	99	NO	1.7	
TOURIGA	1	C&S	2	99		9	99	YES		

Appendix 3: *Environmental Audit of Recently Drilled Wells* Summary

Well Name	Block	Spud date	Rig	Status	Numbers: System Non-conformance (SNC) / Objectives Not Achieved (O)		
					Well Site Location, Construction and Restoration	Drilling & Workover Activities	Producing Well S
Big Lake #64	Moomba	1/6/00	C #18	C&S	(SNC) 1 (O) 1	(O) 2 (SNC) 1	
Dullingari #51	Toolachee	4/5/99	OD&E #32	C&S	(O) 1	(O) 2 (SNC) 1	
Jack Lake #3	Patchawarra SW	11/17/99	C #18	C&S	(O) 1	(O) 2 (SNC) 1	
Meranji #19	Merrimelia Innamincka	2/20/00	C #18	C&S	(O) 1	(O) 2 (SNC) 1	
Meranji East #1	Merrimelia Innamincka	10/24/99	C #18	C&S	(O) 1	(O) 3 (SNC) 1	
Moomba #108	Moomba	2/23/00	OD&E #32	C&S	(O) 1	(O) 3 (SNC) 1	
Big Lake #63	Moomba	6/14/99	C #27	prod	none identified	(O) 4 (SNC) 1	None identifie
Kerna #7	Toolachee	3/12/99	C #27	prod	(SNC) 1	(O) 3 (SNC) 1	None identifie
Moomba #103	Moomba	2/17/99	C #27	prod	(O) 2	(O) 2 (SNC) 1	None identifie
Nephrite South #2	Patchawarra SW	12/10/99	C #18	prod	(O) 1	(O) 2 (SNC) 1	None identifie
Pondrinie #15DW	Merrimelia Innamincka	2/24/99	OD&E #32	prod	none identified	(O) 2 (SNC) 1	None identifie
Swan Lake #4	Merrimelia Innamincka	8/5/99	OD&E #32	prod	(O) 1	(O) 3 (SNC) 1	None identifie
Allunga Trough #1	Nappacoongie Murteree	6/6/98	C #18	C&S	(O) 1	none identified	
Della #18 (deepening)	Nappacoongie Murteree	5/10/98	Smart #1	C&S	(O) 1	(O) 1 (SNC) 1	
Ficus #1	Merrimelia Innamincka	9/1/98	Smart #1	C&S	(O) 1	(SNC) 1	
Gudnuki #3	Toolachee	7/9/98	OD&E #32	C&S	none identified	none identified	
Kerna North #1	Toolachee	6/12/98	OD&E #32	P&S	(SNC) 1	none identified	
Merlot #1	Moomba	11/20/98	C #27	P&S	(SNC) 1	none identified	
Napowie #2	Merrimelia Innamincka	5/3/98	C #27	C&S	(O) 1 (SNC) 1	none identified	
Scrubby Creek #1	Merrimelia Innamincka	6/16/98	C #27	C&S	(O) 1 (SNC) 1	none identified	
Shiraz #1	Moomba	7/4/98	C #2	P&S	none identified	(SNC) 1	
Terrace #1	Patchawarra East	11/3/98	C #3	P&S	none identified	(SNC) 1	
Vatore #1	Patchawarra SW	5/2/98	C #18	C&S	(O) 1 (SNC) 1	none identified	
Barina #3	Murta	6/18/98	C #2	prod	(O) 1	(O) 1	None identifie
Big Lake #62	Moomba	5/15/98	OD&E #32	prod	(O) 1 (SNC) 1	(O) 1	None identifie
Cabernet #2	Murta	5/30/98	C #2	prod	(SNC) 1	(O) 1 (SNC) 1	None identifie
Cabernet #3	Murta	1/4/99	C #18	prod	(O) 1	none identified	None identifie
Daralingie #25	Moomba	5/14/98	C #2	prod	none identified	none identified	None identifie
Meranji #17	Merrimelia Innamincka	1/1/99	OD&E #32	prod	(O) 1	(O) 1 (SNC) 1	None identifie
Mica #1	Patchawarra SW	12/1/98	C #2	prod	(O) 1	(O) 1	None identifie
Moolion North #1	Patchawarra East	8/2/98	C #27	prod	(O) 1	(O) 1 (SNC) 1	None identifie
Moomba #95	Moomba	4/9/98	Smart #1	prod	none identified	none identified	None identifie
Moomba #99	Moomba	4/30/98	Smart #1	prod	(O) 1	(SNC) 1	None identifie
Moomba #100	Moomba	10/25/98	C #2	prod	(O) 1	(SNC) 1	None identifie
Moomba #101	Moomba	12/10/98	C #18	prod	(SNC) 1	(O) 1	None identifie
Moomba #102DW	Moomba	11/17/98	C #18	prod	none identified	(SNC) 1	None identifie
Moonanga #1	Patchawarra SW	10/18/98	C #18	prod	(O) 2	(SNC) 1	None identifie
Pondrinie #14DW	Merrimelia Innamincka	11/15/98	OD&E #32	prod	(O) 1	none identified	None identifie
Pondrinie North #1	Merrimelia Innamincka	7/15/99	OD&E #32	prod	none identified	none identified	None identifie
Raven #1	Patchawarra SW	12/29/98	C #2	prod	(O) 1	(O) 1 (SNC) 1	None identifie
Touriga #1	Murta	1/23/99	OD&E #32	prod	(SNC) 1	(O) 1	None identifie
Verona #1	Patchawarra East	10/18/98	OD&E #32	prod	none identified	(O) 1 (SNC) 1	None identifie
Welcome Lake East #1	Patchawarra SW	7/15/98	C #18	prod	(O) 1 (SNC) 1	(O) 1	None identifie
Big Lake #61	Moomba	5/23/98	Smart #1	P&A	none identified	none identified	
Cobbler #1	Merrimelia Innamincka	10/15/98	C #27	P&A	(O) 1	none identified	

Well Name	Block	Spud date	Rig	Status	Numbers: System Non-conformance (SNC) / Objectives Not Achieved (O)		
					Well Site Location, Construction and Restoration	Drilling & Workover Activities	Producing Well S
Dirkala #4	Murta	2/7/99	OD&E #32	P&A	none identified	none identified	
Doublejay #1	Patchawarra SW	11/23/98	C #2	P&A	none identified	none identified	
Gamay #1	Murta	11/18/98	C #2	P&A	none identified	none identified	
Kelbrook #1	Toolachee	12/14/98	OD&E #32	P&A	none identified	none identified	
Lujoel #1	Patchawarra East	1/10/99	C #3	P&A	none identified	none identified	
Moolion East #1	Patchawarra East	1/18/99	C #27	P&A	(SNC) 1	none identified	
Moomba #98	Moomba	7/8/98	Smart #1	P&A	none identified	(SNC) 1	
Pelican South #1	Merrimelia Innamincka	9/29/98	C #2	P&A	none identified	none identified	
Rutherford #1	Patchawarra East	11/9/98	C #3	P&A	none identified	(SNC) 1	
Tarragon #2	Patchawarra East	8/30/98	OD&E #32	P&A	none identified	(SNC) 1	
Thiele #1	Merrimelia Innamincka	12/24/98	C #27	P&A	(O) 1	none identified	
Trebianno #1	Murta	1/20/99	C #18	P&A	none identified	none identified	

Appendix 4: Actions Arising from PIRSA Quarterly Environmental Management Meetings

PIRSA Meetings: 1 November 1999
14 February 2000
3 April 2000
10 July 2000

Meeting between PIRSA and SABU Environmental Management in the SA Cooper Basin.

Actions arising from Meeting of Monday, 1 November 1999
91 King William Street, Level 9, Strzelecki Meeting Room
Meeting commenced at 2.30 pm

Present

WJ Hudson, S Tunstill, A Lahne, C McTaggart, E Dyer (Santos)
T Aust, M Malavazos, R McDonough (PIRSA)

Actions Arising

Action	Responsibility	Due Date
Provide T Aust with a copy of the EPA Licence Conditions for the Landfarm and Waste Depot.	S Tunstill	12/11/99
T Aust to contact E Dyer to arrange online presentation of Santos IMS.	T Aust	When convenient
Santos to provide graphical summaries of oil spill volume and number of incidents.	S Tunstill	Next meeting

PIRSA to provide S Tunstill with details of the Environment Protection Officers training course.	T Aust	When available
PIRSA to formalise comments on Oil Spill Project and provide to Santos.	T Aust	23/12/99
PIRSA to provide report on inspection of evaporation pond facilities.	M Malavazos	23/12/99

Next Meeting: Monday 14 th February 2000,
Santos House
Level 9, 91 Ki ng William Street, Adelaide
Room 9.1 (Strzelecki)
at 2.30pm.

Meeting between PIRSA and Santos
Environmental Management in the SA Cooper Basin.

Actions arising from Meeting of Monday, 14 February 2000
91 King William Street, Level 9, Strzelecki Meeting Room
Meeting commenced at 2.30 pm

Present

WJ Hudson, S Tunstill, A Lahne, C McTaggart, E Dyer (Santos)
T Aust, M Malavazos, D Cockshell (part) (PIRSA)

Apologies

R McDonough (PIRSA)

Actions Arising

Action	Responsibility	Due Date
Santos to present analysis of crude and condensate streams for non-hydrocarbon contaminants at next meeting (agenda item).	E Dyer	3/4/2000
Santos to review report on bio-remediation study undertaken at Big Lake and plots to be re-sampled.	S Tunstill	Prior to 3/4/2000
Santos to review GAS criteria for remediation of oil spill sites and submit to PIRSA for approval.	S Tunstill	Prior to 3/4/2000
Santos to provide results of recent analysis of Keleary pipeline spill as soon as available.	E Dyer	Prior to 3/4/2000
Santos to ensure that field personnel are	E Dyer	3/4/2000

Action	Responsibility	Due Date
advised of spill reporting requirements for PFW disposal facilities.		
Abandoned Jena #2 facility to be restored.	A Lahne	TBA
Santos to provide PIRSA with definitions of compliance and conformance for reporting consistency.	E Dyer	Prior to 3/4/2000
PIRSA to provide S Tunstill with details of next Environment Protection Officers training course.	T Aust	As soon as available.
Santos to respond to PIRSA correspondence commenting on Cooper Creek Oil Spill Study and provide outline of future direction.	C McTaggart	Prior to 3/4/2000
Santos to provide PIRSA with a list of sites and scope of analysis for pond sediment sampling program.	S Tunstill	Prior to 3/4/2000.
PIRSA to provide copy of reporting timeframes and format to Santos as agreed with SACOME.	M Malavazos	As soon as practical.
Santos to finalise generic abandonment procedure/guideline for wells and submit to PIRSA for approval.	WJ Hudson (A DeGaris and S Dorigo to finalise).	Urgent.
PIRSA to provide Santos with formal correspondence clarifying comments made in the PIRSA Annual Report –1998/99.	T Aust	As soon as possible.
Santos to provide PIRSA with summary of environmental incidents at quarterly meetings (agenda item).	E Dyer	3/4/2000

Next Meeting: Monday 3 rd April 2000,
Santos House
Level 9, 91 King William Street, Adelaide
Room 9.1 (Strzelecki)
at 2.30pm.

Meeting between PIRSA and Santos
Environmental Management in the SA Cooper Basin.

Actions arising from Meeting of Monday, 3 April 2000
91 King William Street, Level 9, Strzelecki Meeting Room

Meeting commenced at 2.30 pm

Present **Santos**: WJ Hudson, S Tunstill, A Lahne, C McTaggart, E Dyer
S Dorigo (part), A De Daris (part), P Mackey (part)

PIRSA: T Aust, M Malavazos, R McDonough

Apologies

There were no apologies.

Actions Arising

Action	Responsibility	Due Date
Santos to finalise procedure for well abandonment risk assessment and management. PIRSA to be advised on completion of interim stages.	P Mackey	As appropriate and before 3/7/2000
Santos to review EGIS report on remediation of oil spills commissioned by QNTBU.	S Tunstill	Prior to 3/7/2000
Santos to review report on bio-remediation study undertaken at Big Lake and arrange for plots to be re-sampled.	S Tunstill	Prior to 3/7/2000
Based on review of reports and results, Santos to amend GAS criteria for remediation of oil spill sites and submit to PIRSA for approval.	S Tunstill	Subject to completion of above 2 actions.
Santos to provide PIRSA with results of recent analysis of Jena #1, #4, Limestone Creek pipeline (2 sites) and Ulandi #1 (2 sites) oil spills.	E Dyer	As soon as available.
Tanks at Jena #2 facility to be removed and surface rehabilitated.	A Lahne	When practical.
PIRSA to provide S Tunstill with details of next Environment Protection Officers training course.	T Aust	As soon as available.
PIRSA to provide formal response to Santos' earlier correspondence on proposed direction of Cooper Creek Oil Spill Study.	R McDonough	As soon as practical.
Santos to advise PIRSA of outcomes of future discussions and resultant direction of Cooper Creek Oil Spill Study.	C McTaggart	As appropriate.
Santos to undertake analysis of sediment samples collected from produced formation water holding and evaporation ponds for gas and oil satellites.	E Dyer	When access conditions permit.

Action	Responsibility	Due Date
Santos to consider draft letter on alternative arrangement approval and schedule meeting with PIRSA to address issues.	S Tunstill	20/4/2000
Santos to review revised draft of Drilling and Workover Statement of Environmental Objectives and provide comments to PIRSA.	S Tunstill	As soon as practical.

Meeting closed at 4.20 pm

Next Meeting: Monday 3 July 2000
Santos House
Level 9, 91 King William Street, Adelaide
Room 9.1 (Strzelecki)
at 2.30pm.

Meeting between PIRSA and Santos Environmental Management in the SA Cooper Basin.

Actions arising from Meeting of Monday, 10 July 2000
91 King William Street, Level 9, Strzelecki Meeting Room
Meeting commenced at 2.00 pm

Present	**Santos**:	WJ Hudson, S Tunstill, J Young S Dorigo (part), P Mackey (part) S Smith (Ecos Consulting)
	PIRSA:	M Malavazos, J Morton
Apologies	**Santos**:	A De Garis, A Lahne, C McTaggart
	PIRSA:	T Aust, R McDonough

Actions Arising

Action	Responsibility	Due Date
Santos to consider and incorporate comments on draft well abandonment procedure raised by PIRSA during meeting. Santos to finalise procedure for well abandonment risk assessment and management. PIRSA to be advised on completion of interim stages.	P Mackey	As appropriate and before 3/7/2000
Santos to review EGIS report on remediation of oil spills commissioned by QNTBU.	S Tunstill	Prior to 3/7/2000

Action	Responsibility	Due Date
Santos to review report on bio-remediation study undertaken at Big Lake and arrange for plots to be re-sampled.	S Tunstill	Prior to 3/7/2000
Based on review of reports and results, Santos to amend GAS criteria for remediation of oil spill sites and submit to PIRSA for approval.	S Tunstill	Subject to completion of above 2 actions.
Santos to provide PIRSA with results of recent analysis of Jena #1, #4, Limestone Creek pipeline (2 sites) and Ulandi #1 (2 sites) oil spills.	E Dyer	As soon as available.
Tanks at Jena #2 facility to be removed and surface rehabilitated.	A Lahne	When practical.
PIRSA to provide S Tunstill with details of next Environment Protection Officers training course.	T Aust	As soon as available.
PIRSA to provide formal response to Santos' earlier correspondence on proposed direction of Cooper Creek Oil Spill Study.	R McDonough	As soon as practical.
Santos to advise PIRSA of outcomes of future discussions and resultant direction of Cooper Creek Oil Spill Study.	C McTaggart	As appropriate.
Santos to undertake analysis of sediment samples collected from produced formation water holding and evaporation ponds for gas and oil satellites.	E Dyer	When access conditions permit.
Santos to consider draft letter on alternative arrangement approval and schedule meeting with PIRSA to address issues.	S Tunstill	20/4/2000
Santos to review revised draft of Drilling and Workover Statement of Environmental Objectives and provide comments to PIRSA.	S Tunstill	As soon as practical.

Meeting closed at 3.50 pm

Next Meeting: Monday 9 July 2000
Santos House
Level 9, 91 King William Street, Adelaide
Room 9.1 (Strzelecki)
at 2.0 0pm.

Appendix 5: Wells Drilled

BLOCK	WELL NAME	CURRENT STATUS	LATITUDE	LONGITUDE	SPUD DATE
MEI	PONDRINIE NORTH 1	Producing	27 31 32.50 S	140 41 48.49 E	15-Jul-99
MEI	SWAN LAKE 4	Producing	27 51 08.67 S	140 07 34.11 E	05-Aug-99
MEI	MERANJI EAST 1	Producing	27 51 11.06 S	140 05 56.59 E	24-Oct-99
PSW	JACK LAKE 3	LO	27 57 08.10 S	139 48 59.85 E	17-Nov-99
NM	DELLA 19	Producing	28 5 43.68 S	140 39 18.10 E	06-Dec-99
PSW	NEPHRITE SOUTH 2	Producing	27 54 31.64 S	139 52 9.16 E	10-Dec-99
MOO	MOOMBA 105	Producing	28 02 30.14 S	140 11 55.82 E	01-Jan-00
MUR	BARINA 4	Producing	28 18 32.14 S	139 55 11.56 E	02-Jan-00
MOO	BIG LAKE 64	Producing	28 13 44.73 S	140 18 18.51 E	06-Jan-00
MUR	BARINA 5	Producing	28 18 26.96 S	139 54 15.05 E	16-Jan-00
MOO	MOOMBA 106	Producing	28 03 19.98 S	140 10 40.47 E	26-Jan-00
PE	CUTTAPIRRIE 6	Producing	27 14 51.19 S	140 19 06.54 E	03-Feb-00
MOO	MOOMBA 104	SUO	28 10 11.48 S	140 11 22.57 E	06-Feb-00
MEI	MERANJI 19	Producing	27 51 21.82 S	140 05 32.35 E	20-Feb-00
MOO	MOOMBA 108	Producing	28 03 55.06 S	140 10 41.42 E	23-Feb-00
MEI	PONDRINIE 16	SUG	27 35 02.62 S	140 35 33.81 E	01-Mar-00
MEI	MERANJI 21	Producing	27 50 57.94 S	140 05 18.37 E	10-Mar-00
MOO	MOOMBA 109	Producing	28 04 32.43 S	140 10 42.83 E	11-Mar-00
PE	CUTTAPIRRIE 7	ABGS	27 14 49.64 S	140 21 36.53 E	27-Mar-00
MOO	MOOMBA 111	Producing	28 02 38.47 S	140 09 33.56 E	28-Mar-00
TOO	BECKLER 2	Producing	28 03 21.82 S	140 57 13.25 E	31-Mar-00
MOO	MOOMBA 112	Producing	28 03 15.48 S	140 09 31.95 E	15-Apr-00
NM	DELLA 20	Producing	28 6 27.46 S	140 37 36.53 E	23-Apr-00
MOO	MOOMBA 113	Producing	28 03 20.76 S	140 08 36.43 E	10-May-00
NM	DELLA 22	Producing	28 6 5.07 S	140 39 30.01 E	16-May-00
MEI	PONDRINIE NORTH 2	PSG	27 31 11.21 S	140 42 01.68 E	25-May-00
MOO	MOOMBA 110	Producing	28 03 35.65 S	140 11 24.10 E	26-May-00
NM	DELLA 21	SUG	28 06 27.96 S	140 37 14.28 E	30-May-00
MOO	MOOMBA 107	Producing	28 03 02.63 S	140 10 04.87 E	11-Jun-00
TOO	TOOLACHEE WEST 1	LO	28 23 44.70 S	140 45 38.87 E	11-Jun-00
MEI	PONDRINIE 17DW	Producing	27 35 16.02 S	140 36 20.90 E	14-Jun-00
MOO	MOOMBA 116	Producing	28 03 42.47 S	140 08 06.44 E	27-Jun-00
MOO	MOOMBA 114	SUG	28 02 40.90 S	140 08 15.50 E	12-Jul-00
MEI	MERANJI 20	LO	27 50 35.38 S	140 05 03.50 E	13-Jul-00
MOO	MOOMBA 118DW	LO	28 10 09.77 S	140 11 34.27 E	13-Jul-00
MOO	MOOMBA 115	Producing	28 01 43.32 S	140 08 58.21 E	25-Jul-00
MEI	MERANJI 22	LO	27 51 08.48 S	140 04 35.91 E	30-Jul-00
MOO	MOOMBA 117DW	LO	28 09 44.69 S	140 11 29.73 E	04-Aug-00

Appendix 6: Workover Operations

WELL NAME	ACTIVITY: WORKOVER/FRACTURE STIMULATION	COMPLETED AS MONOBORE OR CONVENTIONAL	ONLINE DATE
Barina 4	Yes	Monobore	26/5/00
Barina 5	Yes	Monobore	25/5/00
Big Lake 63	Yes	Monobore	1/11/99
Big Lake 64	Yes	Monobore	29/4/00
Bungee 1	No	Conventional	3/2/00
Cabernet 2	Yes	Monobore	26/5/00
Coonatie 1	Yes	Conventional	8/3/00
Cuttapirrie 6	No	Monobore	13/4/00
Della 19	No	Monobore	1/2/00
Massy 1	No	Conventional	8/4/00
Meranji 18	Yes (20/6/99)	Conventional	-
Meranji 19	Yes	Monobore	18/5/00
Meranji 21	Yes	Monobore	25/6/00
Meranji East 1	Yes	Monobore	17/5/00
Moomba 103	Yes (15/6/99)	Monobore	-
Moomba 105	Yes	Monobore	10/4/00
Moomba 106	Yes	Monobore	13/5/00
Moomba 108	Yes	Monobore	25/5/00
Moomba 109	Yes	Monobore	26/6/00
Moomba 111	Yes	Monobore	14/6/00
Moomba North 2	Yes	Conventional	28/2/00
Nephrite South 2	No	Monobore	19/3/00
Pelican 5	No	Conventional	8/4/00
Pondrinie North 1	No	Monobore	1/11/99
Swan Lake 4	Yes	Monobore	1/11/99

Appendix 7: Memory Production Logs

Well Name & No.		Start Date	End Date	Notes
KANOWANA	3	07-Jul-99	11-Jul-99	RIH 1.75"GR & tag HUD @ 9607'KB. RIH 1.75" x 20' drift & tag HUD @ 9607'KB. RIH & make flowing passes from 8820'-9597'KB. Perform static passes from 8820'-9589'KB
DELLA	16	12-Jul-99	12-Jul-99	RIH MPL gauges & make flowing passes of test.
KANOWANA	1	14-Jul-99	15-Jul-99	RIH MPLT tools performing flowing gradient stops to end of tubing (in-line spinner). RIH full bore spinner & complete flowing passes of survey. Shut in well overnight. Complete static passes of survey, well handed back to production.
EPSILON	7	23-Aug-99	24-Aug-99	Make flowing passes in tubing with well on 50% & 100% choke, Make flowing passes in casing with well on 50% & 100% choke.
MERANJI	17	25-Aug-99	03-Sep-99	RIH 1.75"GR & tag PBTD @ 9847'KB. RIH 1.75" x 20' drift & tag PBTD @ 9847'KB. Make flowing passes on 100%, 60% & 70% choke. Make static passes & SGS. RDMO.

MERANJI	7	25-Oct-99	28-Oct-99	RIH 1.75" GR & tag PBTD @ 9577'KB. RIH 1.75" x 20' drift & tag PBTD 2 9479'KB. 27/10/99; perform static passes of test. 28/10/99; perform flowing passes to 9450'KB.
DELLA	10	29-Oct-99	29-Oct-99	RIH with MPL tool & perform flowing passes to 6475'KB.
LELEPTIAN	1	06-Dec-99	08-Dec-99	RIH 2.3"GR & tag obstruction at 8961'KB, RIH 2.19" GR & tag HUD at 9750'KB, RIH 2.3"GR, tag at 8961'KB and attempt to jar through, shear off gauge ring. RIH SB pulling tool, latch and POOH with gauge ring. RIH 1.5" x 15' drift & tag PBTD @ 9756'KBRIH MPL tool.
MOONANGA	1	31-Dec-99	01-Jan-00	RIH 1.75"GR & tag HUD @ 9919'KB. Conduct flowing & static passes of MPLT."
CABERNET	1	07-Jan-00	10-Jan-00	2 rate MPLT. Make flowing passes of MPLT with well on 14/64" & 10/64" choke during LET. Make static passes of MPLT
GOYDER	2	11-Jan-00	11-Jan-00	RIH with MPLT performing FGS, then make flowing passes of MPLT between 6475'-6780'KB
SWAN LAKE	4	15-Jan-00	17-Jan-00	RIH with 1.75" GR & tag HUD at 10112'KB. RIH with 1.75" x 20' drift & tag HUD at 10115'KB, RIH with MPL logging tool & perform flowing passes. Shut well in & perform Static passes."
COONATIE	1	26-Jan-00	31-Jan-00	RIH 1.75"GR & tag PBTD @ 7642'KB. RIH 1.75" x 20' drift & tag PBTD @ 9644'KB. Conduct flowing passes of MPLT with well flowing on 100%, 45% & 35% choke. 4th flowing pass with well flowing @ 25E3m3/day. Make static passes of MPLT between 9635'-9280'KB (SITHP=1814psi).
BECKLER	1	15-Mar-00	16-Mar-00	RIH 2.34"GR & tag HUD (Vann gun fish) @ 9233'KB. RIH gauges performing flowing passes of MPLT. 16/3/00; perform static passes of MPLT.

Appendix 7 (cont.)

Well Name & No.		Start Date	End Date	Notes
MERANJI	18	20-Mar-00	21-Mar-00	RIH MPLT & conduct flowing passes from 7950' to 9770'KB. 21/3/00; make static passes & perform SGS.@ surface SITHP=1136psi.
EPSILON	9	13-May-00	14-May-00	13/5/00; RIH with gauges, unable to get down, well lifting tool, choked well back, still unable to gain depth. RIH 1.75"GR, had to choke back well to pass through tailpipe. Open choke & pass through tailpipe several times. 14/5/00; RIH with logging tool.
KERNA	4	18-May-00	19-May-00	RIH 1.75"GR & tag HUD @ 8360'KBRIH gauges performing flowing & static passes of MPLT between 7700'-8349'KB."
STRZELECKI	15	03-Jun-00	04-Jun-00	RIH 2.3"GR to 6046'KB. RIH 1.875" x 20' drift to 6330'KB (all clear). MIRU, conduct MPL flowing and static passes. RDMO. Choke well back to get into casing. Open well back up and let stabilise. Perform flowing passes,

POOH, perform FGS. Unable to get final two stops @ 2000' & 1000'KB, well lifting tool string, cut back choke. POOH. No static.
Four flowing passes between 9340'-9752'KB.
RIH MPL tool for static passes between 9340'-9754'KB.

Appendix 8: †Reportable Environmental Incident Summary

Date Occurred	Time (24 hours)	Report #	Location	Approx. volume (m^3)	Approx. area affected (m^2)	Cause	Rehabilitation actions	Actions to prevent recurrence
20/06/2000		PSSM-4LPT5F (No)	Big Lake Oil facility	5.0	400	Design Factor	Insitu bioremediation.	Readjusted throttling valve.
18/06/2000		PSSM-4LN87Q (Yes)	Moomba 102	5.0	400	Design Factor	Raked oil spill area 26/6/00, after area had dried out. Insitu bioremediation.	Will now reinstate fixed metal pipe with better bracing.
14/06/2000	05:00	PSSM-4L9STJ (Yes)	Moomba Utilities Fire Pump # p 5350	0.05	20		Requisition raised to have contaminated soil removed & replaced.	Operator counselled on the need to maintain vigilance when carrying out filling operations.
31/05/2000		SSTA-4KUB7F (Yes)	Meranji evaporation pond frac tank.	0.1	5	Human Factor	Insitu bioremediation.	Operators to ensure that tanks do not overflow during any pumping operations.
31/05/2000		JJOS-4KVC4Q (No)	Moomba Nth 1	0.004	0.25	Mechanical/Electrical Failure	Most of the wetted earth was placed into a waste bin, the ground adjacent to the spill was treated with super-phosphate.	Take more care when starting up operations in the cool of the morning. A possible contribution to the spill was the increased viscosity of the oil due to cool early morning temperatures leading to higher spot pressures near the oil pump discharge.
30/05/2000	09:30	SSTA-4KT2WC (Yes)	KP66 Keleary trunk line	5.0	100	Unknown/Undetermined	Hose isolated. Clean up cannot start until access is available, as the area is currently surrounded by flood water.	Field Services to inspect the area and recommend adequate area to be fenced to keep cattle away from the trunkline equipment.
29/05/2000		PSSM-4KT9C5 (Yes)	Sturt Field manifold	4.0	125	Corrosion	Suck truck to be on site 31/5/00 at 11:00, Insitu bioremediation.	Operators continue with routine checks

† Those incidents highlighted in the above table are associated with pipelines and will be discussed in the Pipelines Annual Report.

Date Occurred	Time (24 hours)	Report #	Location	Approx. volume (m^3)	Approx. area affected (m^2)	Cause	Rehabilitation actions	Actions to prevent recurrence
11/05/2000		IEWT-4K86TJ (Yes)	KP66 Keleary trunk line	2.0	60	Unknown/Undetermined	Insitu bioremediation.	The area around the equipment is to be fenced to prevent access by cattle, to the equipment. Replaced with higher rated flexible line Cajon TH6,
04/05/2000		PSMA-4JZTE7 (No)	Lime Stone Creek Satellite	25.0	600	Corrosion	In situ bioremediation.	Line blinded. Product returned to storage tanks.
25/04/2000		PESS-4JQ6CZ (Yes)	Moomba 104	0.04	6	Mechanical/Electrical Failure, Human Factor	In situ bioremediation.	Commissioning procedure reviewed.
24/04/2000		PSMA-4JNV39 (Yes)	Spool u/stream of tie into the Gidgealpa oil t/line	0.25	80	Mechanical/Electrical Failure	Clean up will consist of removing stained bushes and remediating filmed area.	Line s/d and depressured, removed and repaired. Block oil Eng. including an expansion joint to eliminate stress point in the F.I.C.
07/04/2000		PSSM-4J6B5K (Yes)	2 kms from LSC	5.0	5	Mechanical/Electrical Failure, Corrosion	Shut shipping pumps down, isolated leak and fitted clamp, Insitu bioremediation.	Ensure regular pressure tests of the line continues.
30/03/2000	16:30	PEBO-4HX6SA	Moomba #104	0.015	10	Design factor - tank internal inlet riser configured differently to other tanks in use.	Spill was bioremediated insitu.	Tank to be used in different configuration in future if same operating conditions arise.
25/03/2000	02:00	CWIE-4HRH3F	Moomba #104 production test/load out tanks	0.6	24	Human factor, procedural error - tank ullage not sufficient for unloading tanker during a production test.	Spill was bioremediated insitu.	1. Specific load out instructions and crew support are to be provided prior to continuation of the flowing test. 2. Provision of a high level alarm. 3. Ensure trainees are added to a regular crew and not initially used as a replacement.

Date Occurred	Time (24 hours)	Report #	Location	Approx. volume (m^3)	Approx. area affected (m^2)	Cause	Rehabilitation actions	Actions to prevent recurrence
22/02/2000	09:00	PSSD-4GSASZ	Strzelecki Oil Satellite	0.4	30	Human factor - line pressured up due to closed valve and gasket blew.	Spill was bioremediated insitu.	Personnel counselled to follow procedure for receiving and removing pigs from the pig receiver. Gasket was replaced. Oil effected area was pressure cleaned to drains. Work order raised to check high pressure switch at Dullingari shipping pumps.
26/01/2000	01:30	SSTA-4FW2ES	Tirrawarra Satellite	30.0	80	Design factor - high liquids level shut down installed incorrectly.	Spill contained within bund.	Change request to remove high pressure switch from Booka ROV and install on Patchawarra Separator, re-install orifice restrictors in the dump lines. Work order to inspect inlet control valve.
25/01/2000		PSSM-4FW43Z	Big Lake #39	1.5	126	Natural hazard - cattle knocked valve.	Area raked.	Valve handle removed.
25/01/2000		PSSM-4FW65M	Big Lake Satellite	2.5	40	Natural hazard - tank overflowed due to recent rain.	Area raked.	TJR raised to determine if a pump is required to transfer liquid to the interceptor pit or if gravity bleed is adequate.
23/01/2000		OSTA-4FTALE	Tirrawarra #49	0.5	10	Corrosion - external	Insitu bioremediation.	Well and flow line have been isolated.
19/11/1999		PEBO-4DTUVM	Moomba 102	1.0		Human Factor		The pipe section has been changed for an alternate section with correct camlock connections (section of pipe later had cams reversed to prevent future occurrence).
03/11/1999		PSMA-4DATSD	Muteroo satellite	30.0	95	Design Factor	In situ bioremediation.	Engineering F.I.C. package in place to fit a N.R.V D/Stream of charge p/p's flexible hose to avoid overpressuring in future.
22/10/1999		PSSM-4CWDXP	Spencer Oil Facility Interceptor Pond	2.0		Mechanical Failure	The area where water had soaked in was raked.	The operator dug a channel so product flowed back into interceptor pond.

Date Occurred	Time (24 hours)	Report #	Location	Approx. volume (m^3)	Approx. area affected (m^2)	Cause	Rehabilitation actions	Actions to prevent recurrence
19/10/1999		JJOS-4CRCN8	Pondrinie Nth 1	0.0	5	Mechanical/ Electrical Failure	Super-phosphate is the prescribed treatment for a spill of this nature and volume, and it will be carried out by 18/10/99.	Examine the hose end where the fitting came free, look for signs of wear and tear that may be looked for on other hoses on that machine and others.
18/10/1999		SSTA-4CRUNE	Keleary Satellite	500.0	100		Keleary and Telopea wells shut in.	Breach inspected and repaired.
12/10/1999		SSDI-4CL94R	Lepena Nodal Compressor	0.4		Mechanical Failure		
31/08/1999		PSSM-4BATYW	Adelaide Rd (Gate 10 - Load in/out Bay)	0.2		Human Factor	Spill limited to surrounds of pump installation. Affected area of spill treated with fertiliser.	
23/08/1999		OSTA-4AZUZK	Merrimelia #21	15.0		Mechanical Failure	Spill bioremediated insitu.	Bund wall repaired.
14/08/1999		PSSD-4AS5S5	Strzelecki Tee	7.0		Human/ mechanical failure	Highly contaminated soil was removed from the site and the site remediated.	
13/08/1999		PSSD-4ATT2B	Toolachee	0.0	0	Mechanical Failure	Dead cattle (5) removed from the site.	All gates and fences have been check and environmental bulletin issued.
07/07/1999		PSSD-49K2B8	Strzelecki Satellite	40.0	6000	Process or procedural error	Contaminated soil removed. Insitu bioremediation.	Shipping pump high discharge shutdown switch & recycle valve system to be checked for correct operation. The trunkline and pig launcher PSVs to be checked for correct settings. Oil to be shipped in daylight hours with a operator on site. Pig to be launched in daylight hours with a operator on site. TJR to be raised to have the PSV discharge lines redirected to the pump suction or similar.(Discharge to open drains at present).

Appendix 9: Production Facility Projects

Project No	Description	Start Date	Finish Date
815023	Relocate Dullingari LP Compressor to Toolachee West	04-Sep-98	26-Nov-99
815026	Moomba North Compression Phase 2	15-Nov-99	02-Jun-00
815027	Merrimelia LP Compression	19-Nov-99	30-May-00
811026	Pipeline to Feed Drums and Vessel	09-Jun-98	15-Dec-99
811028	Big Lake Raw Gas to Sales Gas (ESA #1)	13-Apr-98	05-Sep-99
811029	Offspec Ethane Protection	17-Aug-98	15-Aug-99
811031	Moomba Northern Facilities for Tirrawarra Ex-Ethane Pipeline	01-Feb-99	04-Sep-99
811032	Moomba Tank 3000 Oil in Water Monitor	12-Aug-98	18-Jul-99
811038	Cooper Basin Data Radio Communications System	01-Sep-98	12-Aug-99
811039	Moomba SC#1 & #3 Oil Coolers	01-Aug-98	31-Oct-99
811042	Merrimelia Oil PLC Replacement	20-Apr-98	23-Jul-99
811052	Instrument Air Dryers #3, #4, #5 & #6 Control Modifications	25-Aug-98	27-Sep-99
811053	Moomba CCR Foxboro Multistation Replacement	02-Feb-98	25-Jul-99
811055	Big Lake Compressor Control Upgrade	01-Mar-98	20-Feb-00
811056	Gidgealpa #10 Raw Water Well	01-Sep-98	31-Aug-99
811059	Moomba SC Vibration Monitoring Upgrade	01-Mar-98	20-Feb-00
811061	Moomba Boilers Oxygen Analyser (Trialing)	22-Feb-99	02-Aug-99
811064	ETP Amine Pump Cabling	20-Aug-98	12-Jul-99
811065	Block Oil Field PSV Changeout	18-Mar-99	31-Mar-00
811068	Moomba Comms Site Relocation	01-Dec-98	20-Nov-99
811069	Moomba #4 Flash Evaporator Shell Replacement	30-Nov-98	12-Nov-99
811073	Tirrawarra Ethane Pipeline Pigging Facility	01-Feb-99	13-Sep-99
811075	MSC LDB Ethane & SG Inhibitor Injection System	08-Jan-99	28-Nov-99
811079	Tirrawarra Ethane Separation	29-Apr-99	25-Nov-99
811091	Moomba FC40 Smoke Detection System Upgrade	04-May-99	24-Dec-99
811092	CO2 Train Seal Water Pump Upgrade	01-Apr-99	10-Feb-00
811093	MSC LP Comp Inlet Pressure Control	01-May-99	04-Nov-99
811095	Moomba Potable Water Plant	01-May-99	29-Nov-99
811096	Tirrawarra Ethane Well Modifications	10-May-99	12-Nov-99
811098	Moomba #4 & #6 Boilers Super Heater Upgrade	24-Aug-99	01-Mar-00
811103	Moomba #10 Boiler Upgrade	04-Aug-99	21-Jan-00
811116	Fox Intellegent Auto Work Station	18-Nov-99	15-Mar-00
811124	Big Lake Blowcase Upgrade	10-Sep-99	04-Apr-00
811126	Moomba Boilers #6 & #10 Oxygen Analysers	30-Nov-99	29-Feb-00
815022	Patchawarra East Compression	01-Oct-98	23-Sep-99
815024	Goyder Development Big Lake Phase 2	01-Aug-99	24-Apr-00
815027	Merrimelia LP Compression Phase 2	09-Mar-99	01-May-00

Appendix 9: Production Facility Projects

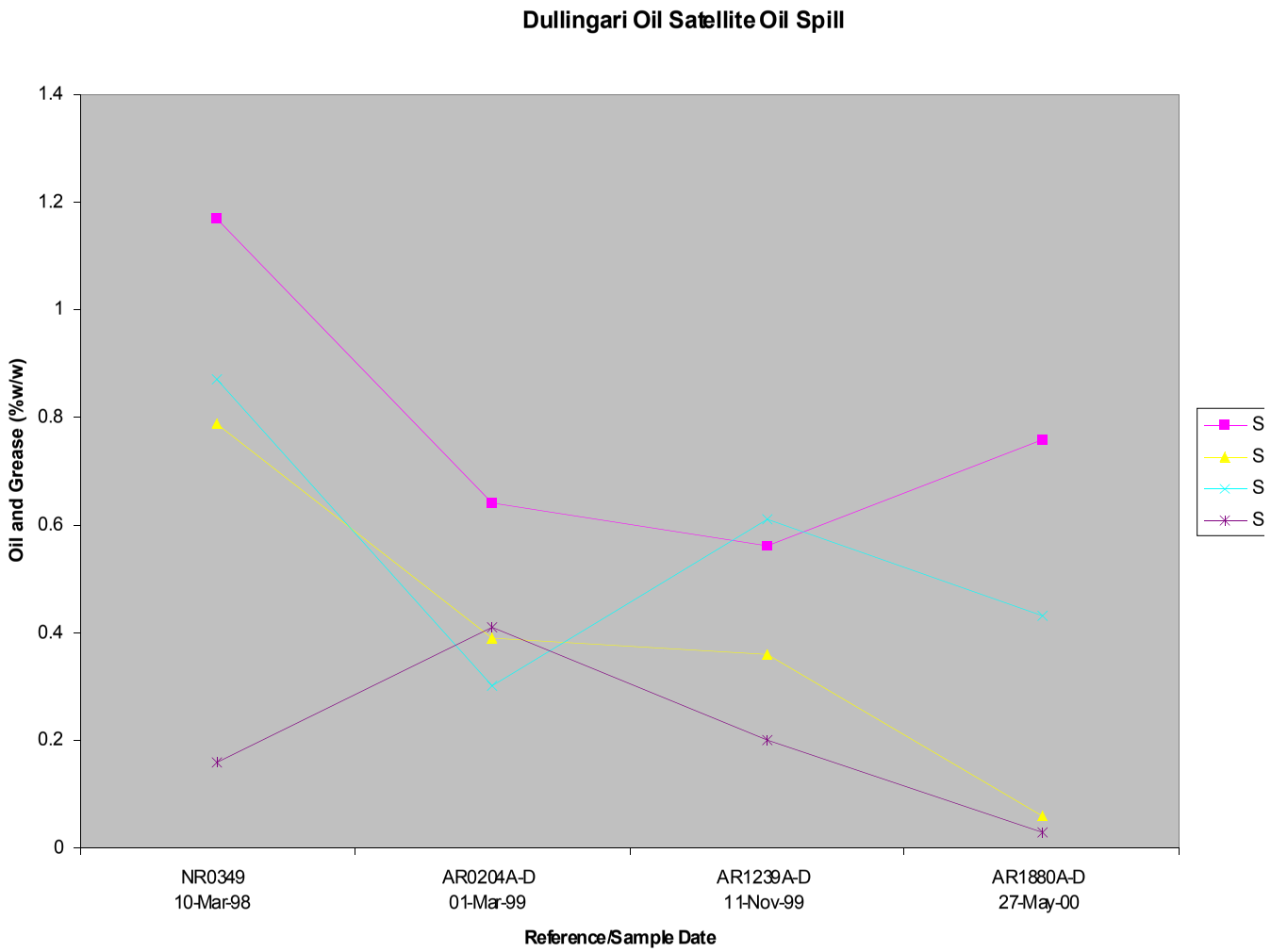
Appendix 10: Operations Support Guides and Specifications Listing

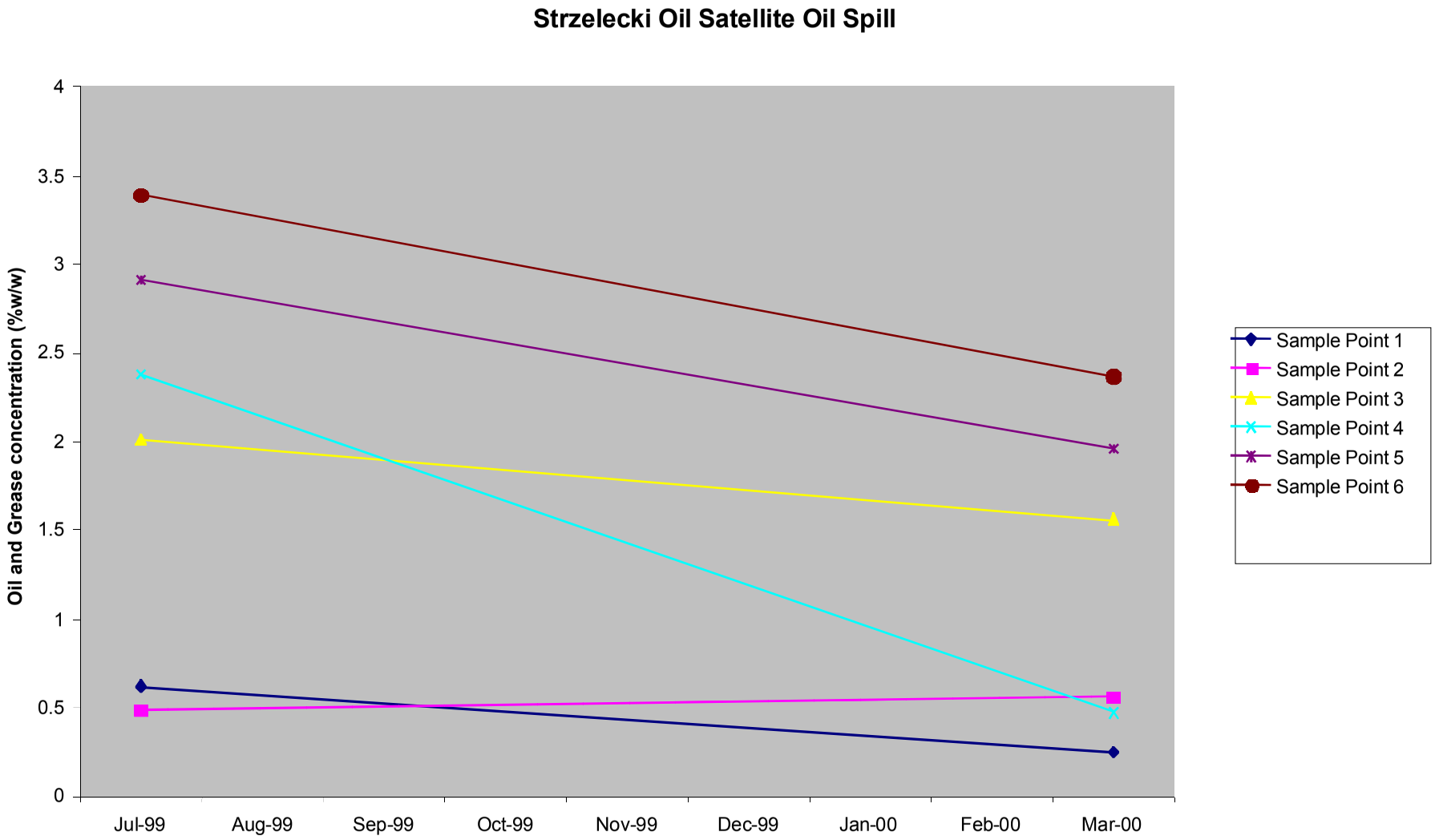
Document	Rev	Title	Under Review
1500-00-S001		PREPARATION OF ENGINEERING DRAWINGS	
1500-10-G002		HAZARDOUS AREA CLASSIFICATION	
1500-10-G003		VENTS TO ATMOSPHERE	
1500-10-G004		GAS SATELLITE EMERGENCY SHUTDOWN SYSTEMS	
1500-10-G005		GAS WELLHEAD CONNECTION DESIGN	
1500-10-G007		FLUID FLOW CALCULATIONS	
1500-10-G008		WATER DISPOSAL SYSTEM DESIGN	
1500-10-G010		TWO AND THREE PHASE SEPARATORS	
1500-10-G012		GAS SATELLITE DESIGN	
1500-10-G014		RELIEF DEVICE SIZING	
1500-10-G015		DEPRESSURISING	
1500-10-G016		GAS BREAKTHROUGH AND RO SIZING	
1500-10-G017		RELIEF SYSTEM DESIGN	
1500-10-G018		FLARE DESIGN	
1500-10-G019		MOOMBA AREA DESIGN CONDITIONS	
1500-10-G020		PORT BONYTHON DESIGN CONDITIONS	
1500-10-G022		FIREPROOFING OF STEELWORK	
1500-10-S001		PACKAGED RECIPROCATING COMPRESSOR - PROCESS SPEC	
1500-10-W001		PRO-FORMA RISK ASSESSMENT FOR SA COOPER BASIN GAS FLOWLINES	
_		Attachment 9.3 Worksheet for Performing the Location and Threat Analysis and Determination of Design Mitigations	
1500-20-S001		UNFIRED PRESSURE VESSELS	
1500-30-G001		PUMPS - CENTRIFUGAL	
1500-30-G002		PACKAGED RECIPROCATING COMPRESSORS	
1500-30-G003		RECIPROCATING PUMPS	
1500-30-S002		PACKAGED RECIPROCATING COMPRESSORS - MECHANICAL AND GENERAL	
1500-40-G001		ROADWORKS DESIGN STANDARDS	
1500-50-G001		DESIGN GUIDE FOR PIPING	
1500-50-G002		DESIGN GUIDE FOR VALVES	
1500-50-G006		HOT TAPPING	
1500-50-G007		PIPELINE GATHERING SYSTEM	
1500-50-P001		ASME 150# CARBON STEEL PIPING	
1500-50-P003		ASME 300# CARBON STEEL PIPING	

Document	Rev	Title	Under Review
1500-50-P006		ASME 600# CARBON STEEL PIPING	
1500-50-P009		11.4 MPAG CARBON STEEL PIPING	
1500-50-P010		ASME 900# CARBON STEEL PIPING	
1500-50-P015		ASME 1500# CARBON STEEL PIPING	
1500-50-P025		ASME 2500# CARBON STEEL PIPING	
1500-50-P101		ASME 150# LOW TEMP CARBON STEEL PIPING	
1500-50-P106		ASME 600# LOW TEMP CARBON STEEL PIPING	
1500-50-P109		ASME 900# LOW TEMP CARBON STEEL PIPING	
1500-50-P201		ASME 150# STAINLESS STEEL PIPING	
1500-50-P203		ASME 300# STAINLESS STEEL PIPING	
1500-50-P206		ASME 600# STAINLESS STEEL PIPING	
1500-50-P301		ASME 150# LINEPIPE CARBON STEEL PIPING	
1500-50-P303		ASME 300# LINEPIPE CARBON STEEL PIPING	
1500-50-P306		ASME 600# LINEPIPE CARBON STEEL PIPING	
1500-50-P309		11.4 MPAG LINEPIPE CARBON STEEL PIPING	
1500-50-P310		ASME 900# LINEPIPE CARBON STEEL PIPING	
1500-50-P315		ASME 1500# LINEPIPE CARBON STEEL PIPING	
1500-50-P325		ASME 2500# LINEPIPE CARBON STEEL PIPING	
1500-50-S003		HOT BENDS	
1500-50-S004		HIGH PRESSURE STEEL LINE PIPE	
1500-50-S008		PIG LAUNCHER AND RECEIVER BARRELS	
1500-50-V300		GATE VALVES	
1500-50-V400		GLOBE VALVES	
1500-50-V500		CHECK VALVES	
1500-50-V600		BALL VALVES	
1500-50-V700		PLUG VALVES	
1500-50-V800		BUTTERFLY VALVES	
1500-50-V900		NEEDLE VALVES	
1500-50-W001		HOT TAPPING	
1500-60-G001		ELECTRICAL DESIGN	
1500-70-S019		PACKAGING OF FIELD COMPRESSION CONTROL SYSTEMS	
1500-70-S020		PROGRAMMABLE/CONFIGURABLE SYSTEMS	
1500-90-S001		SKIDS AND SKID MOUNTED ASSEMBLIES	
1500-120-S001		BULK EARTH WORKS	
1500-120-S002		EXCAVATION AND BACK FILLING	
1500-120-S003		CONCRETE CONSTRUCTION	
1500-120-S004		FABRICATION OF STEELWORK	
1500-120-S005		ERECTION OF STEELWORK	
1500-120-S006		ROADWORKS	
1500-120-S007		EVAPORATION/STORAGE PONDS	
1500-120-S009		INSTALLATION OF EQUIPMENT	
1500-120-S011		GROUTING PLANT AND EQUIPMENT AND STRUCTURAL STEELWORK	

Document	Rev	Title	Under Review
1500-120-S012		ABOVE GROUND PROTECTIVE COATING	
1500-120-S015		FABRICATION AND INSTALLATION OF PROCESS AND UTILITY PIPING	
1500-120-S018		PRESSURE TESTING OF PROCESS AND UTILITY PIPING	
1500-120-S020		BURIED FIELD PIPELINE SYSTEMS	
1500-120-S021		FIELD JOINT COATING	
1500-120-S023		COATING REPAIR TO OPERATING PIPELINES	
1500-120-S025		SHOP APPLICATION OF LIQUID APPLIED HIGH BUILD EPOXY	
1500-120-S027		ABOVE GROUND PIPELINE SYSTEMS	
1500-120-S028		LABORATORY TESTING OF LIQUID APPLIED POLYMERIC COATINGS	
1500-120-S029		CONSTRUCTION OF IMPRESSED CURRENT CATHODIC PROTECTION SYSTEM	
1500-120-S030		INSTALLATION OF CATHODIC PROTECTION TEST POINTS ON BURIED PIPELINE	

Appendix 11: Oil Spill Monitoring Results




Strzelecki Oil Satellite Oil Spill
Oil and Grease concentration (%w/w)
4
3.5
3
2.5
2
1.5
1
0.5
0
Jul-99
Aug-99
Sep-99
Oct-99
Nov-99
Dec-99
Jan-00
Feb-00
Mar-00
Sample Point 1
Sample Point 2
Sample Point 3
Sample Point 4
Sample Point 5
Sample Point 6

Appendix 12: Annual Formation Water Monitoring Results

ANALYTICAL REPORT

Date of Report:	22 December, 1999
Job No:	99374
Client:	Santos Ltd
Address:	GPO Box 2319, Adelaide SA 5001
Contact:	Emma Dyer
Dates of Sampling:	25-31/10/99
Dates of Receipt:	27/29/30-10-99; 2-11-99
Analytical Request:	Wildlife and stock watering parameters
Description of Samples:	Water samples collected from oil and gas well evaporation ponds and bore waters - Cooper Basin

Sampling Program:

Site No.	Sample Description	Sampling Date	Sampling Time
1	Lake Brooks	25-10-99	1:30pm
2	Northern Evaporation Pond	25-10-99	3:35pm
3	Moomba South Central	25-10-99	4:15pm
4	Keleary	26-10-99	12:00pm
5	Bookabourdie	26-10-99	1:30pm
6	Dullingari Oil	26-10-99	4:25pm
7	Dullingari Gas	26-10-99	5:15pm
8	Narcoonowie Pond 2	27-10-99	8:10am
9	Narcoonowie Pond 1	27-10-99	8:20am
10	Narcoonowie Interceptor Pit	27-10-99	7:00am
11	Narcoonowie Free-Form Pond	27-10-99	9:15am
12	Toolachee South	27-10-99	9:45am
13	Toolachee Gas Satellite	27-10-99	9:40am
14	Toolachee East	27-10-99	11:00am
15	Munkari	27-10-99	11:30am
16	Della Gas	27-10-99	5:00pm
17	Anyema-Brumby	28-10-99	8:25am
18	Toolachee North	28-10-99	9:15am
19	Kidman	28-10-99	10:50am
20	Aroona	28-10-99	11:40am
21	Lepena	28-10-99	12:10pm
22	Strzelecki Oil & Gas	28-10-99	1:50pm
23	Toolachee South Nodal	28-10-99	2:15pm
24	Limestone Creek Satellite	28-10-99	3:30pm
25	Murta South	29-10-99	9:30am
26	Daralingie Gas Satellite	29-10-99	10:15am
27	Big Lake Gas Satellite	29-10-99	12:00pm
28	Big Lake 36	29-10-99	12:30pm
29	Big Lake 17	29-10-99	1:10pm
30	Moomba Oil	29-10-99	1:55pm
31	Tirrawarra Gas	30-10-99	8:00am
32	Merrimelia Gas Satellite	30-10-99	9:10am
33	Merrimelia Oil Satellite	30-10-99	10:00am
34	Meranji Oil Satellite	30-10-99	11:35am
35	Tantanna Oil	31-10-99	9:00am
36	Spencer	31-10-99	10:20am
37	Muteroo Facility	31-10-99	10:45am
38	Gidgealpa Oil 1	31-10-99	2:50pm
39	Gidgealpa Oil 2	31-10-99	3:00pm
40	Gidgealpa Gas Interceptor	31-10-99	3:40pm
41	Gidgealpa Gas Evap. Pond	31-10-99	4:00pm

Sample Description:

Lab No	Sample ID	Sample Type	Sample Description	Preservation	Container
99374-1.1	site 1 25/10/99	water	Lake Brooks	direct	120mL S
99374-1.2	site 1 25/10/99	water	Lake Brooks	Lugols soln	250mL S
99374-1.4	site 1 25/10/99	water	Lake Brooks	4°C	1L P(D)
99374-1.5	site 1 25/10/99	water	Lake Brooks	Nitric acid	250mL P(A)
99374-1.6	site 1 25/10/99	water	Lake Brooks	Zinc acetate/ caustic	250mL P(D)
99374-1.7	site 1 25/10/99	water	Lake Brooks	Freeze	500mL P(D)
99374-1.8	site 1 25/10/99	water	Lake Brooks	4°C	250mL G(S)
99374-1.9	site 1 25/10/99	water	Lake Brooks	4°C	1L G(S)
99374-1.10	site 1 25/10/99	water	Lake Brooks	4°C	1L G(S)
99374-1.11	site 1 25/10/99	water	Lake Brooks	Sulphuric acid	1L G(S)
99374-1.12	site 1 25/10/99	water	Lake Brooks	4°C	1L G(S)
99374-2.1	site 2 25/10/99	water	Nthn Evap Pond	direct	120 mL S
99374-2.2	site 2 25/10/99	water	Nthn Evap Pond	Lugols soln	250mL S
99374-2.3	site 2 25/10/99	water	Nthn Evap Pond	Freeze	1L P(D)
99374-2.4	site 2 25/10/99	water	Nthn Evap Pond	4°C	1L P(D)
99374-2.5	site 2 25/10/99	water	Nthn Evap Pond	Nitric acid	250mL P(A)
99374-2.6	site 2 25/10/99	water	Nthn Evap Pond	Zinc acetate/caustic	250mL P(D)
99374-2.7	site 2 25/10/99	water	Nthn Evap Pond	Freeze	500mL P (D)
99374-2.8	site 2 25/10/99	water	Nthn Evap Pond	4°C	250mL G(S)
99374-2.9	site 2 25/10/99	water	Nthn Evap Pond	4°C	1L G(S)
99374-2.10	site 2 25/10/99	water	Nthn Evap Pond	4°C	1L G(S)
99374-2.11	site 2 25/10/99	water	Nthn Evap Pond	Sulphuric aicd	1L G(S)
99374-2.12	site 2 25/10/99	water	Nthn Evap Pond	4°C	1L G(S)
99374-3.1	site 3 25/10/99	water	Moomba Sth Central	direct	120mL S
99374-3.2	site 3 25/10/99	water	Moomba Sth Central	Lugols soln	250mL S
99374-3.4	site 3 25/10/99	water	Moomba Sth Central	4°C	1L P(D)
99374-3.5	site 3 25/10/99	water	Moomba Sth Central	Nitric acid	250mL P(A)
99374-3.6	site 3 25/10/99	water	Moomba Sth Central	Zinc acetate/ caustic	250mL P(D)
99374-3.7	site 3 25/10/99	water	Moomba Sth Central	Freeze	500mL P(D)
99374-3.8	site 3 25/10/99	water	Moomba Sth Central	4°C	250mL G(S)
99374-3.9	site 3 25/10/99	water	Moomba Sth Central	4°C	1L G(S)
99374-3.10	site 3 25/10/99	water	Moomba Sth Central	4°C	1L G(S)
99374-3.11	site 3 25/10/99	water	Moomba Sth Central	Sulphuric acid	1L G(S)
99374-3.12	site 3 25/10/99	water	Moomba Sth Central	4°C	1L G(S)
99374-45	25/10/99	Sediment	Sediment Nthn Evap Pond	4°C	250mL G(S)
99374-4.1	site 4 26/10/99	water	Keleary	direct	120mL S
99374-4.2	site 4 26/10/99	water	Keleary	Lugols soln	250mL S
99374-4.4	site 4 26/10/99	water	Keleary	4°C	1L P(D)
99374-4.5	site 4 26/10/99	water	Keleary	Nitric acid	250mL P(A)
99374-4.8	site 4 26/10/99	water	Keleary	4°C	250mL G(S)
99374-4.9	site 4 26/10/99	water	Keleary	4°C	1L G(S)
99374-4.10	site 4 26/10/99	water	Keleary	4°C	1L G(S)
99374-4.11	site 4 26/10/99	water	Keleary	Sulphuric acid	1L G(S)
99374-4.12	site 4 26/10/99	water	Keleary	4°C	1L G(S)
99374-5.1	site 5 26/10/99	water	Bookabourdie	direct	120mL S
99374-5.2	site 5 26/10/99	water	Bookabourdie	Lugols soln	250mL S
99374-5.4	site 5 26/10/99	water	Bookabourdie	4°C	1L P(D)
99374-5.5	site 5 26/10/99	water	Bookabourdie	Nitric acid	250mL P(A)
99374-5.6	site 5 26/10/99	water	Bookabourdie	Zinc acetate/ caustic	250mL P(sulphide)
99374-5.7	site 5 26/10/99	water	Bookabourdie	Freeze	500mL P(D)
99374-5.8	site 5 26/10/99	water	Bookabourdie	4°C	250mL G(S)
99374-5.9	site 5 26/10/99	water	Bookabourdie	4°C	1L G(S)
99374-5.10	site 5 26/10/99	water	Bookabourdie	4°C	1L G(S)
99374-5.11	site 5 26/10/99	water	Bookabourdie	Sulphuric acid	1L G(S)
99374-5.12	site 5 26/10/99	water	Bookabourdie	4°C	1L G(S)
99374-6.1	site 6 26/10/99	water	Dullingari Oil	direct	120mL S

Lab No	Sample ID	Sample Type	Sample Description	Preservation	Container
99374-6.2	site 6 26/10/99	water	Dullingari Oil	Lugols soln	250mL S
99374-6.4	site 6 26/10/99	water	Dullingari Oil	4°C	1L P(D)
99374-6.5	site 6 26/10/99	water	Dullingari Oil	Nitric acid	250mL P(A)
99374-6.6	site 6 26/10/99	water	Dullingari Oil	Zinc acetate/ caustic	250mL P(sulphide)
99374-6.7	site 6 26/10/99	water	Dullingari Oil	Freeze	500mL P(D)
99374-6.8	site 6 26/10/99	water	Dullingari Oil	4°C	250mL G(S)
99374-6.9	site 6 26/10/99	water	Dullingari Oil	4°C	1L G(S)
99374-6.10	site 6 26/10/99	water	Dullingari Oil	4°C	1L G(S)
99374-6.11	site 6 26/10/99	water	Dullingari Oil	Sulphuric acid	1L G(S)
99374-6.12	site 6 26/10/99	water	Dullingari Oil	4°C	1L G(S)
99374-7.1	site 7 26/10/99	water	Dullingari Gas	direct	120mL S
99374-7.2	site 7 26/10/99	water	Dullingari Gas	Lugols soln	250mL S
99374-7.4	site 7 26/10/99	water	Dullingari Gas	4°C	1L P(D)
99374-7.5	site 7 26/10/99	water	Dullingari Gas	Nitric acid	250mL P(A)
99374-7.6	site 7 26/10/99	water	Dullingari Gas	Zinc acetate/ caustic	250mL P(sulphide)
99374-7.7	site 7 26/10/99	water	Dullingari Gas	Freeze	500mL P(D)
99374-7.8	site 7 26/10/99	water	Dullingari Gas	4°C	250mL G(S)
99374-7.9	site 7 26/10/99	water	Dullingari Gas	4°C	1L G(S)
99374-7.10	site 7 26/10/99	water	Dullingari Gas	4°C	1L G(S)
99374-7.11	site 7 26/10/99	water	Dullingari Gas	Sulphuric acid	1L G(S)
99374-7.12	site 7 26/10/99	water	Dullingari Gas	4°C	1L G(S)
99374-8.1	site 8 27/10/99	water	Narcoonowie	direct	120mL S
99374-8.2	site 8 27/10/99	water	Narcoonowie	Lugols soln	250mL S
99374-8.4	site 8 27/10/99	water	Narcoonowie	4°C	1L P(D)
99374-8.5	site 8 27/10/99	water	Narcoonowie	Nitric acid	250mL P(A)
99374-8.6	site 8 27/10/99	water	Narcoonowie	Zinc acetate/ caustic	250mL P(sulphide)
99374-8.7	site 8 27/10/99	water	Narcoonowie	Freeze	500mL P(D)
99374-8.8	site 8 27/10/99	water	Narcoonowie	4°C	250mL G(S)
99374-8.9	site 8 27/10/99	water	Narcoonowie	4°C	1L G(S)
99374-8.10	site 8 27/10/99	water	Narcoonowie	4°C	1L G(S)
99374-8.11	site 8 27/10/99	water	Narcoonowie	Sulphuric acid	1L G(S)
99374-8.12	site 8 27/10/99	water	Narcoonowie	4°C	1L G(S)
99374-9.1	site 9 27/10/99	water	Narcoonowie Pond 1	direct	120mL S
99374-9.2	site 9 27/10/99	water	Narcoonowie Pond 1	Lugols soln	250mL S
99374-9.4	site 9 27/10/99	water	Narcoonowie Pond 1	4°C	1L P(D)
99374-9.5	site 9 27/10/99	water	Narcoonowie Pond 1	Nitric acid	250mL P(A)
99374-9.6	site 9 27/10/99	water	Narcoonowie Pond 1	Zinc acetate/ caustic	250mL P(sulphide)
99374-9.7	site 9 27/10/99	water	Narcoonowie Pond 1	Freeze	500mL P(D)
99374-9.8	site 9 27/10/99	water	Narcoonowie Pond 1	4°C	250mL G(S)
99374-9.9	site 9 27/10/99	water	Narcoonowie Pond 1	4°C	1L G(S)
99374-9.10	site 9 27/10/99	water	Narcoonowie Pond 1	4°C	1L G(S)
99374-9.11	site 9 27/10/99	water	Narcoonowie Pond 1	Sulphuric acid	1L G(S)
99374-9.12	site 9 27/10/99	water	Narcoonowie Pond 1	4°C	1L G(S)
99374-10.1	site 10 27/10/99	water	Narcoonowie 1P	direct	120mL S
99374-10.2	site 10 27/10/99	water	Narcoonowie 1P	Lugols soln	250mL S
99374-10.4	site 10 27/10/99	water	Narcoonowie 1P	4°C	1L P(D)
99374-10.5	site 10 27/10/99	water	Narcoonowie 1P	Nitric acid	250mL P(A)
99374-10.6	site 10 27/10/99	water	Narcoonowie 1P	Zinc acetate/ caustic	250mL P(sulphide)
99374-10.7	site 10 27/10/99	water	Narcoonowie 1P	Freeze	500mL P(D)
99374-10.8	site 10 27/10/99	water	Narcoonowie 1P	4°C	250mL G(S)
99374-10.9	site 10 27/10/99	water	Narcoonowie 1P	4°C	1L G(S)
99374-10.10	site 10 27/10/99	water	Narcoonowie 1P	4°C	1L G(S)
99374-10.11	site 10 27/10/99	water	Narcoonowie 1P	Sulphuric acid	1L G(S)
99374-10.12	site 10 27/10/99	water	Narcoonowie 1P	4°C	1L G(S)
99374-11.1	site 11 27/10/99	water	Narcoonowie Free-Form	direct	120mL S
99374-11.2	site 11 27/10/99	water	Narcoonowie Free-Form	Lugols soln	250mL S
99374-11.4	site 11 27/10/99	water	Narcoonowie Free-Form	4°C	1L P(D)

Lab No	Sample ID	Sample Type	Sample Description	Preservation	Container
99374-11.5	site 11 27/10/99	water	Narcoonowie Free-Form	Nitric acid	250mL P(A)
99374-11.6	site 11 27/10/99	water	Narcoonowie Free-Form	Zinc acetate/ caustic	250mL P(sulphide)
99374-11.7	site 11 27/10/99	water	Narcoonowie Free-Form	Freeze	500mL P(D)
99374-11.8	site 11 27/10/99	water	Narcoonowie Free-Form	4°C	250mL G(S)
99374-11.9	site 11 27/10/99	water	Narcoonowie Free-Form	4°C	1L G(S)
99374-11.10	site 11 27/10/99	water	Narcoonowie Free-Form	4°C	1L G(S)
99374-11.11	site 11 27/10/99	water	Narcoonowie Free-Form	Sulphuric acid	1L G(S)
99374-11.12	site 11 27/10/99	water	Narcoonowie Free-Form	4°C	1L G(S)
99374-12.1	site 12 27/10/99	water	Toolachee South	direct	120mL S
99374-12.2	site 12 27/10/99	water	Toolachee South	Lugols soln	250mL S
99374-12.4	site 12 27/10/99	water	Toolachee South	4°C	1L P(D)
99374-12.5	site 12 27/10/99	water	Toolachee South	Nitric acid	250mL P(A)
99374-12.6	site 12 27/10/99	water	Toolachee South	Zinc acetate/ caustic	250mL P(sulphide)
99374-12.7	site 12 27/10/99	water	Toolachee South	Freeze	500mL P(D)
99374-12.8	site 12 27/10/99	water	Toolachee South	4°C	250mL G(S)
99374-12.9	site 12 27/10/99	water	Toolachee South	4°C	1L G(S)
99374-12.10	site 12 27/10/99	water	Toolachee South	4°C	1L G(S)
99374-12.11	site 12 27/10/99	water	Toolachee South	Sulphuric acid	1L G(S)
99374-12.12	site 12 27/10/99	water	Toolachee South	4°C	1L G(S)
99374-13.1	site 13 27/10/99	water	Toolachee Gas	direct	120mL S
99374-13.2	site 13 27/10/99	water	Toolachee Gas	Lugols soln	250mL S
99374-13.4	site 13 27/10/99	water	Toolachee Gas	4°C	1L P(D)
99374-13.5	site 13 27/10/99	water	Toolachee Gas	Nitric acid	250mL P(A)
99374-13.6	site 13 27/10/99	water	Toolachee Gas	Zinc acetate/ caustic	250mL P(sulphide)
99374-13.7	site 13 27/10/99	water	Toolachee Gas	Freeze	500mL P(D)
99374-13.8	site 13 27/10/99	water	Toolachee Gas	4°C	250mL G(S)
99374-13.9	site 13 27/10/99	water	Toolachee Gas	4°C	1L G(S)
99374-13.10	site 13 27/10/99	water	Toolachee Gas	4°C	1L G(S)
99374-13.11	site 13 27/10/99	water	Toolachee Gas	Sulphuric acid	1L G(S)
99374-13.12	site 13 27/10/99	water	Toolachee Gas	4°C	1L G(S)
99374-14.1	site 14 27/10/99	water	Toolachee East	direct	120mL S
99374-14.2	site 14 27/10/99	water	Toolachee East	Lugols soln	250mL S
99374-14.4	site 14 27/10/99	water	Toolachee East	4°C	1L P(D)
99374-14.5	site 14 27/10/99	water	Toolachee East	Nitric acid	250mL P(A)
99374-14.6	site 14 27/10/99	water	Toolachee East	Zinc acetate/ caustic	250mL P(sulphide)
99374-14.7	site 14 27/10/99	water	Toolachee East	Freeze	500mL P(D)
99374-14.8	site 14 27/10/99	water	Toolachee East	4°C	250mL G(S)
99374-14.9	site 14 27/10/99	water	Toolachee East	4°C	1L G(S)
99374-14.10	site 14 27/10/99	water	Toolachee East	4°C	1L G(S)
99374-14.11	site 14 27/10/99	water	Toolachee East	Sulphuric acid	1L G(S)
99374-14.12	site 14 27/10/99	water	Toolachee East	4°C	1L G(S)
99374-15.1	site 15 27/10/99	water	Munkari	direct	120mL S
99374-15.2	site 15 27/10/99	water	Munkari	Lugols soln	250mL S
99374-15.4	site 15 27/10/99	water	Munkari	4°C	1L P(D)
99374-15.5	site 15 27/10/99	water	Munkari	Nitric acid	250mL P(A)
99374-15.6	site 15 27/10/99	water	Munkari	Zinc acetate/ caustic	250mL P(sulphide)
99374-15.7	site 15 27/10/99	water	Munkari	Freeze	500mL P(D)
99374-15.8	site 15 27/10/99	water	Munkari	4°C	250mL G(S)
99374-15.9	site 15 27/10/99	water	Munkari	4°C	1L G(S)
99374-15.10	site 15 27/10/99	water	Munkari	4°C	1L G(S)
99374-15.11	site 15 27/10/99	water	Munkari	Sulphuric acid	1L G(S)
99374-15.12	site 15 27/10/99	water	Munkari	4°C	1L G(S)
99374-46		sediment	Cooper Creek Causeway	4°C	500mL G(S)
99374-16.1	site 16 27/10/99	water	Della Gas	direct	120mL S
99374-16.2	site 16 27/10/99	water	Della Gas	Lugols soln	250mL S
99374-16.4	site 16 27/10/99	water	Della Gas	4°C	1L P(D)
99374-16.5	site 16 27/10/99	water	Della Gas	Nitric acid	250mL P(A)

Lab No	Sample ID	Sample Type	Sample Description	Preservation	Container
99374-16.6	site 16 27/10/99	water	Della Gas	Zinc acetate/ caustic	250mL P(sulphide)
99374-16.7	site 16 27/10/99	water	Della Gas	Freeze	500mL P(D)
99374-16.8	site 16 27/10/99	water	Della Gas	4°C	250mL G(S)
99374-16.9	site 16 27/10/99	water	Della Gas	4°C	1L G(S)
99374-16.10	site 16 27/10/99	water	Della Gas	4°C	1L G(S)
99374-16.11	site 16 27/10/99	water	Della Gas	Sulphuric acid	1L G(S)
99374-16.12	site 16 27/10/99	water	Della Gas	4°C	1L G(S)
99374-17.1	site 17 28/10/99	water	Anyema	direct	120mL S
99374-17.2	site 17 28/10/99	water	Anyema	Lugols soln	250mL S
99374-17.4	site 17 28/10/99	water	Anyema	4°C	1L P(D)
99374-17.5	site 17 28/10/99	water	Anyema	Nitric acid	250mL P(A)
99374-17.6	site 17 28/10/99	water	Anyema	Zinc acetate/ caustic	250mL P(sulphide)
99374-17.7	site 17 28/10/99	water	Anyema	Freeze	500mL P(D)
99374-17.8	site 17 28/10/99	water	Anyema	4°C	250mL G(S)
99374-17.9	site 17 28/10/99	water	Anyema	4°C	1L G(S)
99374-17.10	site 17 28/10/99	water	Anyema	4°C	1L G(S)
99374-17.11	site 17 28/10/99	water	Anyema	Sulphuric acid	1L G(S)
99374-17.12	site 17 28/10/99	water	Anyema	4°C	1L G(S)
99374-18.1	site 18 28/10/99	water	Toolachee North	direct	120mL S
99374-18.2	site 18 28/10/99	water	Toolachee North	Lugols soln	250mL S
99374-18.4	site 18 28/10/99	water	Toolachee North	4°C	1L P(D)
99374-18.5	site 18 28/10/99	water	Toolachee North	Nitric acid	250mL P(A)
99374-18.6	site 18 28/10/99	water	Toolachee North	Zinc acetate/ caustic	250mL P(sulphide)
99374-18.7	site 18 28/10/99	water	Toolachee North	Freeze	500mL P(D)
99374-18.8	site 18 28/10/99	water	Toolachee North	4°C	250mL G(S)
99374-18.9	site 18 28/10/99	water	Toolachee North	4°C	1L G(S)
99374-18.10	site 18 28/10/99	water	Toolachee North	4°C	1L G(S)
99374-18.11	site 18 28/10/99	water	Toolachee North	Sulphuric acid	1L G(S)
99374-18.12	site 18 28/10/99	water	Toolachee North	4°C	1L G(S)
99374-19.1	site 19 28/10/99	water	Kidman	direct	120mL S
99374-19.2	site 19 28/10/99	water	Kidman	Lugols soln	250mL S
99374-19.4	site 19 28/10/99	water	Kidman	4°C	1L P(D)
99374-19.5	site 19 28/10/99	water	Kidman	Nitric acid	250mL P(A)
99374-19.6	site 19 28/10/99	water	Kidman	Zinc acetate/ caustic	250mL P(sulphide)
99374-19.7	site 19 28/10/99	water	Kidman	Freeze	500mL P(D)
99374-19.8	site 19 28/10/99	water	Kidman	4°C	250mL G(S)
99374-19.9	site 19 28/10/99	water	Kidman	4°C	1L G(S)
99374-19.10	site 19 28/10/99	water	Kidman	4°C	1L G(S)
99374-19.11	site 19 28/10/99	water	Kidman	Sulphuric acid	1L G(S)
99374-19.12	site 19 28/10/99	water	Kidman	4°C	1L G(S)
99374-20.1	site 20 28/10/99	water	Aroona	direct	120mL S
99374-20.2	site 20 28/10/99	water	Aroona	Lugols soln	250mL S
99374-20.4	site 20 28/10/99	water	Aroona	4°C	1L P(D)
99374-20.5	site 20 28/10/99	water	Aroona	Nitric acid	250mL P(A)
99374-20.6	site 20 28/10/99	water	Aroona	Zinc acetate/ caustic	250mL P(sulphide)
99374-20.7	site 20 28/10/99	water	Aroona	Freeze	500mL P(D)
99374-20.8	site 20 28/10/99	water	Aroona	4°C	250mL G(S)
99374-20.9	site 20 28/10/99	water	Aroona	4°C	1L G(S)
99374-20.10	site 20 28/10/99	water	Aroona	4°C	1L G(S)
99374-20.11	site 20 28/10/99	water	Aroona	Sulphuric acid	1L G(S)
99374-20.12	site 20 28/10/99	water	Aroona	4°C	1L G(S)
99374-21.1	site 21 28/10/99	water	Lepena	direct	120mL S
99374-21.2	site 21 28/10/99	water	Lepena	Lugols soln	250mL S
99374-21.4	site 21 28/10/99	water	Lepena	4°C	1L P(D)
99374-21.5	site 21 28/10/99	water	Lepena	Nitric acid	250mL P(A)
99374-21.6	site 21 28/10/99	water	Lepena	Zinc acetate/ caustic	250mL P(sulphide)
99374-21.7	site 21 28/10/99	water	Lepena	Freeze	500mL P(D)

Lab No	Sample ID	Sample Type	Sample Description	Preservation	Container
99374-21.8	site 21 28/10/99	water	Lepena	4°C	250mL G(S)
99374-21.9	site 21 28/10/99	water	Lepena	4°C	1L G(S)
99374-21.10	site 21 28/10/99	water	Lepena	4°C	1L G(S)
99374-21.11	site 21 28/10/99	water	Lepena	Sulphuric acid	1L G(S)
99374-21.12	site 21 28/10/99	water	Lepena	4°C	1L G(S)
99374-22.1	site 22 28/10/99	water	Strzelecki Oil	direct	120mL S
99374-22.2	site 22 28/10/99	water	Strzelecki Oil	Lugols soln	250mL S
99374-22.4	site 22 28/10/99	water	Strzelecki Oil	4°C	1L P(D)
99374-22.5	site 22 28/10/99	water	Strzelecki Oil	Nitric acid	250mL P(A)
99374-22.6	site 22 28/10/99	water	Strzelecki Oil	Zinc acetate/ caustic	250mL P(sulphide)
99374-22.7	site 22 28/10/99	water	Strzelecki Oil	Freeze	500mL P(D)
99374-22.8	site 22 28/10/99	water	Strzelecki Oil	4°C	250mL G(S)
99374-22.9	site 22 28/10/99	water	Strzelecki Oil	4°C	1L G(S)
99374-22.10	site 22 28/10/99	water	Strzelecki Oil	4°C	1L G(S)
99374-22.11	site 22 28/10/99	water	Strzelecki Oil	Sulphuric acid	1L G(S)
99374-22.12	site 22 28/10/99	water	Strzelecki Oil	4°C	1L G(S)
99374-23.1	site 23 28/10/99	water	Strzelecki 15	direct	120mL S
99374-23.2	site 23 28/10/99	water	Strzelecki 15	Lugols soln	250mL S
99374-23.4	site 23 28/10/99	water	Strzelecki 15	4°C	1L P(D)
99374-23.5	site 23 28/10/99	water	Strzelecki 15	Nitric acid	250mL P(A)
99374-23.6	site 23 28/10/99	water	Strzelecki 15	Zinc acetate/ caustic	250mL P(sulphide)
99374-23.7	site 23 28/10/99	water	Strzelecki 15	Freeze	500mL P(D)
99374-23.8	site 23 28/10/99	water	Strzelecki 15	4°C	250mL G(S)
99374-23.9	site 23 28/10/99	water	Strzelecki 15	4°C	1L G(S)
99374-23.10	site 23 28/10/99	water	Strzelecki 15	4°C	1L G(S)
99374-23.11	site 23 28/10/99	water	Strzelecki 15	Sulphuric acid	1L G(S)
99374-23.12	site 23 28/10/99	water	Strzelecki 15	4°C	1L G(S)
99374-24.1	site 24 28/10/99	water	Limestone Creek	direct	120mL S
99374-24.2	site 24 28/10/99	water	Limestone Creek	Lugols soln	250mL S
99374-24.4	site 24 28/10/99	water	Limestone Creek	4°C	1L P(D)
99374-24.5	site 24 28/10/99	water	Limestone Creek	Nitric acid	250mL P(A)
99374-24.6	site 24 28/10/99	water	Limestone Creek	Zinc acetate/ caustic	250mL P(sulphide)
99374-24.7	site 24 28/10/99	water	Limestone Creek	Freeze	500mL P(D)
99374-24.8	site 24 28/10/99	water	Limestone Creek	4°C	250mL G(S)
99374-24.9	site 24 28/10/99	water	Limestone Creek	4°C	1L G(S)
99374-24.10	site 24 28/10/99	water	Limestone Creek	4°C	1L G(S)
99374-24.11	site 24 28/10/99	water	Limestone Creek	Sulphuric acid	1L G(S)
99374-24.12	site 24 28/10/99	water	Limestone Creek	4°C	1L G(S)
99374-25.1	site 25 28/10/99	water	Murta South	direct	120mL S
99374-25.2	site 25 28/10/99	water	Murta South	Lugols soln	250mL S
99374-25.4	site 25 28/10/99	water	Murta South	4°C	1L P(D)
99374-25.5	site 25 28/10/99	water	Murta South	Nitric acid	250mL P(A)
99374-25.6	site 25 28/10/99	water	Murta South	Zinc acetate/ caustic	250mL P(sulphide)
99374-25.7	site 25 28/10/99	water	Murta South	Freeze	500mL P(D)
99374-25.8	site 25 28/10/99	water	Murta South	4°C	250mL G(S)
99374-25.9	site 25 28/10/99	water	Murta South	4°C	1L G(S)
99374-25.10	site 25 28/10/99	water	Murta South	4°C	1L G(S)
99374-25.11	site 25 28/10/99	water	Murta South	Sulphuric acid	1L G(S)
99374-25.12	site 25 28/10/99	water	Murta South	4°C	1L G(S)
99374-26.1	site 26 28/10/99	water	Daralingie Gas	direct	120mL S
99374-26.2	site 26 28/10/99	water	Daralingie Gas	Lugols soln	250mL S
99374-26.4	site 26 28/10/99	water	Daralingie Gas	4°C	1L P(D)
99374-26.5	site 26 28/10/99	water	Daralingie Gas	Nitric acid	250mL P(A)
99374-26.6	site 26 28/10/99	water	Daralingie Gas	Zinc acetate/ caustic	250mL P(sulphide)
99374-26.7	site 26 28/10/99	water	Daralingie Gas	Freeze	500mL P(D)
99374-26.8	site 26 28/10/99	water	Daralingie Gas	4°C	250mL G(S)
99374-26.9	site 26 28/10/99	water	Daralingie Gas	4°C	1L G(S)

Lab No	Sample ID	Sample Type	Sample Description	Preservation	Container
99374-26.10	site 26 28/10/99	water	Daralingie Gas	4°C	1L G(S)
99374-26.11	site 26 28/10/99	water	Daralingie Gas	Sulphuric acid	1L G(S)
99374-26.12	site 26 28/10/99	water	Daralingie Gas	4°C	1L G(S)
99374-27.1	site 27 29/10/99	water	Big Lake Gas	direct	120mL S
99374-27.2	site 27 29/10/99	water	Big Lake Gas	Lugols soln	250mL S
99374-27.4	site 27 29/10/99	water	Big Lake Gas	4°C	1L P(D)
99374-27.5	site 27 29/10/99	water	Big Lake Gas	Nitric acid	250mL P(A)
99374-27.6	site 27 29/10/99	water	Big Lake Gas	Zinc acetate/ caustic	250mL P(sulphide)
99374-27.7	site 27 29/10/99	water	Big Lake Gas	Freeze	500mL P(D)
99374-27.8	site 27 29/10/99	water	Big Lake Gas	4°C	250mL G(S)
99374-27.9	site 27 29/10/99	water	Big Lake Gas	4°C	1L G(S)
99374-27.10	site 27 29/10/99	water	Big Lake Gas	4°C	1L G(S)
99374-27.11	site 27 29/10/99	water	Big Lake Gas	Sulphuric acid	1L G(S)
99374-27.12	site 27 29/10/99	water	Big Lake Gas	4°C	1L G(S)
99374-28.1	site 28 29/10/99	water	Big Lake 36	direct	120mL S
99374-28.2	site 28 29/10/99	water	Big Lake 36	Lugols soln	250mL S
99374-28.4	site 28 29/10/99	water	Big Lake 36	4°C	1L P(D)
99374-28-5	site 28 29/10/99	water	Big Lake 36	Nitric acid	250mL P(A)
99374-28.6	site 28 29/10/99	water	Big Lake 36	Zinc acetate/ caustic	250mL P(sulphide)
99374-28.7	site 28 29/10/99	water	Big Lake 36	Freeze	500mL P(D)
99374-28.8	site 28 29/10/99	water	Big Lake 36	4°C	250mL G(S)
99374-28.9	site 28 29/10/99	water	Big Lake 36	4°C	1L G(S)
99374-28.10	site 28 29/10/99	water	Big Lake 36	4°C	1L G(S)
99374-28.11	site 28 29/10/99	water	Big Lake 36	Sulphuric acid	1L G(S)
99374-28.12	site 28 29/10/99	water	Big Lake 36	4°C	1L G(S)
99374-29.1	site 29 29/10/99	water	Big Lake 17	direct	120mL S
99374-29.2	site 29 29/10/99	water	Big Lake 17	Lugols soln	250mL S
99374-29.4	site 29 29/10/99	water	Big Lake 17	4°C	1L P(D)
99374-29.5	site 29 29/10/99	water	Big Lake 17	Nitric acid	250mL P(A)
99374-29.6	site 29 29/10/99	water	Big Lake 17	Zinc acetate/ caustic	250mL P(sulphide)
99374-29.7	site 29 29/10/99	water	Big Lake 17	Freeze	500mL P(D)
99374-29.8	site 29 29/10/99	water	Big Lake 17	4°C	250mL G(S)
99374-29.9	site 29 29/10/99	water	Big Lake 17	4°C	1L G(S)
99374-29.10	site 29 29/10/99	water	Big Lake 17	4°C	1L G(S)
99374-29.11	site 29 29/10/99	water	Big Lake 17	Sulphuric acid	1L G(S)
99374-29.12	site 29 29/10/99	water	Big Lake 17	4°C	1L G(S)
99374-30.1	site 30 29/10/99	water	Moomba Oil	direct	120mL S
99374-30.2	site 30 29/10/99	water	Moomba Oil	Lugols soln	250mL S
99374-30.4	site 30 29/10/99	water	Moomba Oil	4°C	1L P(D)
99374-30.5	site 30 29/10/99	water	Moomba Oil	Nitric acid	250mL P(A)
99374-30.6	site 30 29/10/99	water	Moomba Oil	Zinc acetate/ caustic	250mL P(sulphide)
99374-30.7	site 30 29/10/99	water	Moomba Oil	Freeze	500mL P(D)
99374-30.8	site 30 29/10/99	water	Moomba Oil	4°C	250mL G(S)
99374-30.9	site 30 29/10/99	water	Moomba Oil	4°C	1L G(S)
99374-30.10	site 30 29/10/99	water	Moomba Oil	4°C	1L G(S)
99374-30.11	site 30 29/10/99	water	Moomba Oil	Sulphuric acid	1L G(S)
99374-30.12	site 30 29/10/99	water	Moomba Oil	4°C	1L G(S)
99374-31.1	site 31 30/10/99	water	Tirrawarra Gas	direct	120mL S
99374-31.2	site 31 30/10/99	water	Tirrawarra Gas	Lugols soln	250mL S
99374-31.4	site 31 30/10/99	water	Tirrawarra Gas	4°C	1L P(D)
99374-31.5	site 31 30/10/99	water	Tirrawarra Gas	Nitric acid	250mL P(A)
99374-31.6	site 31 30/10/99	water	Tirrawarra Gas	Zinc acetate/ caustic	250mL P(sulphide)
99374-31.7	site 31 30/10/99	water	Tirrawarra Gas	Freeze	500mL P(D)
99374-31.8	site 31 30/10/99	water	Tirrawarra Gas	4°C	250mL G(S)
99374-31.9	site 31 30/10/99	water	Tirrawarra Gas	4°C	1L G(S)
99374-31.10	site 31 30/10/99	water	Tirrawarra Gas	4°C	1L G(S)
99374-31.11	site 31 30/10/99	water	Tirrawarra Gas	Sulphuric acid	1L G(S)

Lab No	Sample ID	Sample Type	Sample Description	Preservation	Container
99374-31.12	site 31 30/10/99	water	Tirrawarra Gas	4°C	1L G(S)
99374-32.1	site 32 30/10/99	water	Merrimelia Gas	direct	120mL S
99374-32.2	site 32 30/10/99	water	Merrimelia Gas	Lugols soln	250mL S
99374-32.4	site 32 30/10/99	water	Merrimelia Gas	4°C	1L P(D)
99374-32.5	site 32 30/10/99	water	Merrimelia Gas	Nitric acid	250mL P(A)
99374-32.6	site 32 30/10/99	water	Merrimelia Gas	Zinc acetate/ caustic	250mL P(sulphide)
99374-32.7	site 32 30/10/99	water	Merrimelia Gas	Freeze	500mL P(D)
99374-32.8	site 32 30/10/99	water	Merrimelia Gas	4°C	250mL G(S)
99374-32.9	site 32 30/10/99	water	Merrimelia Gas	4°C	1L G(S)
99374-32.10	site 32 30/10/99	water	Merrimelia Gas	4°C	1L G(S)
99374-32.11	site 32 30/10/99	water	Merrimelia Gas	Sulphuric acid	1L G(S)
99374-32.12	site 32 30/10/99	water	Merrimelia Gas	4°C	1L G(S)
99374-33.1	site 33 30/10/99	water	Merrimelia Oil	direct	120mL S
99374-33.2	site 33 30/10/99	water	Merrimelia Oil	Lugols soln	250mL S
99374-33.4	site 33 30/10/99	water	Merrimelia Oil	4°C	1L P(D)
99374-33.5	site 33 30/10/99	water	Merrimelia Oil	Nitric acid	250mL P(A)
99374-33.6	site 33 30/10/99	water	Merrimelia Oil	Zinc acetate/ caustic	250mL P(sulphide)
99374-33.7	site 33 30/10/99	water	Merrimelia Oil	Freeze	500mL P(D)
99374-33.8	site 33 30/10/99	water	Merrimelia Oil	4°C	250mL G(S)
99374-33.9	site 33 30/10/99	water	Merrimelia Oil	4°C	1L G(S)
99374-33.10	site 33 30/10/99	water	Merrimelia Oil	4°C	1L G(S)
99374-33.11	site 33 30/10/99	water	Merrimelia Oil	Sulphuric acid	1L G(S)
99374-33.12	site 33 30/10/99	water	Merrimelia Oil	4°C	1L G(S)
99374-34.1	site 34 30/10/99	water	Meranji Oil	direct	120mL S
99374-34.2	site 34 30/10/99	water	Meranji Oil	Lugols soln	250mL S
99374-34.4	site 34 30/10/99	water	Meranji Oil	4°C	1L P(D)
99374-34.5	site 34 30/10/99	water	Meranji Oil	Nitric acid	250mL P(A)
99374-34.6	site 34 30/10/99	water	Meranji Oil	Zinc acetate/ caustic	250mL P(sulphide)
99374-34.7	site 34 30/10/99	water	Meranji Oil	Freeze	500mL P(D)
99374-34.8	site 34 30/10/99	water	Meranji Oil	4°C	250mL G(S)
99374-34.9	site 34 30/10/99	water	Meranji Oil	4°C	1L G(S)
99374-34.10	site 34 30/10/99	water	Meranji Oil	4°C	1L G(S)
99374-34.11	site 34 30/10/99	water	Meranji Oil	Sulphuric acid	1L G(S)
99374-34.12	site 34 30/10/99	water	Meranji Oil	4°C	1L G(S)
99374-35.1	site 35 31/10/99	water	Tantanna Oil	direct	120mL S
99374-35.2	site 35 31/10/99	water	Tantanna Oil	Lugols soln	250mL S
99374-35.4	site 35 31/10/99	water	Tantanna Oil	4°C	1L P(D)
99374-35.5	site 35 31/10/99	water	Tantanna Oil	Nitric acid	250mL P(A)
99374-35.6	site 35 31/10/99	water	Tantanna Oil	Zinc acetate/ caustic	250mL P(sulphide)
99374-35.7	site 35 31/10/99	water	Tantanna Oil	Freeze	500mL P(D)
99374-35.8	site 35 31/10/99	water	Tantanna Oil	4°C	250mL G(S)
99374-35.9	site 35 31/10/99	water	Tantanna Oil	4°C	1L G(S)
99374-35.10	site 35 31/10/99	water	Tantanna Oil	4°C	1L G(S)
99374-35.11	site 35 31/10/99	water	Tantanna Oil	Sulphuric acid	1L G(S)
99374-35.12	site 35 31/10/99	water	Tantanna Oil	4°C	1L G(S)
99374-36.1	site 36 31/10/99	water	Spencer	direct	120mL S
99374-36.2	site 36 31/10/99	water	Spencer	Lugols soln	250mL S
99374-36.4	site 36 31/10/99	water	Spencer	4°C	1L P(D)
99374-36.5	site 36 31/10/99	water	Spencer	Nitric acid	250mL P(A)
99374-36.6	site 36 31/10/99	water	Spencer	Zinc acetate/ caustic	250mL P(sulphide)
99374-36.7	site 36 31/10/99	water	Spencer	Freeze	500mL P(D)
99374-36.8	site 36 31/10/99	water	Spencer	4°C	250mL G(S)
99374-36.9	site 36 31/10/99	water	Spencer	4°C	1L G(S)
99374-36.10	site 36 31/10/99	water	Spencer	4°C	1L G(S)
99374-36.11	site 36 31/10/99	water	Spencer	Sulphuric acid	1L G(S)
99374-36.12	site 36 31/10/99	water	Spencer	4°C	1L G(S)
99374-37.1	site 37 31/10/99	water	Muteroo	direct	120mL S

Lab No	Sample ID	Sample Type	Sample Description	Preservation	Container
99374-37.2	site 37 31/10/99	water	Muteroo	Lugols soln	250mL S
99374-37.4	site 37 31/10/99	water	Muteroo	4°C	1L P(D)
99374-37.5	site 37 31/10/99	water	Muteroo	Nitric acid	250mL P(A)
99374-37.6	site 37 31/10/99	water	Muteroo	Zinc acetate/ caustic	250mL P(sulphide)
99374-37.7	site 37 31/10/99	water	Muteroo	Freeze	500mL P(D)
99374-37.8	site 37 31/10/99	water	Muteroo	4°C	250mL G(S)
99374-37.9	site 37 31/10/99	water	Muteroo	4°C	1L G(S)
99374-37.10	site 37 31/10/99	water	Muteroo	4°C	1L G(S)
99374-37.11	site 37 31/10/99	water	Muteroo	Sulphuric acid	1L G(S)
99374-37.12	site 37 31/10/99	water	Muteroo	4°C	1L G(S)
99374-38.1	site 38 31/10/99	water	Gidgealpa Oil 1	direct	120mL S
99374-38.2	site 38 31/10/99	water	Gidgealpa Oil 1	Lugols soln	250mL S
99374-38.4	site 38 31/10/99	water	Gidgealpa Oil 1	4°C	1L P(D)
99374-38.5	site 38 31/10/99	water	Gidgealpa Oil 1	Nitric acid	250mL P(A)
99374-38.6	site 38 31/10/99	water	Gidgealpa Oil 1	Zinc acetate/ caustic	250mL P(sulphide)
99374-38.7	site 38 31/10/99	water	Gidgealpa Oil 1	Freeze	500mL P(D)
99374-38.8	site 38 31/10/99	water	Gidgealpa Oil 1	4°C	250mL G(S)
99374-38.9	site 38 31/10/99	water	Gidgealpa Oil 1	4°C	1L G(S)
99374-38.10	site 38 31/10/99	water	Gidgealpa Oil 1	4°C	1L G(S)
99374-38.11	site 38 31/10/99	water	Gidgealpa Oil 1	Sulphuric acid	1L G(S)
99374-38.12	site 38 31/10/99	water	Gidgealpa Oil 1	4°C	1L G(S)
99374-39.1	site 39 31/10/99	water	Gidgealpa Oil 2	direct	120mL S
99374-39.2	site 39 31/10/99	water	Gidgealpa Oil 2	Lugols soln	250mL S
99374-39.4	site 39 31/10/99	water	Gidgealpa Oil 2	4°C	1L P(D)
99374-39.5	site 39 31/10/99	water	Gidgealpa Oil 2	Nitric acid	250mL P(A)
99374-39.6	site 39 31/10/99	water	Gidgealpa Oil 2	Zinc acetate/ caustic	250mL P(sulphide)
99374-39.7	site 39 31/10/99	water	Gidgealpa Oil 2	Freeze	500mL P(D)
99374-39.8	site 39 31/10/99	water	Gidgealpa Oil 2	4°C	250mL G(S)
99374-39.9	site 39 31/10/99	water	Gidgealpa Oil 2	4°C	1L G(S)
99374-39.10	site 39 31/10/99	water	Gidgealpa Oil 2	4°C	1L G(S)
99374-39.11	site 39 31/10/99	water	Gidgealpa Oil 2	Sulphuric acid	1L G(S)
99374-39.12	site 39 31/10/99	water	Gidgealpa Oil 2	4°C	1L G(S)
99374-40.1	site 40 31/10/99	water	Gidgealpa Gas IP	direct	120mL S
99374-40.2	site 40 31/10/99	water	Gidgealpa Gas IP	Lugols soln	250mL S
99374-40.4	site 40 31/10/99	water	Gidgealpa Gas IP	4°C	1L P(D)
99374-40.5	site 40 31/10/99	water	Gidgealpa Gas IP	Nitric acid	250mL P(A)
99374-40.6	site 40 31/10/99	water	Gidgealpa Gas IP	Zinc acetate/ caustic	250mL P(sulphide)
99374-40.7	site 40 31/10/99	water	Gidgealpa Gas IP	Freeze	500mL P(D)
99374-40.8	site 40 31/10/99	water	Gidgealpa Gas IP	4°C	250mL G(S)
99374-40.9	site 40 31/10/99	water	Gidgealpa Gas IP	4°C	1L G(S)
99374-40.10	site 40 31/10/99	water	Gidgealpa Gas IP	4°C	1L G(S)
99374-40.11	site 40 31/10/99	water	Gidgealpa Gas IP	Sulphuric acid	1L G(S)
99374-40.12	site 40 31/10/99	water	Gidgealpa Gas IP	4°C	1L G(S)
99374-41.1	site 41 31/10/99	water	Gidgealpa Gas Evap	direct	120mL S
99374-41.2	site 41 31/10/99	water	Gidgealpa Gas Evap	Lugols soln	250mL S
99374-41.4	site 41 31/10/99	water	Gidgealpa Gas Evap	4°C	1L P(D)
99374-41.5	site 41 31/10/99	water	Gidgealpa Gas Evap	Nitric acid	250mL P(A)
99374-41.6	site 41 31/10/99	water	Gidgealpa Gas Evap	Zinc acetate/ caustic	250mL P(sulphide)
99374-41.7	site 41 31/10/99	water	Gidgealpa Gas Evap	Freeze	500mL P(D)
99374-41.8	site 41 31/10/99	water	Gidgealpa Gas Evap	4°C	250mL G(S)
99374-41.9	site 41 31/10/99	water	Gidgealpa Gas Evap	4°C	1L G(S)
99374-41.10	site 41 31/10/99	water	Gidgealpa Gas Evap	4°C	1L G(S)
99374-41.11	site 41 31/10/99	water	Gidgealpa Gas Evap	Sulphuric acid	1L G(S)
99374-41.12	site 41 31/10/99	water	Gidgealpa Gas Evap	4°C	1L G(S)
99374-1.3	site 1 25/10/99	water	Lake Brooks	Freeze	1L P(D)
99374-3.3	site 3 25/10/99	water	Moomba Sth Central	Freeze	1L P(D)
99374-4.3	site 4 26/10/99	water	Keleary	Freeze	1L P(D)

Lab No	Sample ID	Sample Type	Sample Description	Preservation	Container
99374-5.3	site 5 26/10/99	water	Bookabourdie	Freeze	1L P(D)
99374-6.3	site 6 26/10/99	water	Dullingari Oil	Freeze	1L P(D)
99374-7.3	site 7 26/10/99	water	Dullingari Gas	Freeze	1L P(D)
99374-8.3	site 8 27/10/99	water	Narcoonowie	Freeze	1L P(D)
99374-9.3	site 9 27/10/99	water	Narcoonowie Pond 1	Freeze	1L P(D)
99374-10.3	site 10 27/10/99	water	Narcoonowie 1P	Freeze	1L P(D)
99374-11.3	site 11 27/10/99	water	Narcoonowie Free Form	Freeze	1L P(D)
99374-12.3	site 12 27/10/99	water	Toolachee South	Freeze	1L P(D)
99374-13.3	site 13 27/10/99	water	Toolachee Gas	Freeze	1L P(D)
99374-14.3	site 14 27/10/99	water	Toolachee East	Freeze	1L P(D)
99374-15.3	site 15 27/10/99	water	Munkari	Freeze	1L P(D)
99374-16.3	site 16 27/10/99	water	Della Gas	Freeze	1L P(D)
99374-17.3	site 17 28/10/99	water	Anyema	Freeze	1L P(D)
99374-18.3	site 18 28/10/99	water	Toolachee North	Freeze	1L P(D)
99374-19.3	site 19 28/10/99	water	Kidman	Freeze	1L P(D)
99374-20.3	site 20 28/10/99	water	Aroona	Freeze	1L P(D)
99374-21.3	site 21 28/10/99	water	Lepena	Freeze	1L P(D)
99374-22.3	site 22 28/10/99	water	Strzelecki Oil	Freeze	1L P(D)
99374-23.3	site 23 28/10/99	water	Strzelecki 15	Freeze	1L P(D)
99374-24.3	site 24 28/10/99	water	Limestone Creek	Freeze	1L P(D)
99374-25.3	site 25 28/10/99	water	Murta South	Freeze	1L P(D)
99374-26.3	site 26 28/10/99	water	Daralingie Gas	Freeze	1L P(D)
99374-27.3	site 27 29/10/99	water	Big Lake Gas	Freeze	1L P(D)
99374-28.3	site 28 29/10/99	water	Big Lake 36	Freeze	1L P(D)
99374-29.3	site 29 29/10/99	water	Big Lake 17	Freeze	1L P(D)
99374-30.3	site 30 29/10/99	water	Moomba Oil	Freeze	1L P(D)
99374-31.3	site 31 30/10/99	water	Tirrawirra Gas	Freeze	1L P(D)
99374-32.3	site 32 30/10/99	water	Merrimelia Gas	Freeze	1L P(D)
99374-33.3	site 33 30/10/99	water	Merrimelia Oil	Freeze	1L P(D)
99374-34.3	site 34 30/10/99	water	Meranji Oil	Freeze	1L P(D)
99374-35.3	site 35 30/10/99	water	Tantanna Oil	Freeze	1L P(D)
99374-36.3	site 36 30/10/99	water	Spencer	Freeze	1L P(D)
99374-37.3	site 37 30/10/99	water	Muteroo	Freeze	1L P(D)
99374-38.3	site 38 31/10/99	water	Gidgealpa Oil 1	Freeze	1L P(D)
99374-39.3	site 39 31/10/99	water	Gidgealpa Oil 2	Freeze	1L P(D)
99374-40.3	site 40 31/10/99	water	Gidgealpa Gas 1P	Freeze	1L P(D)
99374-41.3	site 41 31/10/99	water	Gidgealpa Gas Evap	Freeze	1L P(D)
99374-47	31/10/99	sediment	Gidgealpa Gas IP	4°C	250mL S
99374-48	27/10/99	sediment	Narcoonowie IP	4°C	250mL G(S)

Analytical Methodology:

Parameter	Envirotest Method No.	Reference Method	Method Description
Faecal Coliforms	WM-30	APHA 9222D	Membrane Filter Procedure
Phytoplankton (Blue-Green Algae)	WM-101	APHA 1200F and 10900	Microscope and counting cell
Chlorophyll-a	WM-15	APHA 10200H	Sample filtration and filters frozen. 90% acetone extraction and determination by UV-Vis Spectrophotometer
Temperature	WPC-75	-	Temperature probe – determined in-situ
Dissolved Oxygen	WPC-40	APHA 4500-OG	Membrane electrode method – determined in-situ
pH	WPC-60	APHA 4500-H+	Electrometric method – determined in-situ
Conductivity	WPC-30	APHA 2510B	Conductivity electrode – determined in-situ
Salinity	WPC-31	APHA 2520	Salinity probe – determined in-situ
Total Dissolved Solids	WPC-90	APHA 2540C	Filtration and gravimetric determination @105°C
Trace Elements	WTE-10	APHA 3120B	Determination by ICP-MS/OES. CSIRO, Tropical Agriculture – Analytical Services Facility
Mercury	WTE-22	APHA 3112	Cold vapour atomic absorption spectrophotometry
Cadmium and silver	WTE-20	APHA 3111	Carbon furnace atomic absorption spectrophotometry
Ammonia-Nitrogen	WI-92	APHA 4500-NH_3	Ammonia selective electrode
Ammonia-Nitrogen	WI-90	APHA 4500-NH_3 B,C	Distillation and titrimetric determination
Nitrate-Nitrogen	WI-112	APHA 4500-NO_3 E	Cadmium Reduction Method
Nitrite-Nitrogen	WI-120	APHA 4500-NO_2-B	Colorimetric method (UV-Vis Spectrophotometer)
Nitrogen (total)	WI-65	APHA 4500-N	Modified Kjeldahl digest. Determination by ammonia selective electrode
Phosphorus (total)	WI-151	APHA 4500-P B, E	Sulphuric acid-nitric acid digestion. Colorimetric determination by ascorbic acid method (UV-Vis Spectrophotometer)
Fluoride	WI-50	APHA 4500-F^-	Ion selective electrode method
Sulphate	WI-160	APHA 4500-SO_4E	Turbidimetric method (UV-Vis Spectrophotometer)
Sulphide	WI-166	APHA 4500-S_2-F	Iodometric titration.
Benzene/toluene	WO-121	Varian application - SPME	Solid Phase Microextraction (SPME) Method (Varian) and gas liquid chromatography (GC-FID and GC-MS)
Semi-Volatile Organics	WO-115	APHA 6410	Solvent extraction by liquid-liquid partitioning (base/neutrals and acids). Determination by gas chromatography-mass spectrometry (GC-MS)
Phthalate Esters	WO-140		Solvent extraction by liquid-liquid partitioning. Florisil/silver nitrate column clean-up. Determination by gas liquid chromatography coupled with an electron capture detector (GLC-ECD).
Trichlorobenzenes	WO-150		Solvent extraction by liquid-liquid partitioning. Florisil/silver nitrate column clean-up. Determination by gas liquid chromatography coupled with an electron

Parameter	Envirotest Method No.	Reference Method	Method Description
			capture detector (GLC-ECD).
Oil and Grease	WO-70	APHA 5520B	Partition-gravimetric method
PCBs	WO-80	APHA 6630	Solvent extraction by liquid-liquid partitioning. Florisil/silver nitrate column clean-up. Determination by gas liquid chromatography coupled with an electrode capture detector (GLC-ECD)

Analytical Results:

See Attachment

Reference:

ANZECC (1992). "Australian Water Quality Guidelines for Fresh and Marine Waters". Australian and New Zealand Environment and Conservation Council.

Notes:

Total sulphide levels are reported to a limit of 100 µg/L because most samples contained significant to high levels of sulphides.

Undissociated hydrogen sulphide in brackish pond waters will be much lower than the reporting limit of 100 µg/L. In essence, formation waters will contain levels of undissociated hydrogen sulphide at or above the 2 µg/L ANZECC guideline for aquatic wildlife. However, this guideline is not directly applicable to evaporation ponds.

The toxicity of sulphide to aquatic animals is dependent on the temperature, pH and dissolved oxygen concentration. Fish usually exhibit a strong avoidance reaction to sulphide in waters while sensitive fish species may be affected at levels above 2 µg/L. In the case of formation waters, it is the risk of discharge of relatively high sulphide-containing waters into natural waterbodies that is significant and not the exposure in evaporation pond waters.

Dr Greg Miller
ENVIROTEST

Checked by:

Quality Control:

Formation Waters – Cooper Basin, South Australia, Santos Ltd

Parameter	Batch No.	Method	Type of QC	Units	Laboratory Control Standards			Acceptance Units for Precision (%)
					Measured	Nominal	% Recovery of Known Additions	
Physico-chemical								
Total Dissolved Solids	00100	APHA 2540C	APHA Control Solution	mg/L	286	293		±10
Inorganic								
Trace Elements	Lot # A905325	APHA 3120B	Certified Wastewater	µg/L				±10
Antimony					13	10		80-120
Arsenic					13	10		
Beryllium					10	10		
Chromium					38	50		
Cobalt					47	50		
Copper					47	50		
Lead					53	50		
Molybdenum					47	50		
Nickel					47	50		
Selenium					14	10		
Vanadium					50	50		
Zinc					51	50		
Cadmium	99374	APHA 3111	Certified Wastewater	µg/L	11	10		
Mercury	99374	APHA 3112	Surrogate	µg/L	1	1		
Silver	99374	APHA 3111	Certified Wastewater	µg/L	5	10		
Fluoride	00101	APHA 4500-F^-	APHA Control Solution	mg/L	1.2	1.2		±10
Sulphate	00101	APHA 4500-SO_4^{2-} E	APHA Control Solution	mg/L	21	20		±10
Sulphide	99374	APHA 4500-S_2-C,D	APHA Recovery	µg/L			107	80-120
Nutrients								
Ammonia-Nitrogen	00102	APHA 4500-NH_3	Certified Wastewater	µg/L	200	200		±10
Ammonia-Nitrogen	00102	APHA 4500-NH_3 B,C	Certified Wastewater	µg/L	1100	1000		±10
Nitrate+Nitrite-Nitrogen	00102	APHA 4500-E	Certified Wastewater	µg/L	180-220	200		±10
Total Kjeldahl Nitrogen	00102	APHA 4500-N	Certified Wastewater	µg/L	900-1100	1000		±10
Total Phosphorus	00102	APHA 4500-P B,E	Certified Wastewater	µg/L	100	100		±10

Parameter	Batch No.	Method	Type of QC	Units	Laboratory Control Standards			Acceptance Units for Precision (%)
					Measured	Nominal	% Recovery of Known Additions	
Organics								
Volatile Organics								
Benzene Recovery	99374	SPME GC-FID	Surrogate	µg/L		10	100	80-120
Toluene Recovery	99374	SPME GC-FID	Surrogate	µg/L		10	100	80-120
Semi-Volatile Organics		APHA 6410 GC-MS						
Pyrene	99374		Surrogate	µg/L		10	84	80-120
Fluoranthene	99374		Surrogate	µg/L		10	86	80-120
Polychlorinated Biphenyls	99374	APHA 6630	Arochlor	µg/L		5.56	85	80-120
Trichlorobenzenes	99374	WO-150	Surrogate	µg/L		10	85-95	80-120

Note:

Oil and Grease

- crude oil reference was unsuitable for quality control because of volatile fraction
- method previously validated using recovery of weathered crude oil added to water

Analytical Results: Oil Well Evaporation Ponds
- Wildlife and Stock Parameters
Moomba Oil and Gas Fields
(October 1999)

Parameter	Units	Keleary	Dullingari	Narcoonowie	Narcoonowie Pond 1	Narcoonowie Interceptor Pit	Narcoonowie Free Form	Strzelecki	Limestone Creek	Wildlife Guideline Level[1]	Stock Guideline Level[1]
Site No.		4	6	8	9	10	11	22	24		
Biological											
Faecal Coliforms	cfu/100mL	300	0	0	300	100	4100	2900	4100	N/A	1000
Blue-Green Algae (total)	cells/mL	2050	230300	1350	650	7250	1500	50800	0	N/A	10000
Chlorophyll-a	µg/L	7	56	<1	20	2	3	<1	1	2.0-10.0	N/A
Physico-Chemical											
Water Temperature	°C	20.8	20.8	18.6	20.1	48.1	21.1	33.8	31.1	<2°C increase	N/A
Dissolved Oxygen	mg/L	7.7	9.5	5.7	5.3	<1.0	7.9	1.5	2.2	>6	N/A
pH	Stand.	9.2	7.4	9.3	9	7.7	9.4	8.4	8.2	6.5-9.0	N/A
Conductivity	µS/cm	6090	21240	5630	4300	3830	6230	6140	5500	<1500 (freshwaters)	N/A
Salinity	mg/L	4100	15700	3600	3700	2680	4100	4200	3850	<1000 (freshwaters)	N/A
TDS	mg/L	4000	14800	3550	3650	3125	3800	4400	3784	N/A	10000 [3]
Inorganic											
Aluminium	µg/L	28	30	23	19	22	3070	1364	3024	<100	5000
Antimony	µg/L	3	6	2	2	<1	2	2	4	30	N/A
Arsenic	µg/L	44	160	62	59	47	70	90	74	50	500
Beryllium	µg/L	<1	3	<1	<1	<1	1	1	1	4	100
Boron	µg/L	4200	15100	3800	2800	2300	4500	3800	3000	N/A	5000
Cadmium	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2-2.0	10
Chromium	µg/L	10	17	13	10	8	15	11	12	10	1000
Copper	µg/L	<1	154	<1	2	<1	6	24	7	2.0-5.0	500
Iron	µg/L	850	6710	340	480	630	2630	1190	5490	1000	N/A
Lead	µg/L	<1	<1	7	7	<1	<1	<1	<1	1.0-5.0	100
Mercury	µg/L	<0.1	0.1	<0.1	<0.1	0.2	<0.1	0.5	<0.1	0.1	2
Molybdenum	µg/L	3	7	2	2	1	5	3	2	N/A	10
Nickel	µg/L	<1	46	<1	<1	<1	<1	<1	17	15.0-150.0	1000
Selenium	µg/L	57	223	<1	29	25	65	37	63	5	20
Silver	µg/L	<0.1	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	0.1	N/A
Vanadium	µg/L	223	269	53	39	31	121	58	237	N/A	100
Zinc	µg/L	<1	<1	<1	<1	<1	<1	<1	<1	5.0-50.0	20000
Fluoride	mg/L	2	2	4	3	3	2	2	3	N/A	2
Sulphate	mg/L	25	<1	2	17	8	<1	<1	10	N/A	1000
Sulphide	mg/L	1.1	1.1	1.1	0.3	0.7	0.7	0.5	1.9	0.002	N/A
Nutrients											
Ammonia-Nitrogen	µg/L	300	14400	200	200	1200	300	300	2400	20.0-30.0	N/A
Nitrate-Nitrogen	µg/L	29	22	42	<10	11	48	2296	<10	N/A	40000
Nitrite-Nitrogen	µg/L	<1	7	4	29	1	79	34	18	N/A	10000
Total Nitrogen	µg/L	21030	266700	43830	29870	16440	6910	34420	20880	100-500	N/A
Total Phosphorus	µg/L	190	410	480	112	78	430	430	55	5.0-50	N/A
Organics											
Benzene	µg/L	<10	<10	<10	<10	<10	<10	110	<10	300	10*
Benzo(a)pyrene	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	N/A	0.01*
Oil and Grease	mg/L	1	1	1	226	4	2	7	3	30 [2]	N/A
Pentachlorophenol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	10*

1: ANZECC (1992)
2: SANTOS guideline
3: maximum concentration for limited periods

N/A = not available
* = drinking water guidelines
Note: level of reporting raised where appropriate due to sample matrix interferences

Analytical Results: Oil Well Evaporation Ponds
- Wildlife and Stock Parameters
Moomba Oil and Gas Fields
(October 1999)

Parameter	Units	Keleary	Dullingari	Narcoonowie	Narcoonowie Pond 1	Narcoonowie Interceptor Pit	Narcoonowie Free Form	Strzelecki	Limestone Creek	Wildlife Guideline Level[1]	Stock Guideline Level[1]
Site No.		4	6	8	9	10	11	22	24		
Phenol	µg/L	40	0.3	0.3	0.3	0.1	0.03	0.1	0.6	50	N/A
Phenolics (total)	µg/L	451	1	2	1	4	0.1	1	3	N/A	2*
Phthalate esters (other)	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	N/A
Polycyclic aromatic hydrocarbons (total)	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	3	N/A
Polychlorinated biphenyls	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.1*
Tetrachlorophenol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	1	N/A
Toluene	µg/L	<10	<10	<10	<10	<10	<10	920	<10	300	N/A
2,4-dichlorophenol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.2	N/A
1,2,3-trichlorobenzene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.9	N/A
1,2,4-trichlorobenzene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	N/A
1,3,5-trichlorobenzene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.7	N/A
2,4,5-trichlorophenol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	N/A	1*

1: ANZECC (1992)
2: SANTOS guideline
3: maximum concentration for limited periods

N/A = not available
* = drinking water guidelines
Note: level of reporting raised where appropriate due to sample matrix interferences

Analytical Results: Oil Well Evaporation Ponds
- Wildlife and Stock Parameters
Moomba Oil and Gas Fields
(October 1999)

Parameter	Units	Big Lake 36	Moomba Oil	Merrimelia Oil	Meranji Oil	Tantanna Oil	Spencer	Muteroo	Gidgealpa Oil 1	Gidgealpa Oil 2	Wildlife Guideline Level[1]	Stock Guideline Level[1]
Site No.		28	30	33	34	35	36	37	38	39		
Biological												
Faecal Coliforms	cfu/100mL	100	100	0	0	0	0	0	0	0	N/A	1000
Blue-Green Algae (total)	cells/mL	5850	16450	263500	14550	35500	17750	17400	1350	14250	N/A	10000
Chlorophyll-a	µg/L	12	<1	27	<1	<1	<1	<1	<1	2	2.0-10.0	N/A
Physico-Chemical												
Water Temperature	°C	24.1	24.7	19.6	23.1	17.6	19.7	44.3	21.4	22.1	<2°C increase	N/A
Dissolved Oxygen	mg/L	16.3	8	9	8.6	10	8.6	1.8	6.6	4.4	>6	N/A
pH	Stand.	9.6	8.7	8.9	9.5	9.8	9.6	8.1	8.8	8.6	6.5-9.0	N/A
Conductivity	µS/cm	16200	7870	6030	8590	2000	5440	3550	5500	5430	<1500 (freshwaters)	N/A
Salinity	mg/L	11000	5500	4220	5840	2900	3800	2480	3850	3600	<1000 (freshwaters)	N/A
TDS	mg/L	10850	8604	3968	7897	2766	3750	2500	4050	3188	N/A	10000[3]
Inorganic												
Aluminium	µg/L	899	24	21	33	13	22	25	20	16	<100	5000
Antimony	µg/L	5	2	4	3	<1	2	<1	2	<1	30	N/A
Arsenic	µg/L	149	49	78	99	48	71	62	73	47	50	500
Beryllium	µg/L	3	1	1	1	<1	1	1	1	1	4	100
Boron	µg/L	23300	4500	2600	5600	1600	3000	2200	3300	3000	N/A	5000
Cadmium	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2-2.0	10
Chromium	µg/L	69	12	12	37	9	12	8	11	9	10	1000
Copper	µg/L	6	3	6	9	<1	<1	1	3	3	2.0-5.0	500
Iron	µg/L	960	570	600	320	220	230	420	350	460	1000	N/A
Lead	µg/L	<1	<1	10	<1	9	7	7	11	6	1.0-5.0	100
Mercury	µg/L	<0.1	0.4	0.5	0.5	0.3	0.3	0.2	0.3	0.3	0.1	2
Molybdenum	µg/L	8	2	4	2	4	2	<1	2	2	N/A	10
Nickel	µg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	15.0-150.0	1000
Selenium	µg/L	141	45	61	30	41	44	20	53	18	5	20
Silver	µg/L	0.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.1	N/A
Vanadium	µg/L	274	87	39	52	14	27	18	32	30	N/A	100
Zinc	µg/L	<1	<1	<1	854	<1	<1	<1	<1	<1	5.0-50.0	20000
Fluoride	mg/L	9	3	2	4	6	7	2	2	2	N/A	2
Sulphate	mg/L	63	13	<1	<1	2	9	13	15	11	N/A	1000
Sulphide	mg/L	3.6	0.2	0.3	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	0.002	N/A
Nutrients												
Ammonia-Nitrogen	µg/L	900	200	100	300	100	100	3500	200	700	20.0-30.0	N/A
Nitrate-Nitrogen	µg/L	37	28	128	44	<10	<10	10	195	11	N/A	40000
Nitrite-Nitrogen	µg/L	11	3	2	<1	3	4	24	5	<1	N/A	10000
Total Nitrogen	µg/L	57390	25300	17360	20400	7290	10190	11230	7480	8420	100-500	N/A
Total Phosphorus	µg/L	330	3070	2170	106	1500	77	83	64	104	5.0-50	N/A
Organics												
Benzene	µg/L	65	<10	<10	<10	<10	<10	<10	<10	<10	300	10*
Benzo(a)pyrene	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	N/A	0.01*
Oil and Grease	mg/l	41	2	2	3	<1	<1	<1	2	<1	30[2]	N/A
Pentachlorophenol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	10*

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Analytical Results: Oil Well Evaporation Ponds
- Wildlife and Stock Parameters
Moomba Oil and Gas Fields
(October 1999)

Parameter	Units	Big Lake 36	Moomba Oil	Merrimelia Oil	Meranji Oil	Tantanna Oil	Spencer	Muteroo	Gidgealpa Oil 1	Gidgealpa Oil 2	Wildlife Guideline Level[1]	Stock Guideline Level[1]
Site No.		28	30	33	34	35	36	37	38	39		
Phenol	µg/L	0.09	0.1	0.4	0.2	0.1	0.1	0.2	2.3	0.4	50	N/A
Phenolics (total)	µg/L	0.09	0.2	1.7	1.2	0.6	0.6	0.8	7.1	1	N/A	2*
Phthalate esters (other)	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	N/A
Polycyclic aromatic hydrocarbons (total)	µg/L	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	<0.1	3	N/A
Polychlorinated biphenyls	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.1*
Tetrachlorophenol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	1	N/A
Toluene	µg/L	<10	<10	<10	48	<10	<10	<10	<10	<10	300	N/A
2,4-dichlorophenol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.2	N/A
1,2,3-trichlorobenzene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.9	N/A
1,2,4-trichlorobenzene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	N/A
1,3,5-trichlorobenzene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.7	N/A
2,4,5-trichlorophenol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	N/A	1*

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Analytical Results: Gas Well Evaporation Ponds
- Wildlife and Stock Parameters
Moomba Oil and Gas Fields
(October 1999)

Parameter	Units	Moomba South Central	Bookabourdie	Dullingari Gas	Toolachee South Nodal	Toolachee Gas	Toolachee East Nodal	Munkari Nodal	Wildlife Guideline Level[1]	Stock Guideline Level[1]
Site No.		3	5	7	12	13	14	15		
Biological										
Faecal Coliforms	cfu/100mL	0	9400	0	0	0	0	0	N/A	1000
Blue-Green Algae (total)	cells/mL	7600	9500	2150	650	550	11200	0	N/A	10000
Chlorophyll-a	µg/L	2	8	<1	<1	<1	<1	<1	2.0-10.0	N/A
Physico-Chemical										
Water Temperature	°C	23.5	25.4	20.2	38.7	25.5	22	28.5	<2°C increase	N/A
Dissolved Oxygen	mg/L	2.1	<1.0	1	1.2	9.9	<1.0	2.8	>6	N/A
pH	Stand.	7.8	6.6	7	7.5	8.8	7	6.9	6.5-9.0	N/A
Conductivity	µS/cm	9800	8750	11840	10920	39000	7020	8050	<1500 (freshwaters)	N/A
Salinity	mg/L	6600	5800	8050	7100	24700	4800	5500	<1000 (freshwaters)	N/A
TDS	mg/L	6123	4856	8854	8874	24780	5686	5433	N/A	10000 [3]
Inorganic										
Aluminium	µg/L	14	24	27	28	787	18	21	<100	5000
Antimony	µg/L	2	3	1	2	21	2	4	30	N/A
Arsenic	µg/L	58	62	159	100	248	85	84	50	500
Beryllium	µg/L	1	3	3	2	7	1	3	4	100
Boron	µg/L	5600	10900	12000	6000	25400	5200	6400	N/A	5000
Cadmium	µg/L	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	0.2-2.0	10
Chromium	µg/L	7	16	17	14	32	16	10	10	1000
Copper	µg/L	55	13	134	45	123	3	15	2.0-5.0	500
Iron	µg/L	5160	5760	9650	2610	1150	18730	1940	1000	N/A
Lead	µg/L	<1	<1	<1	<1	14	18	<1	1.0-5.0	100
Mercury	µg/L	0.3	0.4	0.5	0.2	0.3	0.3	0.2	0.1	2
Molybdenum	µg/L	5	<1	2	2	19	3	4	N/A	10
Nickel	µg/L	12	13	46	8	3	<1	<1	15.0-150.0	1000
Selenium	µg/L	107	51	186	41	576	109	98	5	20
Silver	µg/L	0.6	<0.1	0.4	0.2	0.6	0.7	0.1	0.1	N/A
Vanadium	µg/L	396	508	252	100	435	205	80	N/A	100
Zinc	µg/L	<1	<1	<1	<1	<1	<1	86	5.0-50.0	20000
Fluoride	mg/L	<1	2	3	2	2	2	3	N/A	2
Sulphate	mg/L	<1	105	<1	<1	<1	87	1	N/A	1000
Sulphide	mg/L	<0.1	0.2	1	1.7	<0.1	3.6	0.2	0.002	N/A
Nutrients										
Ammonia-Nitrogen	µg/L	82100	2700	62900	19500	900	12500	26700	20.0-30.0	N/A
Nitrate-Nitrogen	µg/L	51	25	32	89	54	18	32	N/A	40000
Nitrite-Nitrogen	µg/L	3	4	4	2	142	12	<1	N/A	10000
Total Nitrogen	µg/L	1120100	13700	418300	410300	16600	1068000	229100	100-500	N/A
Total Phosphorus	µg/L	290	170	290	430	430	290	210	5.0-50	N/A
Organics										
Benzene	µg/L	<10	<10	<10	7650	<10	5050	340	300	10*
Benzo(a)pyrene	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	N/A	0.01*
Oil and Grease	mg/L	6	87	19	24	<1	170	5	30 [2]	N/A
Pentachlorophenol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	10*

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Analytical Results: Gas Well Evaporation Ponds
- Wildlife and Stock Parameters
Moomba Oil and Gas Fields
(October 1999)

Parameter	Units	Moomba South Central	Bookabourdie	Dullingari Gas	Toolachee South Nodal	Toolachee Gas	Toolachee East Nodal	Munkari Nodal	Wildlife Guideline Level[1]	Stock Guideline Level[1]
Site No.		3	5	7	12	13	14	15		
Phenol	µg/L	55	0.1	354	93	0.2	41	413	50	N/A
Phenolics (total)	µg/L	193	53	1678	359	2	126	6870	N/A	2*
Phthalate esters (other)	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	N/A
Polycyclic aromatic hydrocarbons (total)	µg/L	1.1	3.1	2.9	5.8	0.2	18	17	3	N/A
Polychlorinated biphenyls	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.1*
Tetrachlorophenol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	1	N/A
Toluene	µg/L	<10	<10	<10	13600	<10	14000	4300	300	N/A
2,4-dichlorophenol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.2	N/A
1,2,3-trichlorobenzene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.9	N/A
1,2,4-trichlorobenzene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	N/A
1,3,5-trichlorobenzene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.7	N/A
2,4,5-trichlorophenol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	N/A	1*

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Analytical Results: Gas Well Evaporation Ponds
- Wildlife and Stock Parameters
Moomba Oil and Gas Fields
(October 1999)

Parameter	Units	Della Gas	Anyema/Brumby Nodal	Toolachee North Nodal	Kidman	Aroona Nodal	Lepena Nodal	Strzelecki #15 Nodal	Wildlife Guideline Level[1]	Stock Guideline Level[1]
Site No.		16	17	18	19	20	21	23		
Biological										
Faecal Coliforms	cfu/100mL	0	200	2700	100	0	0	400	N/A	1000
Blue-Green Algae (total)	cells/mL	5150	750	8000	1550	3350	1050	500	N/A	10000
Chlorophyll-a	µg/L	9	2	7	<1	7	<1	5	2.0-10.0	N/A
Physico-Chemical										
Water Temperature	°C	27.5	34.5	27	22.9	22.7	52.6	33.4	<2°C increase	N/A
Dissolved Oxygen	mg/L	5.1	1.1	1.9	<1.0	1.2	1.8	2.6	>6	N/A
pH	Stand.	8.7	6.1	6.3	8.5	8.5	8.4	9	6.5-9.0	N/A
Conductivity	µS/cm	33700	17530	17650	11780	13260	10600	32600	<1500 (freshwaters)	N/A
Salinity	mg/L	22100	12200	12000	11600	9020	7200	22000	<1000 (freshwaters)	N/A
TDS	mg/L	22580	8756	17070	11292	5205	8435	19860	N/A	10000 [3]
Inorganic										
Aluminium	µg/L	777	30	29	28	22	26	20	<100	5000
Antimony	µg/L	16	7	5	2	3	46	2	30	N/A
Arsenic	µg/L	273	197	167	111	90	114	96	50	500
Beryllium	µg/L	5	5	4	2	5	6	2	4	100
Boron	µg/L	28000	11800	12400	9800	8600	7800	6200	N/A	5000
Cadmium	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2-2.0	10
Chromium	µg/L	27	20	17	14	14	12	13	10	1000
Copper	µg/L	54	152	81	44	25	20	24	2.0-5.0	500
Iron	µg/L	1660	12140	8660	3710	1660	820	2300	1000	N/A
Lead	µg/L	<1	<1	<1	<1	<1	<1	<1	1.0-5.0	100
Mercury	µg/L	0.1	0.1	<0.1	<0.1	0.5	0.4	0.4	0.1	2
Molybdenum	µg/L	12	5	6	3	4	2	3	N/A	10
Nickel	µg/L	5	66	36	<1	<1	<1	<1	15.0-150.0	1000
Selenium	µg/L	248	269	188	117	79	47	118	5	20
Silver	µg/L	0.4	0.2	0.1	0.3	<0.1	<0.1	0.2	0.1	N/A
Vanadium	µg/L	324	279	231	131	111	71	98	N/A	100
Zinc	µg/L	<1	28	10	<1	<1	<1	<1	5.0-50.0	20000
Fluoride	mg/L	3	1	4	2	3	4	4	N/A	2
Sulphate	mg/L	341	1	<1	<1	<1	43	<1	N/A	1000
Sulphide	mg/L	1.1	<0.1	0.2	0.5	0.5	0.1	0.8	0.002	N/A
Nutrients										
Ammonia-Nitrogen	µg/L	1300	139000	37000	14300	18000	6300	19700	20.0-30.0	N/A
Nitrate-Nitrogen	µg/L	<10	24	15	43	55	34	272	N/A	40000
Nitrite-Nitrogen	µg/L	106	2	<1	3	2	4	10	N/A	10000
Total Nitrogen	µg/L	263800	229600	180800	88200	63160	43820	339100	100-500	N/A
Total Phosphorus	µg/l	250	450	87	820	113	89	92	5.0-50	N/A
Organics										
Benzene	µg/l	850	3500	2190	40	3900	340	2030	300	10*
Benzo(a)pyrene	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	N/A	0.01*
Oil and Grease	mg/L	8	3	13	6	21	9	6	30 [2]	N/A
Pentachlorophenol	µg/l	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	10*

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Analytical Results: Gas Well Evaporation Ponds
- Wildlife and Stock Parameters
Moomba Oil and Gas Fields
(October 1999)

Parameter	Units	Della Gas	Anyema/Brumby Nodal	Toolachee North Nodal	Kidman	Aroona Nodal	Lepena Nodal	Strzelecki #15 Nodal	Wildlife Guideline Level[1]	Stock Guideline Level[1]
Site No.		16	17	18	19	20	21	23		
Phenol	µg/L	3.5	64	29	68	24	11	21	50	N/A
Phenolics (total)	µg/L	30	186	121	260	102	50	98	N/A	2*
Phthalate esters (other)	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	N/A
Polycyclic aromatic hydrocarbons (total)	µg/L	1.7	1.9	2	<0.1	1.4	0.4	0.3	3	N/A
Polychlorinated biphenyls	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.1*
Tetrachlorophenol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	1	N/A
Toluene	µg/L	380	12800	16700	345	5375	1720	14570	300	N/A
2,4-dichlorophenol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.2	N/A
1,2,3-trichlorobenzene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.9	N/A
1,2,4-trichlorobenzene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	N/A
1,3,5-trichlorobenzene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.7	N/A
2,4,5-trichlorophenol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	N/A	1*

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Analytical Results: Gas Well Evaporation Ponds
- Wildlife and Stock Parameters
Moomba Oil and Gas Fields
(October 1999)

Parameter	Units	Murta South Nodal	Daralingie Gas	Big Lake Gas	Big Lake 17	Tirrawarra Gas	Merrimelia Gas	Gidgealpa Gas Interceptor Pit	Gidgealpa Gas Evaporation Pond	Wildlife Guideline Level[1]	Stock Guideline Level[1]
Site No.		25	26	27	29	31	32	40	41		
Biological											
Faecal Coliforms	cfu/100mL	0	0	0	200	0	0	0	0	N/A	1000
Blue-Green Algae (total)	cells/mL	0	0	23000	4600	30300	55000	24600	29400	N/A	10000
Chlorophyll-a	µg/L	<1	<1	5	5	32	<1	<1	<1	2.0-10.0	N/A
Physico-Chemical											
Water Temperature	°C	23.5	22.4	22.5	24.4	20.5	19.8	22.4	17.9	<2°C increase	N/A
Dissolved Oxygen	mg/L	3.9	<1.0	1.2	1.7	2.1	<1	<1.0	1	>6	N/A
pH	Stand.	7	8.3	8	6.5	8.1	7.6	6.9	8.2	6.5-9.0	N/A
Conductivity	µS/cm	11 650	23120	9270	30200	19910	16560	19060	56000	<1500 (freshwaters)	N/A
Salinity	mg/L	8100	15700	6300	21100	13500	11300	12800	32800	<1000 (freshwaters)	N/A
TDS	mg/L	11260	15700	7576	8776	15950	12190	7004	35254	N/A	10000 [3]
Inorganic											
Aluminium	µg/L	18	24	14	927	20	22	23	40	<100	5000
Antimony	µg/L	4	6	3	9	4	5	3	12	30	N/A
Arsenic	µg/L	108	154	94	217	129	126	162	272	50	500
Beryllium	µg/L	2	2	1	4	3	2	3	6	4	100
Boron	µg/L	4700	10100	6000	22100	11800	9900	10400	26100	N/A	5000
Cadmium	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2-2.0	10
Chromium	µg/L	17	27	11	23	19	18	20	46	10	1000
Copper	µg/L	69	147	64	37	105	49	147	220	2.0-5.0	500
Iron	µg/L	4700	5360	6040	8240	6190	6040	12800	4950	1000	N/A
Lead	µg/L	<1	<1	<1	<1	<1	<1	<1	<1	1.0-5.0	100
Mercury	µg/L	1.2	0.2	0.3	27	0.7	1.1	1.4	0.7	0.1	2
Molybdenum	µg/L	5	7	4	11	7	5	7	12	N/A	10
Nickel	µg/L	17	20	10	54	22	12	42	22	15.0-150.0	1000
Selenium	µg/L	130	200	73	336	156	105	195	559	5	20
Silver	µg/L	<0.1	0.3	0.2	0.2	0.1	0.1	0.2	0.4	0.1	N/A
Vanadium	µg/L	135	237	124	343	212	181	268	502	N/A	100
Zinc	µg/L	<1	<1	<1	<1	<1	<1	<1	<1	5.0-50.0	20000
Fluoride	mg/L	2	2	3	3	2	3	2	2	N/A	2
Sulphate	mg/L	2	<1	74	1	<1	<1	<1	283	N/A	1000
Sulphide	mg/L	0.8	1.2	0.5	0.3	<0.1	0.8	<0.1	0.6	0.002	N/A
Nutrients											
Ammonia-Nitrogen	µg/L	44600	12400	25900	94800	29000	18600	123000	50400	20.0-30.0	N/A
Nitrate-Nitrogen	µg/L	33	24	51	12	38	56	28	192	N/A	40000
Nitrite-Nitrogen	µg/L	2	<1	4	6	2	4	5	<1	N/A	10000
Total Nitrogen	µg/L	88790	694300	89780	1120300	1068000	410300	1336200	764200	100-500	N/A
Total Phosphorus	µg/L	290	1190	520	1350	2050	170	1070	2210	5.0-50	N/A
Organics											
Benzene	µg/L	9560	<10	<20	50	<20	1120	3820	83	300	10*
Benzo(a)pyrene	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	N/A	0.01*
Oil and Grease	mg/L	31	154	87	32	28	36	30	14	30 [2]	N/A
Pentachlorophenol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	10*

1: ANZECC (1992)
2: SANTOS Guideline
3. maximum concentration for limited periods

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Note: level of reporting raised where appropriate due to sample matrix interference

Analytical Results: Gas Well Evaporation Ponds
- Wildlife and Stock Parameters
Moomba Oil and Gas Fields
(October 1999)

Parameter	Units	Murta South Nodal	Daralingie Gas	Big Lake Gas	Big Lake 17	Tirrawarra Gas	Merrimelia Gas	Gidgealpa Gas Interceptor Pit	Gidgealpa Gas Evaporation Pond	Wildlife Guideline Level[1]	Stock Guideline Level[1]
Site No.		25	26	27	29	31	32	40	41		
Phenol	µg/L	17	7.3	0.1	2	20	30	32	5.9	50	N/A
Phenolics (total)	µg/L	70	27	4.4	3.8	71	131	129	21	N/A	2*
Phthalate esters (other)	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	N/A
Polycyclic aromatic hydrocarbons (total)	µg/L	0.5	<0.1	<0.1	6.9	2.2	10	6.5	1.5	3	N/A
Polychlorinated biphenyls	µg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.1*
Tetrachlorophenol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	1	N/A
Toluene	µg/L	56900	<10	<20	<10	<10	5600	760	<10	300	N/A
2,4-dichlorophenol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.2	N/A
1,2,3-trichlorobenzene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.9	N/A
1,2,4-trichlorobenzene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	N/A
1,3,5-trichlorobenzene	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.7	N/A
2,4,5-trichlorophenol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	N/A	1*

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Analytical Results: Moomba Plant Evaporation Ponds
- Wildlife and Stock Parameters
Moomba Oil and Gas Fields
(October 1999)

Parameter	Units	Lake Brooks	Northern Evaporation Pond	Wildlife Guideline Level[1]	Stock Guideline Level[1]
Site No.		1	2		
Biological					
Faecal Coliforms	cfu/100mL	0	100	N/A	1000
Blue-Green Algae (total)	cells/mL	9150	71000	N/A	10000
Chlorophyll-a	µg/L	<1	<1	2.0-10.0	N/A
Physico-Chemical					
Water Temperature	°C	56	25.3	<2°C increase	N/A
Dissolved Oxygen	mg/L	2.7	<1.0	>6	N/A
pH	Stand.	9.7	8.6	6.5-9.0	N/A
Conductivity	µS/cm	8030	11080	<1500 (freshwaters)	N/A
Salinity	mg/L	5400	7500	<1000 (freshwaters)	N/A
TDS	mg/L	5005	6687	N/A	10000 [3]
Inorganic					
Aluminium	µg/L	38	16	<100	5000
Antimony	µg/L	6	4	30	N/A
Arsenic	µg/L	<1	<1	50	500
Beryllium	µg/L	1	1	4	100
Boron	µg/L	4100	3100	N/A	5000
Cadmium	µg/L	<0.2	<0.2	0.2-2.0	10
Chromium	µg/L	10	39	10	1000
Copper	µg/L	189	18	2.0-5.0	500
Iron	µg/L	700	1520	1000	N/A
Lead	µg/L	<1	<1	1.0-5.0	100
Mercury	µg/L	0.2	<0.1	0.1	2
Molybdenum	µg/L	9	20	N/A	10
Nickel	µg/L	10	<1	15.0-150.0	1000
Selenium	µg/L	62	<1	5	20
Silver	µg/L	<0.1	<0.1	0.1	N/A
Vanadium	µg/L	23	34365	N/A	100
Zinc	µg/L	<1	<1	5.0-50.0	20000
Fluoride	**mg/L**	3	<1	N/A	2
Sulphate	**mg/L**	3	57	N/A	1000
Sulphide	**mg/L**	0.2	4.6	0.002	N/A

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Analytical Results: Moomba Plant Evaporation Ponds
- Wildlife and Stock Parameters
Moomba Oil and Gas Fields
(October 1999)

Parameter	Units	Lake Brooks	Northern Evaporation Pond	Wildlife Guideline Level[1]	Stock Guideline Level[1]
Site No.		1	2		
Nutrients					
Ammonia-Nitrogen	µg/L	1000	2000	20.0-30.0	N/A
Nitrate-Nitrogen	µg/L	41	<1	N/A	40000
Nitrite-Nitrogen	µg/L	12	67	N/A	10000
Total Nitrogen	µg/L	25900	82100	100-500	N/A
Total Phosphorus	µg/L	390	430	5.0-50	N/A
Organics					
Benzene	µg/L	<10	<10	300	10*
Benzo(a)pyrene	µg/L	<0.01	<0.01	N/A	0.01*
Oil and Grease	mg/L	3	7	30 [2]	N/A
Pentachlorophenol	µg/L	<0.05	<0.05	0.05	10*
Phenol	µg/L	0.06	192	50	N/A
Phenolics (total)	µg/L	2.1	1053	N/A	2*
Phthalate esters (other)	µg/L	<0.2	<0.2	0.2	N/A
Polycyclic aromatic hydrocarbons (total)	µg/L	<0.1	0.2	3	N/A
Polychlorinated biphenyls	µg/L	<0.001	<0.001	0.001	0.1*
Tetrachlorophenol	µg/L	<0.05	<0.05	1	N/A
Toluene	µg/L	<10	<100	300	N/A
2,4-dichlorophenol	µg/L	<0.05	<0.05	0.2	N/A
1,2,3-trichlorobenzene	µg/L	<0.1	<0.1	0.9	N/A
1,2,4-trichlorobenzene	µg/L	<0.1	<0.1	0.5	N/A
1,3,5-trichlorobenzene	µg/L	<0.1	<0.1	0.7	N/A
2,4,5-trichlorophenol	µg/L	<0.05	<0.05	N/A	1*

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