

Santos Ltd

ABN 80 007 550 923

ANNUAL REPORT FOR SA COOPER BASIN JOINT VENTURE OPERATIONS

REPORT TO:

**DEPARTMENT
OF
PRIMARY INDUSTRIES AND RESOURCES, SA.**

JULY 2002 UPDATE

FOR REPORTING PERIOD:
1st July 2000 – 31st December 2001

PREFACE

This *Annual Report for SA Cooper Basin Joint Venture Operations* has been prepared in accordance with Regulation 33, Part 7: Division 2 – Performance and Technical Reports under the *SA Petroleum Act, 2000*. This *Report* also fulfils the requirements detailed under Alternative Arrangement 4 as described in correspondence from the Director of the Petroleum Division within PIRSA on 8th 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 report provides details of Santos activities undertaken within exploration and production tenements in the Cooper and Eromanga Basins in South Australia, herein referred to as the *Operational Area*.

This report is presented in 6 parts:

Part 1: Seismic Exploration Activities

Part 2: Well Site Activities

Part 3: Flowline, Pipeline and Trunkline Activities

Part 4: Production Operations

Part 5: Statement of Expenditure

Part 6: References & Appendices

Part 6 includes a list of *reports and data* relevant to the operation of the Act generated by the licensee during the relevant license year.

Previous reporting of operational activities has been completed through the provision of separate activity reports to PIRSA. To enable subsequent reports to be aligned with the calendar year, the reporting period for Parts 2, 3 and 4 and 6 extends from 1st July 2000 to 31st December 2001. Seismic exploration activities are reported for the 2001 calendar year.

EXECUTIVE SUMMARY

This *Annual Report for SA Cooper Basin Operations* has been prepared in accordance with the requirements of Regulation 33, under the *SA Petroleum Act, 2000*. The *Report* also fulfils the obligations detailed under Alternative Arrangement 4 as issued by the Director of the Petroleum Division within PIRSA on the 8th June 2000.

This report details seismic exploration, well site, flowline, pipeline and trunkline, and production facility activities undertaken by Santos within exploration and production tenements in the SA sector of the Cooper and Eromanga Basins. With the exception of seismic activities, the reporting period for other activities is 1st July 2000 to 31st December 2001. Seismic exploration activities are reported for the 2001 calendar year.

In accordance with the reporting requirements of Regulation 33, this report also provides a performance assessment with regard to the requirements of the *Petroleum Act 2000*, the *Petroleum Regulations 2000*, licenses, and objectives under several Statement of Environmental Objectives.

During the reporting period, Santos operations in the Cooper and Eromanga Basins produced over 215 petajoules of Sales Gas, 25.9 petajoules of Ethane, 532 megalitres of Condensate, and 689 megalitres of Crude Oil.

Four seismic projects totalling 1988km² were undertaken during the reporting period: Murteree Horst, Coonatie, Greater Strzelecki and Caladan/Daralingie. Eighty-two well leases and associated roads and borrow pits were constructed during the reporting period. Fourteen and a half kilometres of well lease access tracks and roads were restored. Full restoration of temporary camp sites and partial restoration of well leases was undertaken at fifty-six cased and suspended and plugged and suspended well sites.

Eighty-two wells were drilled, and fifty-seven wells worked over during the reporting period. Of these fifty-seven wells, twenty-eight underwent fracture stimulation operations. A total of 683 producing and/or suspended wells were operational during the reporting period.

Gas flowlines totalling 185km and 24.5km of oil flowlines were installed during the reporting period. While no gas pipelines were abandoned during the reporting period, one oil field manifold and five oil lines were decommissioned, abandoned, or mothballed. The majority of this activity was associated with oil lines in the Jena Field.

During this reporting period one *Serious* safety incident occurred at the Moomba Plant. This resulted in fatal injuries to a Santos employee. The incident involved the unintended release of volatile product that subsequently ignited. Details of a full investigation into this incident have been reported to Government.

A further three *Serious* incidents were notified to Government in the reporting period. Two involved losses from oil field pipelines and the third involved a surface casing pressure increase at a well head.

A number of formal internal and external audits of safety, operational and environmental systems, procedures and activities were completed during the reporting

period. The outcomes of these audits drove several reviews of management systems and plans, work procedures, guidelines and codes of practice during the reporting period. projects.

This *Report* provides a summary of all activities undertaken by Santos in the SA Sector of the Cooper and Eromanga Basins. Supporting information and data were presented to PIRSA throughout the reporting period, and are also provided as appendices to this *Report*.

PART 1:
SEISMIC EXPLORATION ACTIVITIES

FOR REPORTING PERIOD:
1ST JANUARY 2001 – 31ST DECEMBER 2001

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Section 1: Seismic Exploration Activities

1.1 Summary of Activities

Four seismic projects were undertaken during the reporting period. Notices of intention to conduct each of the projects were sent to PIRSA and the relevant landholders on 17th November 2000, 30th November 2000, 11th January 2001 and 26th April 2001 for Murteree Horst, Coonatie, Greater Strzelecki and Caladan/Daralingie seismic projects respectively.

All surveys were conducted in dunefield and floodplain/wetland land systems. No surveys were conducted in salt lake systems or gibber/tableland systems.

Line Preparation

Line preparation for these four projects was conducted during 26th December 2000 to 15th August 2001.

Details of the coverage of these four projects are presented in Table 1 below.

Table 1: Seismic projects undertaken between January and December 2001

PROJECT	SOURCE KM PREPARED **	RECEIVER KM PREPARED **	ORTHO- NORMALISED SOURCE KM	ORIGINAL SQ KM PROPOSED	SQ KM RECORDED
Murteree Horst 3D	470	422	470	213	115
Coonatie 3D	195	125	152	88	38
Greater Strzelecki 3D	4,700	3,284	3,397	1324	1,034
Caladan/Daralingie 3D	2,815	2,035	2,081	1004*	801
TOTAL	8180	5866	6100	2629	1988

* Estimated area...not actually designed.

** Represents verified figures at the completion of the particular survey as opposed to those reported on a daily or weekly basis at the time of survey.

Seismic Recording

The area of coverage of each of these seismic projects was significantly reduced as a result of a directive issued by PIRSA preventing seismic operations being undertaken outside of existing PPL's. Access outside the PPL's is required to achieve fully imaged data at the PPL boundaries. Due to the imposition of this requirement, actual total coverage for these four surveys was reduced from 2629 km² to 1988 km².

Restoration

During the reporting period the following restoration activities were undertaken:

- Rehabilitative works to deep wheel ruts on a prepared line associated with the Swan Lake 3D survey.
- Sand dunes with excessive cuts at line crossings constructed for the Coonatie 3D survey were re-profiled.
- Main camp site for the Caladan/Daralingie 3D survey was rehabilitated with rubbish removed and restoration of the hardstand area completed.

1.2 Compliance Report

Every effort was made during the reporting period to ensure Seismic exploration activities were conducted in accordance with the requirements of the *Petroleum Act 2000*, the *Petroleum Regulations 2000*, licenses, and objectives under the *Statement of Environmental Objectives for Seismic Operations in the Cooper and Eromanga Basins in South Australia* (PIRSA 1998) (SEO).

Notices of Intention/Entry to Land to conduct each of the four seismic surveys conducted in the reporting period were submitted in accordance with requirements under Clause 60 of the Act and Reg 20. *Notices of Intention* were submitted to both PIRSA and relevant landholders.

Geophysical Progress Reports as required under Reg 34 were furnished to PIRSA regularly during the acquisition of new seismic data in the reporting period.

Geophysical Operations Reports as required under Reg 35 were presented to PIRSA on completion of the Seismic activities in the reporting period. Approvals were obtained for extensions to the reporting period for two projects (Greater Strzelecki 3D and the Caladan/Daralingie 3D). *Geophysical Operations Reports* for these surveys are to be reported in 2002.

Geophysical Interpretation Reports as per requirements under Reg 36 were provided during the reporting period. Complete seismic surveys are not interpreted as a matter of course. Instead area, field or regional areas are interpreted on an as-required basis.

Geophysical Data were provided to PIRSA through the reporting period as required under Reg 37. Where required, extensions to delivery deadlines were obtained.

Quarterly Meeting to Discuss Compliance Issues

Quarterly compliance meetings were held with PIRSA to discuss a range of issues associated with environmental management of activities undertaken in Santos' *Operational Area*. Actions arising from these meetings are presented in Appendix 4 to this report.

No issues were raised at these meetings regarding seismic activities conducted in the *Operational Area*.

1.3 Management System Audits

There were no significant Health and Safety issues identified during the year for seismic operations. Seismic crews in the SA Cooper Basin performed exceptionally well and achieved the Santos Bronze, Silver and Gold Safety Awards.

A formal audit was carried out on the seismic crew operating in the Cooper Basin during the 2nd-4th July 2001. The audit was conducted against the 23 SABU General Standards and the crew scored a creditable 83%, with no non-conformances against the seismic HS&E Management system identified. Several opportunities for improvement were identified during this audit and included:

- Improved management of risks associated with change;
- Development and implementation of a comprehensive audit/inspection program;
- Implementation of a system for isolation and control of energy sources;
- Improvements to the use of permitting systems to manage risks; and
- Introduce competency assessment to all employee.

These improvement actions will form the basis for the development of remedial action plans within Santos and contractor seismic crews.

1.4 Risk Assessment and Other Audits

Santos aims to undertake seismic operations in the *Operational Area* in such a way that environmental disturbance is avoided or minimised and affected areas can rehabilitate naturally within a reasonable timeframe.

The planning, line preparation, data recording, and rehabilitation associated with all seismic exploration undertaken in Santos' *Operational Area* are undertaken in accordance with the following standards and procedures:

- *Environmental Procedures – Seismic Operations* (Santos Ltd 1999c),
- *Code of Environmental Practice – Seismic Operations* (Santos Ltd 1999b),
- *Dozer Manual – Environmental Procedures for Seismic Line Preparation* (Santos Ltd 1998b), and
- *Statement of Environmental Objectives for Seismic Operations in the Cooper and Eromanga Basins in South Australia*.

Reference is also made to the *Environmental Procedures for the Management of Aboriginal Heritage Sites* (Santos Ltd 1998c), for the identification and protection of potentially significant sites. Where sites of possible significance are identified by field personnel and further verification is required, then a consultant Archaeologist may be commissioned to undertake an inspection of the area and recommend measures to mitigate any potential for disturbance. Sites of potential significance are documented and appropriate notification is provided pursuant to the requirements of the *Aboriginal Heritage Act, 1988*.

Plant clearance priorities are determined with reference to the Santos *Field Guide to the Common Plants of the Cooper Basin* (Santos Ltd 1997c).

All seismic activities were subjected to rigorous visual inspection at the time they were undertaken. These inspections, whilst not considered to be formal audits of seismic activities, are undertaken to provide an account of performance against environmental objectives. Issues identified by these inspections were formulated by completing Environmental Report Forms (ERFs).

For the reporting period, these inspections identified a total of nine instances where the objectives of the SEO were not achieved, indicating instances of unacceptable practice. These related to inappropriate ground disturbance (wheel ruts) during wet conditions, excessive dune cutting, insufficient 'dog-legging' of the line of sight, and inappropriate stock piling of sand. Details of these non-conformances and corrective actions are presented in Appendix 1.

One incidence of line set-out error was identified during the reporting period. The error, caused by incorrect ellipsoid parameters being used in the datum transformation, resulted in a shift in the grid 225m West and 300m South of the designed location. As the 3D grid had been designed to overlap both the 1997 Dullingari 3D and the 1997 Toolachee 3D surveys, the 213km of line prepared in the incorrect location had to be abandoned.

This error also resulted in approx 3.42km of line and 4.16km of access track being prepared in unlicensed land outside the boundary of PPL16. Future incidents of this nature will be avoided since most data are now in GDA 94 and will not require transformation from AGD 84. Where old data require transformation, map overlays will be used to eliminate any potential for set out error. A report on this incident was submitted to PIRSA on 2nd March 2001. As the lines had been prepared in a benign fashion (mostly walked) it was anticipated that they would rehabilitate naturally within a relatively short timeframe. Details of this incident are provided in Appendix 1.

For the reporting period a total of 184 ERFs relating to seismic operations were submitted to PIRSA. These comprised:

- 167 cultural site identifications
- 5 examples of good practice
- 9 examples of poor practice, and
- 3 pastoral issues.

ERF's generated for cultural site identifications were reported in accordance with the requirements of the *Aboriginal Heritage Act, 1988*.

With the exception of those submitted for cultural site identification, details of all ERFs, together with any followup actions, are presented in Appendix 1 to this report.

For the purposes of assessing Santos' performance against environmental objectives specified in the Seismic SEO, Environmental Monitoring Points (EMPs) are installed where seismic activities have been undertaken.

New EMPs were installed during the reporting period for the following seismic surveys:

- Murteree Horst 3D
- Coonatie 3D
- Greater Strzelecki 3D
- Caladan/Daralingie 3D

Re-visits to EMPs installed on seismic lines prepared prior to the reporting period were undertaken for monitoring purposes. Details of this monitoring were submitted to PIRSA in the reporting period, with a summary provided below in Table 2.

Table 2: Revisits to Seismic Line Environmental Monitoring Points

Line Year	Survey / Line Description	Assessment Year	Status Of Recovery
SA97	Moomba/Big Lake 3D	4	Partial Recovery
SA97	Dullingari/Burke 3D	4	*Full Recovery
SA97	Toolachee Field 3D	4	*Full Recovery
SA97	Pondrinie 3D	4	Partial Recovery
SA98	MEI 3D	3	Partial Recovery
SA99	Barina/Farina 3D	2	Partial Recovery
SA00	Goyder/Milluna 3D	1	Partial Recovery
SA00	Fly Lake 3D	1	Partial Recovery
SA00	Cowralli / Hacket / Tindilpie 3D + Swan Lake 3D	1	Partial Recovery
SA00	Cascade	1	Partial Recovery

*Full Recovery at EMPs is deemed applicable when visual assessment has identified an inability to recognise the line from the surrounding environment. Recovery to this level is deemed an acceptable outcome as per the requirements of the Seismic SEO.

A formal audit of seismic activities completed during the reporting period was conducted using Goal Attainment Scaling (GAS). GAS is the means by which seismic activities are assessed to ascertain the degree of conformance against Santos' environmental objectives and other relevant legislative requirements. Environmental Monitoring Points (EMPs) installed during the conduct of seismic activities are revisited periodically for assessment of rehabilitation using the GAS system. GAS scores of 0 to +2 inclusive are deemed acceptable.

Results of GAS assessments conducted during the reporting period at each EMP and at other locations of identified impact are presented in Table 3 below.

Table 3: Goal Attainment Scaling for Seismic Line Preparation

Land System	Environmental Objective	-2	-1	0	+1	+2
Non-Land System Specific	Zero Impact on Aboriginal & European Cultural Sites	0	1	0	1	10
	Negligible Visible Impact	1	4	42	10	0
	Uphole Site Fully Restored	0	0	0	0	0
	Negligible survey markers and rubbish in situ	0	0	0	0	57
Dunefield	Minimal impact upon vegetation	0	0	21	17	0
	Minimal disturbance to land type	0	8	12	13	5
Floodplain & Wetlands	Minimal impact upon vegetation	0	0	12	3	4
	Minimal disturbance to land type	0	4	8	5	2
Gibber Plains & Tablelands	Minimal impact upon vegetation	0	0	0	0	0
	Minimal disturbance to land type	0	0	0	0	0
Salt Lake	Minimal disturbance to land type	0	0	0	0	0

The results of the GAS assessment clearly indicated a skew to the positive end of the scale, thus reflecting a good environmental performance over the reporting period for seismic activities. Graphical representation of these GAS scores are presented in Appendix 2 of this report.

1.5 Reportable Incidents

A single reportable incident associated with seismic activities occurred during the reporting period. During strong winds a piece of burning paper was blown from a campfire cage and ignited surrounding dry grass. The fire was extinguished and the fire cage hosed down to prevent any re-ignition.

There were no reportable incidents associated with seismic activities that resulted in the release of hydrocarbons. Consequently no total petroleum hydrocarbon (TPH) analysis have been undertaken or included in this section of the report.

Appendix 3 provides details of all reportable incidents that occurred throughout the reporting period.

1.6 Operations Proposed For Ensuing Year

Five aspects of Seismic 3D acquisition will be focussed upon in 2002:

- High grade projects with immediate and well defined appraisal/development opportunities;
- Early appraisal of possible and potential Original Gas In Place;
- Address a mix of recent and older discoveries;
- Diverse geographical spread and play type risks; and
- Meet 'value of information' criteria.

Under the 2002 Delineation and Development Seismic Activity Program – South Australia, acquisition activities will focus on the following key areas:

Gas

- 140km² Delineation (Verona, Gidgealpa, Central Patchawarra, Quartpot, Frank Areas, Raven/Moonanga)
- 140km² Development (Central Patchawarra)

Oil

- Undesignated
-

PART 2: WELL SITE ACTIVITIES

**FOR REPORTING PERIOD:
1ST JULY 2000 – 31ST DECEMBER 2001**

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

1.1 Summary of Activities

Well site, camp site, borrow pit and access track scouting, construction and restoration activities undertaken in the *Operational Area* during the period 1st July 2000 to 31st December 2001 (the reporting period) are summarised as;

- 82 well leases constructed (refer Appendix 5);
- 108.9km of new access tracks constructed to well leases (refer Appendix 5);
- 3 plugged and abandoned (P&A) wells and their campsites fully restored (refer Appendix 6);
- 14½ kilometers of access tracks and roads restored during the reporting period;
- 58 cased and suspended (C&S) and plugged and suspended (P&S) wells underwent production lease backfill (ie partial restoration of the well lease and full restoration of camp sites and pits) (refer Appendix 6);
- 27 well leases scouted but not drilled (leases not constructed) during the reporting period (refer Appendix 7);
- 116 borrow pits created in association with well lease, camp site and access track construction activities (refer Appendix 5); and
- 78 borrow pits restored[†] in association with well lease restoration activities (refer Appendix 6).

1.2 Compliance Report

Every effort was made in the reporting period to ensure activities associated with well site, camp site, borrow pit and access track construction and restoration were in accordance with requirements of the *Petroleum Act 2000*, the *Petroleum Regulations 2000*, licenses, and objectives under the *Statement of Environmental Objectives for Drilling and Well Operations in the Cooper / Eromanga Basin – South Australia* (PIRSA 2000) and the *Draft Statement of Environmental Objectives: Production and Processing – SA Cooper Basin Joint Venture* (Santos 2001 DRAFT).

Several non-compliances were encountered during the reporting period for late submission of *Notices of Intention/Entry to Land* (Clause 60 of the Act and Reg 20) to landowners and to Government. Several of these infringements were a result of unexpected changes to drilling programs and the need to avoid placing drilling rigs on standby and disrupting the remainder of the drilling program for the year. A review of reporting procedures and the development of new systems and procedures to allow detailed tracking of timing and submission of notifications is planned to ensure similar further non-compliances do not occur.

Quarterly Meeting to Discuss Compliance Issues

Quarterly compliance meetings were held with PIRSA to discuss a range of issues associated with the environmental management of activities undertaken in the *Operational Area*. Actions arising from these meetings are presented in Appendix 4.

No major issues relating to the construction and restoration of well sites, access tracks or roads were raised.

[†] Restored during backfill operations (initial restoration of lease). Note that of the 78 restored borrow pits, several may have been re-used to provide clay for ongoing operations with a production permit.

1.3 Management System Audits

Two formal audits were undertaken during the reporting period, both related to well lease activities. One of these was an audit of a contracting surveyor's Safety Management System, and the other an audit of the Santos Work Permit System. Both audits revealed generally good levels of adherence to procedures and systems and no safety or environmental hazards, or non-conformances were identified.

1.4 Risk Assessment and Other Audits

All planning, scouting, construction and restoration activities for roads, campsites, borrow pits and well leases undertaken during the reporting period were in accordance with the requirements of relevant standards, procedures and legislation, including:

- *Environmental Procedures for Well Lease Location, Construction and Restoration in the Cooper Basin* (Santos Ltd 1997b);
- *Field Guide to the Common Plants of the Cooper Basin*;
- *Environmental Procedures for the Management of Aboriginal Heritage Sites*;
- *Environmental Procedures for Borrow Pit Management* (Santos Ltd 1997a);
- *Code of Environmental Practice – Drilling and Workover Operations* (Santos Ltd 1998a);
- *Code of Environmental Practice - Production and Processing* (Santos 1999a);
- *Statement of Environmental Objectives for Drilling and Well Operations in the Cooper / Eromanga Basin – South Australia* (PIRSA 2000);
- *Draft Statement of Environmental Objectives: Production and Processing – SA Cooper Basin Joint Venture* (Santos Ltd 2001 DRAFT);
- *Excavation and Backfilling Guide No 1500-120S002* (Santos Ltd undated-a); and
- *Roadworks Design Standards No 1500-40-G001 Rev 0* (Santos Ltd undated-c).

Visual inspections of all well site, camp site, borrow pit and access track construction and restoration activities were undertaken during the reporting period. These inspections identified no non-compliances with the objectives under the SEO for Drilling and Workover Operations

Potential for non-compliance due to accidental disturbance to sites of Aboriginal heritage significance were minimised by ensuring that all operations associated with well lease construction and restoration were confined to the minimum area required. Only staff that had completed appropriate training provided by a consultant Archaeologist performed site inspections to assist in minimising any potential for impact.

An inspection of a site of potential cultural heritage significance at the Bow #1 well lease was undertaken by a consultant Archaeologist during the reporting period. This inspection provided clarification of the sites' significance and recommendations for appropriate measures to mitigate any potential for disturbance.

Details of all significant sites identified in the reporting period were reported in accordance with the *Aboriginal Heritage Act, 1988*.

Key risks identified with the construction and restoration of borrow pits are associated with the pastoral industry. Borrow pits may be left unrestored at the request of the pastoralist so that they do not present a bogging hazard to stock and so they may act as a water source. In such cases formal agreements are obtained from the pastoralist.

During the reporting period however, no such agreements were made since all new borrow pits were constructed within Petroleum Production Licenced areas (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 of the tenement or facility.

1.5 Reportable Incidents

Appendix 3 provides details of all reportable incidents that occurred throughout the reporting period.

There were no reportable environmental incidents associated with well site, camp site, borrow pit, access track or road construction and restoration activities during the reporting period.

1.6 Operations Proposed For Ensuing Year

Planned construction activity for 2002 is matched against the 2002 Drilling Schedule. The number of wells scheduled for drilling and thus requiring lease and campsite construction is 44.

Other activities planned for 2002 include:

- Maintenance of approximately 1250km of roads of Class A (major), B or C (minor);
- Construction of around 70km of new lease access roads;
- Restoration of around 15km of existing lease access roads;
- Upgrade of around 30km of roads in preparation for lease construction and drilling activities;
- Construction of approx 3km of planned new major roads;
- Backfill/partial restorations to 30 well leases and restoration of 20 borrow pits;
- Complete restorations to 2 well leases; and
- Construction of 30 new borrow pits.
- Development of a generic proforma for the recording of assessments of all new developments and activities in the *Operational Area* against the EPBC Act (1999).

Section 2: Drilling Operations

2.1 Summary of Activities

The following is a summary of the activities associated with drilling operations that occurred during the reporting period:

- 82 wells drilled in the *Operational Area* (refer to Appendix 6);
- 76 wells cased and suspended (C&S);
- 3 wells plugged and suspended (P&S);and
- 3 wells plugged and abandoned (P&A).

2.2 Compliance Report

Every effort was made in the reporting period to ensure activities associated with drilling were in accordance with requirements of the *Petroleum Act 2000*, the *Petroleum Regulations 2000*, licenses, and objectives under the *Statement of Environmental Objectives for Drilling and Well Operations in the Cooper / Eromanga Basin – South Australia* (PIRSA 2000) and the *Draft Statement of Environmental Objectives: Production and Processing – SA Cooper Basin Joint Venture* (Santos Ltd 2001 DRAFT).

Non-compliances were incurred during the reporting period for several late submissions of *Detailed Activity Information Reports* (Reg 20). Non compliances were also incurred for late submission of *Notices of Intention/Entry to Land* (Clause 60 of the Act and Reg 20). Both non-compliances were a result of unexpected changes to drilling programs which reduced the available notification window below the minimum specified under the Act and Regulations. A review of reporting procedures and the development of new systems and procedures to allow detailed tracking of timing and submission of data is planned to ensure further similar non-compliances do not occur.

Non-compliances related to *Naming Conventions* (Reg 23) occurred during the reporting period. These related to inconsistencies on the SBT log header. Discussions with PIRSA subsequently have identified appropriate naming conventions for SA wells. All relevant Santos personnel and contractors will be instructed to adopt this approach to eliminate further non-compliances.

Compliance was achieved for the reporting period for the submission of *Daily Drilling Reports* as required under Reg 38. Submissions of reports for activities conducted during weekends and public holidays are made on the first working day following these periods. Formal acceptance of this arrangement has not, however been determined.

No non-compliances were identified for submission of *Wireline Logs* (Reg 39) arising from drilling activities. Systems and procedures have, however, been reviewed to ensure monitoring and tracking of Log submissions continues to be effective.

Non-compliances were encountered during the reporting period with respect to submission of *Well Samples* (drill cores and cuttings) as required under Reg 48. Whilst samples were submitted to the PIRSA Core Library within the allocated timeframe, non compliances were incurred due to samples not being submitted of

adequate weight or in containers suitable for long-term storage. Measures will be put in place to ensure future submissions are in accordance with weight and packaging requirements.

Non-compliances were incurred during the reporting period in relation to Reg 49 – *Report on Analysis of Core Cuttings*. Issues related to provision of a report on analysis on core samples within 6 months of cores being removed from the PIRSA Core Library. These non-conformances were due to a breakdown of core- borrowing and analysis reporting procedures. Improvements to these procedures will eliminate future breaches of this requirement.

No non-compliances with respect to Reg 32 - *Incident Reporting* were identified for drilling activities undertaken in the reporting period. Serious incidents (Reg 32(2)) were reported in accordance with the requirements of this regulation. Recordable Incidents were reported to PIRSA at quarterly compliance meetings.

No non-compliances occurred during the reporting period in relation to Reg 31: *Emergency Response Procedures*. Under this Regulation there is a requirement to submit a report of any practice drills conducted within 2 months of conducting the drill. A report on planned emergency response drills scheduled for late 2001/early 2002 will be submitted in 2002.

Quarterly Meeting to Discuss Compliance Issues

Quarterly compliance meetings were held with PIRSA to discuss a range of issues associated with the environmental management of Santos' activities in the *Operational Area*. Actions arising from these meetings are presented in Appendix 4 of this report. No major issues relating to drilling activities were raised during these meetings.

2.3 Management System Audits

An audit of drilling safety management systems was undertaken during the reporting period. The audit was conducted against four Santos General Standards that were considered most relevant to the Drilling Department operations.

The audit demonstrated that the Drilling Department had a system in place which complied with the selected General Standards. In general the team found a high level of conformance to the Standards and accompanying procedures. In many instances excellent systems had been developed to improve work processes. The overall result of this audit was 84%.

2.4 Risk Assessment and Other Audits

All drilling operations undertaken by Santos in the *Operational Area* are undertaken in accordance with:

- *Code of Environmental Practice – Drilling and Workover Operations.*
- *Statement of Environmental Objectives for Drilling and Well Operations in the Cooper / Eromanga Basin – South Australia.*

Reference is also made to the *Santos Drilling Management System, Drilling Operations Manual (DOM) Version-1* (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 consideration human safety, environmental and third party concerns.

Casing design and setting are carried out in accordance with Company procedures and guidelines which address downhole risks in relation to aquifer protection, and meet worst case expected downhole loads and environmental conditions for wells.

In addition to regular visual inspections of all drilling activities performed at well sites in the *Operational Area*, a formal audit of these activities (including workover activities) was undertaken during the reporting period.

The audit revealed that, overall the standard of housekeeping for drilling and workover activities was high (Santos Ltd 2001). Several issues were identified for improvement including:

- *Fuel, Oil and Chemical Storage* – not all drilling and workover rigs had oil vessels adequately located within a suitably bunded or contained area. Whilst the efforts made by most rigs to reduce the potential for oil spills was noticeable and encouraging, there still remained room for improvement. Additional modifications to oil management practices and equipment have been recommended.
- *General Lease Area* – a few cases of off-lease parking of vehicles and storage of equipment were identified, resulting in minor off-lease disturbance. This practice is actively discouraged.
- *Drilling Mud Sumps* – at the time of the audit, some drilling and workover rigs were experiencing insufficient volume capacity in the mud sumps. Recommendations to rig contractors were made regarding the improved re-use of sump water, and the need to notify relevant Santos personnel well in advance of capacity concerns.
- *Sewage and Grey Water Facilities* – some minor concerns were identified with sewage and grey water pits being placed too close to trafficable areas. As a result odour problems were being experienced by rig personnel. Rig contractors were reminded of the minimum buffer distance (as indicated on the Standard Well Lease Plan and Camp Plan) between the camp/lease facilities and pits for sewage and grey water.

All recommendations arising from this audit were entered onto Santos' Audit and Inspection Manager (AIM) system for tracking and assignment of remedial actions.

2.5 Reportable Incidents

There was a single reportable incident for drilling operations during the reporting period. This incident related to the bursting of a hydraulic hose between a hydraulic pump unit and a powertong while running surface casing at Dullingari #54.

Remedial action to remove any hydrocarbon contaminated soil was instigated immediately and as such, no ongoing monitoring was deemed necessary. Consequently no TPH analysis reports have been prepared for this incident.

Recommendations arising from this incident included a more thorough inspection of hose and fittings, and a directive that hoses be stored in a suitable container to prevent deterioration due to UV light. Details of this incident are provided in Appendix 3.

2.6 Operations Proposed For Ensuing Year

Planned drilling activity for 2002 is matched against the 2002 Drilling Schedule. The number of wells listed under this schedule is 44.

These planned wells are located primarily in the following fields:

- Dullinagari
 - Moomba
 - Tirrawarra
 - Limestone Creek
-

Section 3: Well Completion, Workover, Production and Suspension

3.1 Summary of Activity

At the end of the reporting period there were 683 producing and suspended (P&S) wells operated by Santos within the SA Cooper Basin. The following is a summary of activities relating to these wells:

- 90% of all wells underwent casing annuli pressure testing;
- 84% of producing wells (87% with Cased and Suspended {C&S} wells included) were subjected to casing integrity and corrosion monitoring;
- Additional maintenance or repairs were undertaken on 3 wells;
- Boongala #1 was the only gas well plugged and suspended during the reporting period. It was suspended with cement plugs pending further investigation (further details are provided in Appendix 8); and
- 1 *Serious Incident* related to surface casing pressure increase at Della #20 (refer Appendix 3 for further details).

Workover, fracture stimulation and connection operations were undertaken on 57 wells during this reporting period. Reference should be made to Appendix 8 of this report for detailed information. Of these 57 wells 28 were fracture stimulated. Workover activities included tubing repair, fracture completion/re-completion, siphon string installation, ESP installation, plug and suspends and well deepening operations.

3.2 Compliance Report

During the reporting period every effort was made to ensure well completion, workover, production and suspension activities were conducted in accordance with the requirements of the *Petroleum Act 2000*, the *Petroleum Regulations 2000*, licenses, and objectives under the *Statement of Environmental Objectives for Drilling and Well Operations in the Cooper / Eromanga Basin – South Australia* (PIRSA 2000) and the *Draft Statement of Environmental Objectives: Production and Processing – SA Cooper Basin Joint Venture* (Santos Ltd 2001 DRAFT).

Non-compliances with Reg 41 – *Quarterly Cased Hole Well Activity Report* were encountered during the reporting period, with some activities conducted within well bore casings inadvertently omitted from the reports submitted to PIRSA. To avoid future omissions, procedures were implemented to ensure work (including well integrity risk assessment and casing annuli pressure testing data) would be captured on a weekly basis for inclusion into this quarterly report. Monthly cross-checks will also mitigate the potential for any further omissions.

Several non-compliances were encountered with the provision of *Well Test Analysis Reports* as required under Reg 42. A number of raw data and interpreted data are overdue for submission to PIRSA. As soon as interpretations are completed and all outstanding data are identified and compiled they will be presented to PIRSA. A review of the recording and provision of this information to PIRSA is planned to eliminate the potential for further non-compliances.

Several non-compliances were encountered related to Reg 40 - *Well Completion Reports*. Santos was notified by PIRSA during the reporting period of problems related to: the quality of scanning of digital reports; incomplete reports; and

outstanding reports. Whilst approval was obtained from PIRSA for late submission of several *Well Completion Reports*, measures will be implemented to ensure the need to request further similar extensions are eliminated. The inclusion of *Digital Deviation Surveys* (Reg 28) with *Well Completion Reports* will ensure data for high angle deviated wells are provided to PIRSA as per reporting requirements.

Under Reg 43, *Petroleum Reservoir Fluid Analysis Reports* are required to be submitted to PIRSA within 6 months of sampling. For the reporting period several reports were overdue submission constituting non-compliances. All overdue reports will be identified for submission early in 2002. Planned improvements to systems and procedures for information tracking and recording is planned to eliminate future non-compliances with this Regulation.

As required under Reg 44, *Downhole Diagrams* were regularly submitted to PIRSA during the reporting period. Minor omissions however resulted in some non-compliances being incurred. To prevent future occurrences, improved internal followup together with internal weekly collation of information for *Quarterly Cased Hole* reports will facilitate a more timely and complete presentation of *Downhole Diagrams* to PIRSA.

Where multiple activities are due to be carried out on a well over a period of time, multiple redrafting (and notifications) of the *Downhole Diagrams* is considered inefficient. Modifications are being considered to incorporate existing database information as an attachment to the *Downhole Diagrams* (for example, perforation details) in order to minimise duplication of data and associated transcription errors.

Receipt of *Wireline Logs* from the field and subsequent production of DAT information by Santos contractors on occasion caused delay in the presentation of *Wireline Log* data to PIRSA as required under Reg 39. To prevent future non-compliances with this Regulation, a stricter follow-up procedure will be implemented to alleviate delays in provision of DAT data. Further checks for compliance will be prompted by the weekly collation of the *Cased Hole Report*.

No evidence was identified of non-compliance for provision of *Incident Reports* under Reg 32 or Clause 85 of the Act. The Della #20 Crossflow Incident – classified as a *Serious Incident* as defined in the Drilling and Workover SEO, was reported to PIRSA in accordance with Regulation 32. A formal report has yet to be provided as discussions between PIRSA and Santos on this incident continued up until the time this Annual Report was compiled.

Recordable Incidents were reported to PIRSA at quarterly compliance meetings in compliance with legislative requirements.

Quarterly Meeting to Discuss Compliance Issues

Quarterly compliance meetings were held with PIRSA to discuss a range of issues associated with the environmental management of Santos' activities in the *Operational Area*. Minutes of these meetings are presented in Appendix 4 to this report. Issues raised for discussion at these meetings relating to well completion, workover, production and suspension wells were:

- provision of well integrity risk assessment data, casing annuli pressure testing data and *Quarterly Cased Hole Well Activity Reports* to PIRSA.

- discussions regarding an incident at Della #20. Santos advised PIRSA of a surface casing pressure increase at this well. Preliminary investigations identified the pressure source to be the result of water from the Namur formation entering behind the casing. This incident was treated as a *Serious Incident* and as such was immediately reported to PIRSA. This incident, in part, prompted commencement of a review of the Drilling and Well Operations SEO. A comprehensive investigation of cementing practices, geological considerations and risk of crossflow will form part of this review.

3.3 Management System Audits

There were no audits of management systems that specifically related to well completion, well workover, or production or suspension activities undertaken during the reporting period.

These activities are covered in part, by the drilling safety management system which underwent an audit against several Santos General Standards in the reporting period. Details of this audit are presented in *Section 2.3*.

3.4 Risk Assessment and Other Audits

Assessment of the results of casing annuli pressure testing and casing integrity monitoring is conducted on the basis of *AS 4360–Risk Management* (Standards Australia, Standards New Zealand, 1999). This risk assessment takes into account impact on:

- personnel (proximity);
- third parties (proximity and impact);
- environment (location);
- loss of asset (mechanical integrity); and
- loss of revenue (rate).

By evaluating the frequency and potential severity of an occurrence, an overall risk rating of the integrity of the well is determined. Wells may be risk-ranked as High, Intermediate, Low, or Negligible.

Monitoring of Casing Annuli Pressures

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

The extent of monitoring undertaken during the reporting period for the purposes of assessing crossflow or fluid migration behind the casing did not achieve internal objectives. Of 683 wells, 615 were casing annuli pressure tested. The remainder were not tested owing to extended delays beyond Santos' control during a change in the contractor providing the service. Additionally a number of new wells, whilst tested successfully, had not been recorded in the database at the time of reporting. Implementation of a prioritised program to test all outstanding wells, and changes to data recording procedures to ensure complete capture of all well test data into the database is planned to address these issues.

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. 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 monitoring undertaken during the reporting period are summarised in Table 4 below.

Table 4: Summary of testing for wells with pressure on production casing string (615 wells)

Pressure on Production Casing	Wells tested	Proportion
Can be blown down	517	84 %
Plunger lift	31	5 %
Cannot be blown down	67	11 %
Total	615	

Of the 67 wells in which the Production Casing pressure was unable to be bled off, 8 were considered to be of “High” priority and are monitored accordingly.

Casing Integrity and Corrosion Monitoring Programs

The current Well Maintenance Program results indicate that more than 90% of wells tested have met the criteria for monitoring casing integrity. As indicated in Table 5 below, a number of wells were not tested.

Table 5: Summary of wells not monitored for casing integrity and corrosion in last 18 months (of 683 wells)

Priority	# of wells	Proportion
No pressure survey conducted	108	16 %
less C&S wells	21	
Total not monitored	87	13 %

Generally, where scheduled testing of producing wells was not completed it was a result of access constraints caused by flooding and rainfall events. As mentioned previously, a change in the contractor part way through the reporting period also resulted in several wells not being serviced. Protracted delays beyond Santos’ control in the arrival of new contractor equipment was also a primary cause of missed well tests.

A prioritised program has since been instigated to ensure that these wells are tested as soon as practicable.

The results of casing integrity and corrosion monitoring undertaken during the reporting period are summarised in Table 6 below. Of the 683 total wells in the *Operational Area*, 19 wells were drilled in the last 6 months of the reporting period and did not have a risk score calculated or allocated at the time of reporting.

Seven wells were identified as requiring further testing prior to being assigned a risk score.

Table 6: Summary of casing integrity risk scores for all C&S and producing wells (of 664 wells)

Risk Score (max = 3.0)	Priority	# of wells	Proportion
2.0 – 3.0	High	16	2.4 %
1.2 – 1.9	Intermediate	113	17.0 %
0.6 – 1.1	Low	205	30.9 %
0.0 – 0.5	Negligible	330	49.7 %
	Total	664	100%

Crossflow Monitoring

In the reporting period, 45 wells were tested for crossflow by Memory Production Logs. Results of these tests were presented to PIRSA by Santos Drilling and Completions periodically through the reporting period and subsequently are not repeated in this report. Selection of these wells was based on continual monitoring of:

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

Water shut-off operations were conducted where appropriate.

Maintenance and Repair

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

- Mettika #2 – parted tubing repaired;
- Moomba #40 – tubing repaired; and
- Fly Lake #6 – re-completed (formerly dual well with parted tubing in the short string).

In the reporting period a formal audit of all drilling and workover activities was performed. *Section 2.4* provides details of the outcomes of this audit.

A comprehensive audit was also undertaken in the reporting period of all cased and suspended (C&S), and plugged and abandoned (P&A) wells. In total 167 wells were audited against the objectives and procedures for well lease construction, drilling and workover operations and restoration activities.

Generally the standard of environmental management of C&S and P&A well sites was identified as acceptable or better, however, a number of follow up actions were identified. A high incidence of redundant equipment was found at cased and suspended well leases. There were also a number of sites identified where hydrocarbon contamination of the soil required attention. Numerous disused blowdown pits, interceptor pits and evaporation ponds also required rehabilitation.

To sufficiently address the recommendations arising from this and other environmental audits of Santos' facilities in the *Operational Area*, a project was initiated during the reporting period requiring all audit findings and their recommendations to be entered into a database. This database (under development at the time of reporting) will facilitate the comprehensive review of audit findings and actions and enable a risk-based action plan to be developed and costed for effective implementation.

3.5 Reportable Incidents

There were 43 reportable incidents at suspended and/or producing wells throughout the reporting period. All reportable incidents are presented in Appendix 3.

While many incidents and their respective recommendations can be suitably addressed through changes to work practices and general housekeeping, others require considerable forward planning and financial commitment. To appropriately address the incidents that belong to this latter category, a comprehensive review was underway at the time of reporting to identify common causes of incidents occurring at primary facilities (pipelines, flowlines and trunklines, well heads, evaporation ponds, and satellites etc). Identification of key factors will assist in prioritising any activities, particularly in terms of risk and environmental consequence such that remedial measures may be adequately identified, prioritised, costed and implemented.

3.6 Operations Proposed For Ensuing Year

Well completion and workover activities proposed for 2002 included:

- Drilling, connection, workover and associated activities at 20 oil wells under the 2002 Block Oil Budget Development Plan (refer Table 7)
- Drilling, connection, workover and associated activities at 59 gsa wells under the 2002 Gas Budget Development Plan (refer Table 8)

Table 7: Proposed Development Program 2002 – Block Oil Budget

Project	Comments	Scope*	On Line
Moomba A	Drill Hutton and ESP	DCFA	Jun-02
Big Lake A	Drill Namur and Jet Pump	DCFA	Jul-02
Gidgealpa A	Drill Birkhead & BP	DCFA	Apr-02
JALBU A	Drill Murta & BP	DCFA	Aug-02
JALBU B	Drill Murta & BP	DCFA	Aug-02
JALBU C	Drill Murta & BP	DCFA	Sep-02
JALBU D	Drill Murta & BP	DCFA	Sep-02
Jena 13	Convert from BP to ESP	ESP	Mar-02
Tantanna 10	Water shut-off and Reperf	WSO	Apr-02
Taloola 1	Water shut-off and Jet Pump	WSO/JP	Apr-02
Taloola 4	Water shut-off	WSO	Apr-02
Merrimelia 24	Recompl. to reaccess Namur	WSO/JP	Apr-02
Merrimelia 33	Water shut-off and Jet Pump	WSO/JP	May-02
Jena 11	Mu Frac + recompletion	X	Jul-02
Biala 1	Water shut-off and Jet Pump	WSO/JP	Aug-02
Biala 7	Mu Frac + recompletion	X	Aug-02
Gidgealpa 45	Jet Pump upgrade	JP	Sep-02
Moomba Facil.	ESP Fuel System Upgrade	Fuel System	Various
Moomba Facil.	ESP Telemetry Upgrade	Telemetry	Various
Misc. Facilities	3 flowline/facilities Upgrades	Debottleneck	Various

*

D	Drill	WSO	Water Shut Off
C	Connection	X	Fracture Stimulation
F	Flowline	JP	Jet Pump
A	Artificial Lift	R	Recompletion

Table 8: Proposed Development Program 2002 – Gas Budget

Project	Comments:	Scope*	On Line
Moomba Nth 150	2001 carry over	DCXF	Jan-02
Beckler 4	2001 carry over	DCXF	Jan-02
Moolion 1		CXF	Jan-02
Moolion 2		CXF	Jan-02
Moolion Nth 1		CXF	Jan-02
Moomba Nth 156	2001 carry over	DCXF	Apr-02
Fly Lake Sth 10	2001 carry over	DCXF	Apr-02
Fly Lake Sth 11	2001 carry over	DCXF	Apr-02
Moomba Nth 157		DCXF	May-02
Moomba Nth 155		DCXF	May-02
Dullingari Nth 14		DCXF	May-02
Bindah 2		DCXF	May-02
Additional development	MAYDEV (1)	CXF	May-02
Additional development	MAYDEV (2)	CXF	May-02
Additional development	MAYDEV (3)	CXF	May-02
Additional development	MAYDEV (1)	CF	May-02
Additional development	MAYDEV (2)	CF	May-02
Dullingari Nth 15		DCXF	Jun-02
Dullingari Nth 16		DCXF	Jun-02
Moomba Nth 151		DCXF	Jun-02
Moomba Nth 152		DCXF	Jun-02
Additional development	JUNDEV (1)	CXF	Jun-02
Additional development	JUNDEV (2)	CXF	Jun-02
Additional development	JUNDEV (3)	CXF	Jun-02
Additional development	JUNDEV (1)	CF	Jun-02
Additional development	JUNDEV (2)	CF	Jun-02
Big Lake 02-1		DCXF	Jul-02
Moomba Nth 158		DCXF	Jul-02
Dullingari Nth 17		DCXF	Jul-02
Dullingari 55		DCXF	Jul-02
Coopers Creek 3		DCXF	Jul-02
Additional development	JUL DEV (1)	CXF	Jul-02
Additional development	JUL DEV (2)	CXF	Jul-02
Additional development	JUL DEV (3)	CXF	Jul-02
Additional development	JULDEV (2)	CF	Jul-02
Additional development	JULDEV (1)	CF	Jul-02
Moomba Nth 159		DCXF	Aug-02
Moomba S 02-1		DCXF	Aug-02
Big Lake 02-2		DCXF	Aug-02
Big Lake 02-5		DCXF	Aug-02
Cabernet 5		DCXF	Aug-02
Cabernet 6		DCXF	Aug-02
Additional development	AUGDEV (1)	CXF	Aug-02
Additional development	AUGDEV (2)	CXF	Aug-02
Additional development	AUGDEV	CF	Aug-02
Moomba S 02-2		DCXF	Sep-02
Moomba S 02-3		DCXF	Sep-02
Swan Lake 6		DCXF	Sep-02
Swan Lake 7		DCXF	Sep-02
Additional development	SEPDEV	CXF	Sep-02
Additional development	SEPDEV	CF	Sep-02
Moomba S 02-4		DCXF	Oct-02
Big Lake 02-6		DCXF	Oct-02
Additional development	OCTDEV	CXF	Oct-02
Additional development	OCTDEV	CF	Oct-02
Moomba Nth 160		DCXF	Nov-02
Moomba Nth 161		DCXF	Nov-02
Verona 3		DCXF	Nov-02
Additional development	NOVDEV	CXF	Nov-02

*

D	Drill	WSO	Water Shut Off
C	Connection	X	Fracture Stimulation
F	Flowline	JP	Jet Pump
A	Artificial Lift	R	Recompletion

Section 4: Downhole Well Abandonment

4.1 Summary of Activities

Three wells were plugged and abandoned during the reporting period. These were Cuttapiirrie #7, Epsilon #10, and Moomba #137.

None were abandoned as a consequence of depletion.

4.2 Compliance Report

During the reporting period every effort was made to ensure well abandonment activities were conducted in accordance with the requirements of the *Petroleum Act 2000*, the *Petroleum Regulations 2000*, licenses, and objectives under the *Statement of Environmental Objectives for Drilling and Well Operations in the Cooper / Eromanga Basin – South Australia* (PIRSA 2000) and the *Draft Statement of Environmental Objectives: Production and Processing – SA Cooper Basin Joint Venture* (Santos Ltd 2001 DRAFT);SEO's.

No incidents of non-compliance with the above requirements were identified for the reporting period related to downhole well abandonment activities.

Quarterly Meeting to Discuss Compliance Issues

Quarterly compliance meetings were held with PIRSA to discuss a range of issues associated with Santos' activities in the *Operational Area*. Actions arising from these meetings are presented in Appendix 4 to this report.

The *SABU Petroleum Engineering Well Abandonment Procedures* (Santos Ltd 2000 DRAFT) were developed and submitted to PIRSA as a result of these meetings. Petroleum Engineering has since received comments from PIRSA and, at the time of reporting, were in the process of incorporating these changes into the final document.

4.3 Management System Audit

There were no audits of management systems related to well abandonment operations undertaken during the reporting period.

Activities associated with well abandonment are generally covered under the management systems in place for drilling and other well site activities. *Sections 1.3 and 2.3* present details of audits completed during the reporting period of the Safety Management Systems for these activities.

4.4 Risk Assessment and Other Audits

All well abandonment activities are carried out in accordance with the following procedures:

- *Santos Drilling Management System, Drilling Operations Manual (DOM) Version-1*;
- *NSCA Risk Score Calculator*;
- *SABU Petroleum Engineering Well Abandonment Procedures* (Santos Ltd 2000 DRAFT); and
- *Statement of Environmental Objectives for Drilling and Well Operations in the Cooper / Eromanga Basin – South Australia*.

A comprehensive audit was undertaken during the reporting period of existing plugged and abandoned and cased and suspended wells located in Santos' *Operational Area*. The total number of wells inspected during this audit was 167. *Section 3.4* presents further details of this audit.

Whilst visual inspections were undertaken of all well abandonment activities conducted in the *Operational Area*, no formal audits of these activities was conducted in the reporting period.

4.5 Reportable Incidents

There were 43 reportable incidents at suspended and/or producing wells during the reporting period. All incidents reported to PIRSA during the reporting period are presented in Appendix 3.

As previously detailed in *Section 3.5* a comprehensive review of all incidents was underway at the time of reporting to ensure remedial measures are appropriately identified, prioritised, costed and implemented.

4.6 Operations Proposed For Ensuing Year

At the time of reporting no downhole well abandonments were scheduled for 2001.

PART 3:
FLOWLINE, PIPELINE &
TRUNKLINE ACTIVITIES

FOR REPORTING PERIOD:
1ST JULY 2000 – 31ST DECEMBER 2001

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Section 1: Oil and Gas Pipeline, Trunkline and Flowline Construction

1.1 Summary of Activities

The following is a summary of activities undertaken in the reporting period that were associated with oil and gas pipeline, trunkline and flowline construction.

- 101 gas flowline installations completed, resulting in the installation of 184.76 km of pipe;
- 116 lease pipework connections at gas wells;
- 8 oil flowlines constructed with a combined length of 24.56 km; and
- 6.5 km of “mothballed” oil trunkline converted into a gas pipeline following a detailed risk assessment.

Details of all gas and oil flowline, trunkline and pipeline activity undertaken during the reporting period are provided in Appendix 9.

1.2 Compliance Report

Activities associated with pipeline, trunkline and flowline construction in the *Operational Area* are required to comply with the requirements detailed under the *Petroleum Act 2000*, the *Petroleum Regulations 2000*, licenses, and objectives under the *Draft Statement of Environmental Objectives: Production and Processing Operations* (Santos 2001).

Compliance with the objectives of the SEO was for the most part achieved during the reporting period. A single non-compliance in relation to the environmental objective of avoiding or minimising soil erosion, as defined in the SEO, was identified at the Pondrinie North #1 flowline in September 2000 (refer Appendix 13). This minor subsidence of the pipeline trench resulted in the formation of a larger erosion gully. Actions were taken in the reporting period to fill this gully and install diversion drains to eliminate water running along the trenchline.

Non-compliances with the *Petroleum Regulations 2000* were incurred for late submissions of *Detailed Activity Information Reports* (Reg 20) related to planned flowline construction. Non-compliances were also incurred for late provision to landholders of *Notices of Entry* (Reg 22, and Clause 60 of the *Petroleum Act 2000*) in the reporting period. These non-compliances were primarily due to a failure of recording and notification systems. A review of flowline construction activity and landholder notification procedures and the development of new reporting forms is planned to ensure further non-compliances do not occur.

Quarterly Meeting to Discuss Compliance Issues

Quarterly compliance meetings were held with PIRSA to discuss a range of issues associated with the environmental management of Santos' activities in the *Operational Area*. Actions arising from these meetings are presented in Appendix 4.

No issues were raised at these meetings associated with pipeline, trunkline, or flowline construction activities.

1.3 Management System Audits

An audit of the Oil Pipeline Management System was conducted in July 2000. This audit was conducted to monitor the conformance of activities to Santos *Procedure 3.4.1 – Oil Pipeline Management*.

This audit identified that the Corrosion and Production Departments, and all audited personnel within the Petroleum Engineering – Block Oil Group, were fully aware of this procedure and its requirements. Whilst no non-conformances were observed, a minor issue was noted relating to the availability of the Design and Condition Database for field personnel. The action raised for this issue was entered onto the Santos Audit and Inspection Management (AIM) system for assignment and tracking, and at the time of reporting was not yet complete.

1.4 Risk Assessment and Other Audits

It is a requisite that the planning, designing, scouting and construction of all oil and gas pipelines be in accordance with the requirements of the relevant standards, codes of practice, environmental procedures, and legislative requirements, including:

- AS 2885-1997: *Pipelines – Gas and Liquid Petroleum – Design and Construction* (refer Appendix 10);
- *Environmental Procedures for the Construction, Operation and Abandonment of Pipelines in the Cooper Basin* (Santos Ltd 2000a);
- *Code of Environmental Practice – Production and Processing Operations*;
- *Draft Statement of Environmental Objectives: Production and Processing – SA Cooper Basin Joint Venture*;
- *Field Guide to the Common Plants of the Cooper Basin*; and
- *Environmental Procedures for the Management of Aboriginal Heritage Sites*.

Risk assessments of proposed pipelines are undertaken to determine the possible threats of external interference such as road crossings, fence crossings, creek / wash away crossings, dune crossings, third party or Santos infrastructure and facilities, ground movement, flooding and environmental sensitivity.

The methodology for undertaking these risk assessments is described in the Santos' Internal Work Practice WP 1500 –10 - W001 *Pro-forma Risk Assessment for SA Cooper Basin Gas Flowlines* (Santos Ltd undated-d). This work practice, which was specifically prepared for gas pipelines, is also applied to all oil pipelines within the *Operational Area*.

Further design and construction details specific to the construction of gas and oil pipelines are detailed below.

Gas Pipeline Construction

A comprehensive list of all Santos Operations Support Guides and Specifications, including those relevant to gas pipeline construction are provided in Appendix 11.

All buried sections of gas pipelines are constructed with API 5LX line pipe. A53 grade B seamless pipe is used for any above ground sections.

All gas well connections are carried out according to Santos Guide 1500-10-G005 and the following standards:

- ANSI B31.3 *Chemical Plant and Refinery Piping*
- ANSI B16.5 *Pipe Flanges and Flanged Fittings*
- AS 1271-1997 *Safety Valves, Other Valves, Liquid Level Gauges and other fittings for Boilers and Unfired Pressure Vessels.*

Oil Pipeline Construction

A list of all Santos Operations Support guides and specifications, including those relevant to oil pipeline design and construction are provided in Appendix 11.

Significant Site Identification

Where preliminary identification of a site of possible Aboriginal heritage significance is made during pipeline right-of-way scouting activities, the site is flagged off and the site location and description are documented and reported in accordance with the *Aboriginal Heritage Act, 1988*.

During the reporting period a total of 5 sites of potential Aboriginal heritage significance were identified while scouting proposed flowline and pipeline routes.

- One site was associated with the proposed Dullingari North #12 pipeline.
- Four sites were associated with the proposed Nappacoongie East #1 flowline.

Although not required for these sites, a consultant Archaeologist may be commissioned to undertake an inspection of identified sites for provision of appropriate management recommendations, particularly in areas where the density or probability of site occurrence is high

Other Audits

An audit of a random and representative sample of recently constructed flowlines is undertaken annually in accordance with Santos' audit schedule. The environmental *Audit of Recently Constructed Flowlines in South Australia* (SEA Pty Ltd 2000) was conducted between the 8th and 10th November 2000 with 27 flowlines inspected.

This audit assessed the level of conformance with the environmental standards specified in the SEO, *Code of Environmental Practice – Production and Processing Operations*, and the *Environmental Procedures for the Construction, Operation and Abandonment of Pipelines in the Cooper Basin*.

An audit checklist was developed to measure the level of conformance with previously agreed environmental standards for flowline installation and right-of-way restoration. This checklist is provided in Appendix 12.

For 17 of the 27 flowlines audited during the reporting period, all environmental objectives of the SEO were identified as being met. These included minimal right of way width, minimising terrain disturbance, avoidance of significant vegetation disturbance, and good dune re-profiling. Minor shortfalls were identified for 9 of the flowlines. These issues included rubbish being left on the right-of-way, missing pipeline markers, and excess width of the right-of-way.

A single significant shortfall from an expected environmental goal was identified. This related to subsidence of the pipeline trench on the Pondrinie North #1 line and

formation of an erosion gully. This constituted a non-conformance under the Production and Processing SEO (Draft) to 'avoid or minimise soil erosion', and a non-conformance with Santos codes of practice and environmental procedures.

Following this audit, any corrective actions and recommendations were entered into AIM for the assignment and tracking of remedial actions. A summary of the issues raised by the audit of flowlines and any corrective actions recommended are presented in Appendix 13.

1.5 Reportable Incidents

There were no major or reportable incidents resulting from gas or oil pipeline construction activities and consequently no total petroleum hydrocarbon (TPH) analysis have been undertaken or included in this section of the report.

1.6 Operations Proposed for Ensuing Year

Flowline construction activities for 2002 are envisaged to provide connections for approximately 50 wells. The expected length of flowlines to be constructed will be approximately 40km.

At the time of reporting no plans were finalised for the construction of new pipelines or trunklines.

Section 2: Pipeline, Trunkline and Flowline Operation

2.1 Summary of Activities

The following summarises the activities for the reporting period associated with the operation of pipelines, trunklines and flowlines in the *Operational Area*:

- Gas pipeline management activities included cathodic protection surveys, corrosion inhibitor pump monitoring, visual inspections, and pigging;
- Oil pipeline management activities included visual inspections, maintenance inspections and assessments (cathodic protection and ultrasonic thickness surveys), pigging, hydrotesting, pipe support installation, and other general repairs;
- No gas pipelines mothballed or abandoned;
- 1 field manifold, 1 production line, 1 trunkline, and 1 test line abandoned:
 - Jena #4 field manifold.
 - Jena #4 field manifold to the Jena #2 field manifold production line.
 - Jena #4 field manifold to the Jena #2 field manifold test line.
 - Trunkline line from Fly Lake Oil facility to Moomba abandoned;
- 5 oil flowlines decommissioned and mothballed:
 - Moomba #99 flowline to Moomba Oil Satellite decommissioned.
 - Jena #6, Jena #9, Jena #10, and Jena #12 flowlines (all previously producing to Jena #4 field manifold) mothballed;
- 2 *Serious Incidents*: Keleary – Merimelia oil pipeline leak and the Jena #11 oil flowline leak;
- 13 repairs made to oil flowlines, pipelines and trunklines. Works consisted of 1 isolation valve replacement, 7 pipework replacements, 2 manifold replacements, and 3 pipe clamp installations (refer Appendix 14);
- 6 repairs made to gas flowlines, pipelines and trunklines. Works included repairs of internal pipe corrosion, external pipe corrosion, and internal erosion of choke valves (refer Appendix 14);
- Volumes of product transported through licensed pipelines between 1 July 2000 to 31 December 2001 were:

Moomba to Port Bonython Pipeline (Pipeline License 2)			Stokes to Mettika/Toolachee Pipeline (Pipeline License 9)	
Total	Crude and Naphtha	LPG	Condensate	Raw Gas
(MI)	(MI)	(MI)	(MI)	(E ⁶ SCM)
2750.568	1578.141	1172.428	87.184	925.746

MI = Megalitres

E⁶SCM = million standard cubic metres

2.2 Compliance Report

Annual Reports are required to be submitted under Regulation 33 of the *Petroleum Regulations 2000* for the:

- Moomba to Port Bonython Liquids Pipeline (PL2);
- Ballera to Moomba Gas Pipeline (PL5); and
- Stokes to Mettika Gas Pipeline (PL9).

These reports should be referred to for details of compliance.

Overall the objectives of the *Draft Statement of Environmental Objectives: Production and Processing – SA Cooper Basin Joint Venture* (Santos Ltd 2001 DRAFT), which covers pipeline activities, were achieved in that:

- Environmental damage from activities related to pipeline, trunkline and flowline operation was minimised;
- Consultative processes involving people directly and indirectly affected by regulated activities were adhered to; and
- The public was protected from risks associated with all regulated activities involving pipeline, trunkline and flowline operation.

Quarterly Meeting to Discuss Compliance Issues

Quarterly compliance meetings were held with PIRSA to discuss a range of issues associated with the environmental management of Santos' activities in the *Operational Area*. Minutes of these meetings are presented in Appendix 4 to this report.

The issues associated with pipelines raised at these quarterly meetings were:

- Completion of the study - *Assessment of Potential Impacts of a Crude or Condensate Spill – North West Branch Cooper Creek*.

Desktop review and fate and trajectory modelling (Stages 1 & 2) complete and reported (*Assessment of Potential Impacts of a Crude or Condensate Spill – North West Branch Cooper Creek*, Sinclair Knight Merz. 1999). Stage 3 – Ecotoxicological testing was delayed due to problems with laboratory test fauna stocks. Final results will be incorporated into the Production and Processing Environmental Impact Report.

- Pipeline Oil Spill Monitoring

Pipeline oil spill incidents were discussed along with a review of the oil spill monitoring results. Although exemption from monitoring in 2001 was permitted by PIRSA in anticipation of the completion of the Oil Spill Endpoint Criteria, Santos continued the collection, analysis and reporting of oil spill site data during the entire reporting period as part of its ongoing oil spill management program.

- Statement of Environmental Objectives (SEO)

PIRSA requested that the preparation of the Statement of Environmental Objectives (SEO) for Pipeline License 2 be commenced and the status of the SEO's for Pipeline Licenses 5 and 9 be advised. Santos submitted the

Statement of Environmental Objectives for Pipeline Licenses 2, 5 and 9 during the reporting period. These were subsequently gazetted.

2.3 Management System Audits

An audit of the Oil Pipeline Management System was conducted in July 2000. Details of this audit are presented in *Section 1.3*.

2.4 Risk Assessment and Other Audits

Gas Pipelines

The standard for management of Gas pipelines in Santos' *Operational Area* is AS 2885-1997: *Pipelines – Gas and liquid petroleum – Design and Construction*. Specifications for this Standard are presented in Appendix 10 to this report.

Coating defect repairs of gas pipelines were carried out during the reporting period with the primary focus on the Big Lake trunkline. Although the deterioration of coatings (prior to the use of Fusion Bonded Epoxy) potentially remains an issue, adjustments made to the Cathodic Protection Systems have been able to maintain the required protection levels.

Cathodic Protection (CP) surveys on all buried gas flowlines were carried out approximately every 12 to 16 weeks in the *Operational Area*. This frequency was considered suitable to monitor for CP faults in buried flowlines, despite being less than the 8 week frequency as detailed in AS 2885-1997: *Pipelines – Gas and liquid petroleum – Design and Construction*.

Corrosion inhibitor pumps at each wellhead were monitored and maintained at the same 12 to 16 week frequency.

Trunkline CP surveys were carried out annually on all buried gas pipelines and trunklines. Trunkline inhibitor pump surveys were carried out weekly on all major trunklines. Trunklines, flowlines and gathering line CP potential surveys were carried out annually during routine 100%-CP test point surveys.

Full visual inspections of the pipeline and right-of-ways were also performed at the time of undertaking the CP surveys.

Pigging and chemical batch inhibition treatments were undertaken annually on all major gas trunklines.

Oil Pipelines

Oil pipelines in Santos' *Operational Area* are managed according to *Santos Procedure 3.4.1 Oil Pipeline Management – System Procedure* (Santos Ltd 1999d). This procedure details specifications and guides applicable to the design and operation of oil pipelines (refer Table 9 below), and is based on the requirements of AS2885-1997: *Pipelines – Gas and liquid petroleum – Design and Construction*.

Table 9: Santos Guides and Specifications Applicable to Oil Pipeline Management

Guide / Spec #	Rev	Santos Guide/Spec Title
1515-10-D006		Oil flowline sizing and specification
1515-50-D001	0	Design Guide for Piping
1515-50-S001	0	Piping & Valves – Specification
1515-50-S004	0	High Pressure Steel Line Pipe
1515-50-D007	0	Pipeline Gathering Systems
1515-69-D001	0	Cathodic Protection System Design
1515-120-S020	0	Buried Field Pipeline Systems
1515-120-S027	0	Above Ground Pipeline Systems
S/002	0	Environmental aspects for design of oil pipelines and gathering systems

A number of other Santos Operations Support Guidelines and Specifications exist which are relevant to the operation of oil pipelines. These are presented in Appendix 11.

The following visual inspections were performed for oil pipelines as required by section 5.4.3.1 of *Santos Procedure 3.4.1 Oil Pipeline Management - System Procedure*.

Aerial (helicopter) Surveys

Table 10: Oil pipeline aerial survey frequency

Description	Management Plan Target / 12 Months	Surveys: 2000 (Jul-00 to Dec-00)	Surveys: 2001 (Jan-01 to Dec-01)
Jena to Alwyn/Jena/Ulandi	2	6	16
Alwyn/Jena/Ulandi to Limestone Creek	2	6	16
Limestone Creek to Strzelecki	2	6	16
Tantanna to Gidgealpa Oil	2	6	16
Spencer to Muteroo	2	6	16
Muteroo to Gidgealpa Oil	2	6	16
Gidgealpa Oil to Moomba	2	6	16
Keleary to Merrimelia	12	9	10
Tirrawarra Oil to Moomba	Not defined	4	8

*Road Patrols***Table 11: Oil pipeline road patrol frequency**

Pipeline Description	Management Plan Target / 12 Months	Surveys: 2000 (Jul-00 to Dec-00)	Surveys: 2001 (Jan-01 to Dec-01)
Jena to Alwyn/Jena/Ulandi	1	1	0
Alwyn/Jena/Ulandi to Limestone Creek	1	1	0
Limestone Creek to Strzelecki	1	1	0
Tantanna to Gidgealpa Oil	1	1	0
Spencer to Muteroo	1	1	0
Muteroo to Gidgealpa Oil	1	1	0
Gidgealpa Oil to Moomba	1	1	0
Keleary to Merrimelia	2	1	2

The frequency of road patrols conducted of oil pipelines was below the management target in 2001. This was primarily due to a reduction in the maintenance of pipeline right-of-way tracks in an effort to minimise impact by track grading. To offset this, the frequency of aerial surveys was significantly increased.

As required under Section 5.5.2 of *Santos Procedure 3.4.1 Oil Pipeline Management - System Procedure*, the following maintenance inspection and assessment surveys were performed on oil pipelines during the reporting period:

- Ultrasonic thickness surveys were performed in March and September 2001 on welded pipe sleeves used for leak repairs on the Keleary to Merrimelia pipeline. These surveys revealed no corrosion at these sleeves.
- CP checks were performed on 9 buried oil pipelines during the reporting period. Details are provided in Table 12 below.

Table 12: Pipelines undergoing annual cathodic protection checks

Pipeline Name / Location	Date of CP check
Gidgealpa to Moomba	6 Sept 2000; 14 Apr 2001
Wancoocha to Moomba (mothballed)	4 Sept 2000; 12 Apr 2001
Tirrawarra to Moomba	17 May 2001
Meranji to tie in Tirrawarra-Moomba line	14 Apr 2001
Dullingari to Moomba	20 May 2001
Strzelecki to Dullingari Tie-in	15 Apr 2001
Merrimelia to tie in Tirrawarra-Moomba line	No CP records identified
Limestone creek buried flowlines	No CP records identified
Keleary to Merrimelia buried sections	August 2001

- Field surveys of CP systems were performed on buried oil flowlines at Dullingari, Strzelecki, Merrimelia and Gidgealpa fields in August 2000, and in the last quarter of 2001. Potential problems with line coatings were indicated in the August 2000 surveys. On completion of the analysis of all 2001 CP survey data, a complete review will be undertaken to identify and prioritise any required corrective actions.

Batch Treatments (pigging) with biocide for control of internal corrosion (as required by Section 5.4.3.3 of *Santos Procedure 3.4.1 Oil Pipeline Management-System Procedure*) were performed on 14 different oil lines during the reporting period. Details are presented in Table 13 below.

Table 13: Inhibitor batch treatment of SA Cooper Basin oil pipelines

Description	Management Plan Target / 12 month period	Treatment: Jul-00 to Dec-00	Treatment: Jan-01 to Jun-01	Treatment: Jul-01 to Dec-01
Jena #2 to Alwyn/Jena/Ulandi Tie in	2	Oct	-	Aug
Alwyn/Jena/Ulandi Tie In to Limestone Creek	2	Oct	-	Aug
LSC to Strzelecki Oil	2	Sep	-	Aug
Lake Hope to Gidgealpa	2	Oct	-	Aug
Spencer/Muteroo to Gidgealpa	2	Sep	-	Aug
Gidgealpa to Moomba	2	Sep	-	Aug
Wancoocha to Moomba	1	(mothballed)	(mothballed)	(mothballed)
Keleary to Merrimelia	2	-	Apr	-
Tirrawarra to Moomba	4	Aug	Apr, Jun	Jul
Merrimelia to Tirrawarra Trunkline	2	Aug	Jun	-
Meranji to Tirrawarra Trunkline	2	Aug	May	-
Dullingari to Dullingari/Strzelecki Junction	2	Oct	-	Nov
Strzelecki to Dullingari/Strzelecki Junction	2	Nov	Jan	Nov
Dullingari/Strzelecki Junction to Moomba	2	-	Jan	-

Visual inspections were made of pipeline, flowline and trunkline supports in association with those inspections listed in *Section 2.4*. All damaged pipe supports were replaced with type-3 “Omnipol” (barrel or donut) supports.

No hydrotesting of oil lines was conducted during the reporting period. A review of this procedure commenced in 2000 to assess the validity of hydrotesting as a measurement of pipeline integrity and fitness for purpose. The Santos pipeline management procedures will be updated to reflect the outcomes of this review when it is completed.

Other Audits

In addition to the audit of recently constructed flowlines (refer *Section 1.4*) there was an inspection of Block Oil facilities undertaken during the reporting period. This inspection, whilst not complete at the time of reporting, examined 13 production

satellites and several well leases. The inspection focussed on safety, environmental, and operational issues and once finalised will be used to derive a comprehensive strategy for facility improvement.

A coating defect survey was completed in the Tirrawarra (east) field during the reporting period. Breakdown of coatings were identified as an issue, with repairs required in several areas. This field was also identified as a priority area for future upgrades to the CP system.

Ongoing visual inspections continued to be undertaken during the reporting period of all operational oil pipelines, flowlines and trunklines in the Santos *Operational Area*.

A study commenced during the reporting period to assess the relative risk factors of all operational oil and gas pipelines. This process is based on the *NSCA Risk Score Calculator* issued by the National Safety Council of Australia (NSCA), and adapted to determine environmental risk by Santos personnel. At the time of reporting this assessment was incomplete.

2.5 Reportable Incidents

Seventeen reportable incidents either directly or indirectly associated with pipeline, flowline or trunkline operational activities were reported to regulatory authorities during the reporting period. Details of all incidents including initiated corrective actions are presented in Appendix 3.

Two of these seventeen incidents were classified as *Serious*.

- The first was a microbiological-induced corrosion leak to an oil flowline identified on the 12th September 2001 in the Jena field. The total volume of oil and water mixture released was estimated at 480 - 500 m³ including approximately 170m³ of hydrocarbon (refer Appendices 3 and 19).
- The second incident occurred from a small external corrosion-induced leak on the Keleary – Merimelia oil pipeline. Although the volume of this leak was relatively small at approximately 260L, the proximity of the spill to the North West branch of the Cooper Creek resulted in this incident being assigned a potential consequence classification of *Serious* (refer Appendix 3).

Both of these incidents were reported to PIRSA and EPA in accordance with regulatory requirements. Full cleanup activities were initiated/undertaken during the reporting period.

There are 15 significant oil spill sites associated with pipelines that are subject to ongoing monitoring of Oil and Grease (%w/w) levels in affected soils. The monitoring results for each of these sites, listed below, are presented in Appendix 15.

- Dullingari Oil Satellite
- Jena #1 Flowline
- Jena #4 Trunkline
- Keleary Trunkline (19km)
- Keleary Trunkline (66km)
- Lake Hope Trunkline (3.9km from Tantanna)

- Lake Hope Trunkline (13.1km from Tantanna)
- Lake Hope Trunkline (24.2km from Tantanna)
- Limestone Creek-Strzelecki Creek Trunkline (3.8km)
- Limestone Creek-Strzelecki Creek Trunkline (16km)
- Spencer Interceptor Pit
- Strzelecki Oil Satellite
- Tirrawarra Trunkline
- Ulandi #1 (1-98) Trunkline
- Ulandi #1 (2-99) Trunkline

2.6 Operations Proposed for Ensuing Year

At the time of reporting plans were being finalised for a major oil trunkline refurbishment/upgrade program to be undertaken mid 2002.

Section 3: Right-of-Way Construction and Restoration

3.1 Summary of Activities

There were 101 gas flowlines and 8 oil flowlines constructed in the Santos *Operational Area* during the reporting period. These lines required the survey, scout and installation of over 200km of right-of-way.

Restoration of the right-of-way was undertaken at all pipelines, flowlines and trunklines constructed during the reporting period.

3.2 Compliance Report

Right-of-way construction and restoration activities in the reporting period for pipelines, flowlines and trunklines were conducted in compliance with the requirements of the *Petroleum Act 2000*, *Petroleum Regulations 2000*, licenses, and objectives under the *Draft Statement of Environmental Objectives: Production and Processing – SA Cooper Basin Joint Venture* (Santos 2001 DRAFT).

Quarterly Meeting to Discuss Compliance Issues

Quarterly compliance meetings were held with PIRSA to discuss a range of issues associated with the environmental management of the *Operational Area*. Actions arising from these meetings are presented in Appendix 4 to this report.

No major issues were raised in relation to the construction or restoration of pipeline right-of-ways.

3.3 Management System Audits

Right of way construction and restoration activities are covered under management systems in place for pipelines.

An audit of the Oil Pipeline Management System was conducted in July 2000. Refer *Section 1.3* for details of this audit.

3.4 Risk Assessments and Other Audits

Right-of-way construction activities for pipelines, flowlines and trunklines are required to be conducted in accordance with the requirements of relevant standards, procedures and legislation, including:

- *Environmental Procedures for the Construction, Operation and Abandonment of Pipelines in the Cooper Basin*;
- *Code of Environmental Practice – Production and Processing Operations*;
- *Draft Statement of Environmental Objectives: Production and Processing – SA Cooper Basin Joint Venture*;
- *Field Guide to the Common Plants of the Cooper Basin*; and
- *Environmental Procedures for the Management of Aboriginal Heritage Sites*.

Visual inspection of all right-of-ways is undertaken at the construction and restoration phase of pipelines as a means of identifying immediate concerns from an environmental perspective.

At the completion of pipeline construction activities a track is installed to provide 4WD access for routine pipeline visual inspections and maintenance activities. To ensure environmental disturbance is minimised and third party access is discouraged, it is only permissible to grade these access tracks access when 4WD access is denied.

Periodic auditing formally assesses pipeline-associated activities against relevant environmental objectives. During the reporting period, a formal audit of right-of-ways was undertaken as a component of the audit of recently constructed flowlines. This audit identified that overall the standard of flowline construction undertaken during the reporting period has been very good to excellent. Refer to *Section 1.4* for further details.

Visual inspections conducted during the reporting period have also identified some instances where there was excessive width of the right-of-way. In most cases any additional disturbance resulting from this was identified as unavoidable owing to the need for the grader to straddle the windrow at the edge of the right-of-way during construction and restoration activities.

3.5 Reportable Incidents

There were no reportable environmental incidents resulting from pipeline right-of-way construction or restoration activities conducted in the reporting period.

3.6 Operations Proposed for Ensuing Year

Flowline construction activities for 2002 are envisaged to provide connections for approximately 50 wells, with around 40km of flowline installed.

Each of these installations will require detailed line of sight surveys, right of way construction, and subsequent restoration activities.

PART 4: **PRODUCTION OPERATIONS**

FOR REPORTING PERIOD:
1ST JULY 2000 – 31ST DECEMBER 2001

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Section 1: Production Facility Construction, Operation, Restoration and Abandonment

1.1 Summary of Activities

The following is a summary of activities associated with production facilities conducted during the reporting period:

- 11 projects initiated or completed involving modifications to existing production facilities (refer Appendix 16);
- 1 *Serious Incident*: Moomba Plant Pump Station # 1;
- Several audits/inspections undertaken of facilities at Moomba Plant;
- 3 major installation projects undertaken at the Moomba Plant:
 - #2 GTA installed – base capacity.
 - Gidgealpa and Tirawara trunkline EVI's installed.
 - Propane vessel EVI's installed;
- 2 production facility construction projects;
 - new 40,000m² lined evaporation pond adjacent to the existing Northern Evaporation Pond at Moomba.
 - new lined evaporation pond and oily/water collection and disposal facility at Mawson/Karunda;
- 1 new 2.7 km road to provide access to the Nappacoongie East Facility;
- No production facilities abandoned; and
- Pipelines, trunklines and flowlines piped oil and gas to the Moomba plant resulting in the production volumes detailed in Table 14 below.

Table 14: Production Volumes* for Moomba for the period 1 July 2000 to 31 December 2001.

Sales Gas	Ethane	Condensate	Crude
(PJ)	(PJ)	(MI)	(MI)
215.131	25.923	532.028	689.761

MI = Megalitres

PJ = PetaJoule

*Part 3 – Flowline, Pipeline and Construction Activities, *Section 2-2.1*, presents volumes of product transported through licensed pipelines.

1.2 Compliance Report

Every endeavour was made to ensure production facility construction, operation and abandonment activities were conducted in accordance with requirements under the *Petroleum Act 2000*, *Petroleum Regulations 2000*, *Draft Statement of Environmental Objectives: Production and Processing – SA Cooper Basin Joint Venture* (Santos 2001 DRAFT), and relevant licenses.

Several non-compliances were incurred during the reporting period for late submissions of *Detailed Activity Information Reports* (Reg 20) related to new and upgraded production facilities. Non-compliances were also incurred for late provision to

landholders of *Notices of Entry* (Reg 22, and Clause 60 of the *Petroleum Act 2000*). These non-compliances occurred primarily as a result of inadequate recording and notification systems. A review of reporting procedures and the development of new systems and procedures to allow detailed tracking of timing and submission of data is planned to ensure further non-compliances do not occur.

Non-compliance with Reg 45: *Production Reports* were incurred for the reporting period. Reports for July 2001 and August 2001 were inadvertently overlooked owing to additional work/investigations arising in relation to the Moomba Plant Pump Station #1 incident. All outstanding reports shall be prepared and submitted, with further non-compliances avoided through a strict six week report turnaround.

No evidence was identified of non-compliance for provision of *Incident Reports* under Reg 32. The Moomba Pump Station #1 Incident – classified as a *Serious Incident*, was reported to PIRSA in accordance with Regulation 32. A formal report on the investigation into this incident was submitted to PIRSA.

Recordable Incidents were reported to PIRSA at quarterly compliance meetings in compliance with legislative requirements.

In 2001 the report:- *Fitness for Purpose Report for Santos Cooper Basin Facilities* (Santos 2001) was submitted to PIRSA. Required under Regulation 30, this report details how Santos is managing risks to public health, safety and the environment.

Quarterly Meeting to Discuss Compliance Issues

Quarterly compliance meetings were held with PIRSA to discuss a range of issues associated with the management of Santos' activities in the *Operational Area*. Actions arising from these meetings are presented in Appendix 4 to this report.

The key issues raised at these meetings that related to production facility activities were:

- Finalisation of the *Environmental Impact Report: Production and Processing* and *Draft Statement of Environmental Objectives: Production and Processing – SA Cooper Basin Joint Venture*. At the time of reporting these documents were under review;
- The development of end point criteria for oil spill remediation/bioremediation. Santos drafted a paper on this issue which was subsequently reviewed by PIRSA. These criteria will be incorporated into the EIR and SEO; and
- The status of the *Produced Formation Water Action Plan* (Santos Ltd 2000b). Reports on the results of Level 1 and Level 2 National Environmental Protection Measure (NEPM) Assessments for Moomba landfarmed soils were submitted to PIRSA for review. Based on this work it was concluded that a repeat of these assessments against produced formation water (PFW) pond sediments would not provide any additional benefit, and that a Level 3 NEPM Assessment would be appropriate. Significant consultation was held with PIRSA and the EPA during the reporting period on the development of site specific PFW disposal criteria using a Sediment Health Index approach.

1.3 Management System Audits

Several audits of management systems were undertaken during the reporting period:

- Both Moomba Process and Operations Support groups undertook separate Safety Management Systems audits. These audits assessed operations against the Santos

General Standards. The evaluation of safety systems has shown that overall, the systems in place are working well with a high level of conformance with existing management system requirements.

- An audit of Moomba production facilities was undertaken in both 2000 and 2001 to assess conformance with ISO 9001 by Det Norske Veritas. This audit identified an effective Quality Management System was in place and certification was maintained. The main issues identified from these repeat audits related to document control, process control, and follow-up of audit actions.
- Nine audits were conducted of Santos contractors to assess their Safety Management Systems (SMS). Two further audits specific to Safety Management Systems – Rigging, were also undertaken. Although the audits revealed most contractors to have a suitable SMS in place, it was noted that there is still some work required to fully implement formal procedures to consistently implement these systems, and to ensure conformance with the Santos General Standards.
- In August 2001 Santos engaged Shell Engineering Limited (SEL) and Quality Assurance Services (QAL) to review the Santos Safety Management System and recommend improvements. This involved visits and interviews at production facilities within the *Operational Area*. A range of initiatives have commenced as a result of this review.
- The Moomba Laboratory Quality Management System was audited during the reporting period with respect to conformance with ISO 17025. This review identified that the system mostly satisfies the requirements of this standard, with a few minor issues identified in relation to data recording.
- An audit was undertaken that specifically looked at Maintenance, Operations, and the Moomba Laboratory against the generic elements of ISO 9001:1994. Overall the audit result was satisfactory with only one medium risk exposure identified. This was for the setting/testing of PSV's. Actions to address this issue were assigned following this audit.
- An audit was conducted of the Santos Maintenance Department and their conformance to the System Procedure MP6.04 Rev 02 - Machine Condition Monitoring. This audit identified some minor issues related to responsibilities listed in the procedure, the types of machinery covered, and record keeping. Actions raised from this audit were entered onto AIM for assignment and tracking.

1.4 Risk Assessment and Other Audits

All activities associated with the construction, operation, and abandonment of production facilities in the *Operational Area* are undertaken in accordance with:

- *Code of Environmental Practice – Production and Processing;*
- *Code of Environmental Practice – Drilling and Workover;*
- *Environmental Procedures for Well Lease Location, Construction and Restoration;*
- *Draft Statement of Environmental Objectives: Production and Processing – SA Cooper Basin Joint Venture;*
- *Statement of Environmental Objectives for Drilling and Workover Operations in the Cooper / Eromanga Basin – South Australia; and*

- Operations Support Department Guides and Specifications (based on Australian and/or industry standards) (refer Appendix 11).

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 Company's Management System. All proposed modifications are reviewed prior to implementation using formal and documented Process and Instrument Design change procedures.

Audits of the Northern, Eastern and Central Satellite Facilities in the *Operational Area* were undertaken during the reporting period (SEA Pty Ltd 2001a, 2001b, 2001c). Several opportunities for improvement were observed in addition to some non-conformances with Santos' environmental objectives and requirements. Issues observed primarily related to:

- Remediation of contaminated soil;
- Prevention of oil spills and oil spill contamination;
- Rehabilitation of disused earthworks;
- Access by cattle to produced formation water facilities, and
- Operation of flares.

This audit also identified several instances of possible (but unconfirmed) past non-compliance with the PIRSA requirement under the *Petroleum Act 2000* to ensure water discharged to an evaporation pond contains less than 30ppm oil in water. Minor oil staining of the banks of some audited ponds suggests past exceedence of this level may have occurred.

Function testing of Satellite E.S.D. systems by manually initiating them were undertaken by the Production Department in the reporting period. The test site for this audit was Big Lake. No safety or environmental hazards were identified as a consequence of this audit indicating systems were being effectively implemented.

No nodal compressor facilities were audited during the reporting period.

An audit of producing oil wells commenced in December 2001 to assess the implementation and success of restoration/rehabilitation works identified in previous audits undertaken in January 1999. Preliminary results of the audit indicated several non-conformances and non-compliances with Santos standards and objectives under the Production and Processing SEO. Most of the issues identified related to remaining earthworks (ripping of the lease pad, recontouring etc), removal of redundant equipment, and remediation of oil spills. Once the audit of all priority oil wells is complete, results will be used to generate recommendations for input to AIM for assignment and tracking of remedial actions.

Santos Corporate Environment commissioned an external audit of the Moomba Production Facilities and associated infrastructure during the reporting period. This audit assessed the implementation and success of recommendations identified from previous audits undertaken in May and October 2000. The audit identified several possible non-conformances and non-compliances. These issues related to waste oil management, management of oil spills, interceptor/evaporation pond management, flaring, bunding, and satellite facility upgrades.

The audit of the Moomba Waste Depot conducted in the reporting period identified several potential non-conformances with Santos' environmental objectives and non-compliances with the Depot Licence conditions. Issues identified were in relation to the maintenance of records of waste type and volume, minimisation and management of

localised oil spills, groundwater monitoring frequency, and the management of old disused waste dumps. Actions from this audit were entered onto AIM for assignment and tracking.

A review of the Tirrawarra Satellite Facility commenced during the reporting period. This review led to an investigation of the oil and condensate tank farm to determine the extent of hydrocarbon contamination in the soil beneath the tanks, and if necessary, identify appropriate remediation options. Initial findings of the investigation indicate that hydrocarbon contamination from the tank farm had not contaminated groundwater at the site, and that remediation can be accomplished by the excavation of contaminated material and replacement with clean fill. Following this the proposed placement of an impervious liner would prevent further inadvertent contamination. Once complete, details of this investigation will be formally reported.

As there were no production facilities abandoned or restored during the reporting period, no formal assessment of restoration activities was conducted. Where any such assessments are undertaken, they are done so in accordance with the Goal Attainment Scaling rationale as developed by PIRSA.

1.5 Reportable Incidents

There were 58 reportable incidents at production facilities during the reporting period. Appendix 3 to this report provides details of these incidents and the initial corrective actions instigated.

During this reporting period one *Serious* safety incident occurred at the Moomba Plant. This resulted in fatal injuries to a Santos employee. The incident involved the unintended release of volatile product that subsequently ignited.

Details of a full investigation into this incident have been reported to Government.

1.6 Operations Proposed for Ensuing Year

Production in the ensuing year will primarily focus on:

- Addressing undeveloped reserves in key high rate/reserves fields (3 wells);
- Placing emphasis on high value in-wellbore optimisation (15 projects);
- Evaluating upside potential of lower rate/reserves “Murta” via a low cost structure drilling campaign in the Murteree Horst area (4 wells);
- Assessing the potential for near field exploration drilling opportunities through evaluation of the 2001 3D seismic acquisition; and
- Improving the integration of field appraisal and development opportunities through the recent formation of a multi-disciplinary team.

Major inspections proposed for production facilities in 2002 include:

- LRP ‘A’ Train shutdown;
- #7 Benfield Train inspection;
- #6 Benfield Train inspection;
- Ethane Treatment Facility inspection;
- LRP ‘B’ Train shutdown; and
- Plant Pipework NDT inspection.

Major production facility projects proposed for 2002 include:

- Upgrades to 6 Satellite Facilities;
- Asset Control Enhancement (ACE);
- Plant HV Upgrade;
- Sales Gas Meter Station Upgrade;
- Northern Evaporation Pond Extension;
- Gidgealpa Raw Water Supply Upgrade;
- Competency Based Training Project;
- Emergency Siren Upgrades;
- Maintenance Improvement Program; and
- Safety Studies – “Whole of Plant” Risk Assessments.

1.7 Production Forecast

2002 Gas and Liquids Production Estimates

Table 15: Estimated Production Volumes for SA Cooper Basin JV – 2002.

Sales Gas (PJ)	123.8
Ethane (PJ)	16.5
LPG (Kt)	216.8
Condensate (kbbls)	1,674.7
Unit Oil (kbbls)	354.2
Block Oil (kbbls)	2904.1
Total Crude Oil, kbbls	3258.3
Total Production (kboes)	30,782.2

2002 Gas and Liquids Storage Estimates

Table 16: Estimated Gas and Ethane Storage for SA Cooper Basin JV – 2002.

Opening Storage (PJ) (Sales Gas + Ethane)	44.1
Net Storage Injection/(Withdrawal) (PJ)	(6.5)
Total Closing Sales Gas and Ethane Storage (PJ)	37.6

2002 Gas and Liquids Sales Estimates

Gas and liquid production volumes for 2002 are set to match the forecast sales volumes. Thus refer to production estimates detailed above for 2002 Gas and Liquids Sales Estimates.

1.8 Forseeable Threats

Potential future threats to all activities conducted by Santos and its contractors in the *Operational Area* have been identified and addressed within the following documents:

- *Draft Statement of Environmental Objectives: Production and Processing – SA Cooper Basin Joint Venture (2001);*
- *Environmental Impact Report: Production and Processing Operations (2001)*
- *Statement of Environmental Objectives for Drilling and Workover Operations in the Cooper / Eromanga Basin – South Australia (2000);*

- *Statement of Environmental Objectives for Seismic Operations in the Cooper and Eromanga Basins – South Australia (1998); and*
- *Fitness For Purpose Report – SA Cooper Basin Facilities (2001).*

Through these documents the risks and management requirements for the hazards and consequences associated with Santos' activities in the *Operational Area* are addressed.

Section 2: Produced Formation Water Disposal

2.1 Summary of Activities

The following summarises the activities associated with formation water disposal that occurred in the reporting period:

- 47 formation water disposal facilities were operational;
- 2 new facilities constructed (a 40,000m² lined evaporation pond adjacent to the Northern Evaporation Pond at Moomba, and a produced formation water disposal facility at the Moomba South Oil facility); and
- No facilities decommissioned or restored.

PIRSA formally gave permission for deferment of the requirement to undertake the Annual Formation Water Monitoring Program for the 2001-2002 period. It is envisaged this Program will recommence in 2003.

2.2 Compliance Report

Management of produced formation water is undertaken to ensure compliance with the *Petroleum Act 2000*, the *Petroleum Regulations 2000*, licenses, and objectives under the *Draft Statement of Environmental Objectives: Production and Processing – SA Cooper Basin Joint Venture* (Santos 2001 DRAFT).

The conduct of an audit of Satellite facilities in the reporting period identified several instances of suspected past non-compliance with the PIRSA requirement under the *Petroleum Act 2000* to ensure water discharged to an evaporation pond contains less than 30ppm oil in water. Minor oil staining observed on the banks of some audited ponds suggests past exceedances of this level may have occurred.

A review of pond management practices and general housekeeping activities at Satellite facilities will address this issue. Planned upgrades to selected Satellites in 2002, including oily water separation facilities, will further reduce the potential for this non-compliance to re-occur.

Quarterly Meeting to Discuss Compliance Issues

Quarterly compliance meetings were held with PIRSA to discuss a range of issues associated with environmental management of Santos' *Operational Area*. Minutes of these meetings are presented in Appendix 4 to this report. Items addressed during these meetings relating to produced formation water included:

- The development of the *Formation Water Action Plan*. Refer to *Section 1-1.2* for further details on this Plan;
- The presentation to PIRSA of an analysis report on sediment and water sampling conducted from evaporation ponds (and interceptor pits) in the Cooper Basin; and
- Santos initiatives to reduce oil carryover into evaporation ponds.

2.3 Management System Audits

There were no audits of management systems performed during the reporting period that related to produced formation water activities.

2.4 Risk Assessment and Other Audits

All activities associated with the planning, operation, and abandonment of formation water facilities are undertaken in strict adherence with the following:

- *Code of Environmental Practice – Production and Processing.*
- *Draft Statement of Environmental Objectives: Production and Processing – SA Cooper Basin Joint Venture.*

Conformance with the objectives of these documents is assessed using Goal Attainment Scaling (GAS) criteria.

As required under the operating approvals granted by PIRSA, Santos undertakes an annual formation water monitoring program in which water from the final stage of a facility is sampled and analysed for a range of biological and physico-chemical parameters.

Sampling undertaken for the 2000 monitoring program was completed in this reporting period. A total of 34 active produced formation water sites were sampled, together with 2 sewage disposal facilities. All samples were analysed for 50 parameters as previously defined with PIRSA. Details of analytical methodology, laboratory quality control, sample collection and preservation, and results are presented in Appendix 17 to this report.

Analysis results when compared to the ANZECC Water Quality Guidelines (ANZECC 1992) revealed the majority of results (70%) to be within guideline levels. Of those results identified as outside of these guidelines, the majority were due to elevated concentrations of heavy metals and nutrients. A limited number of exceedences attributable to the concentration of organic compounds and physico-chemical characteristics were also identified.

A large number of the guideline exceedences can be attributed to the extremely low guideline criteria stipulated by the ANZECC Water Quality Guidelines for fresh water bodies. It is considered that these criteria are inappropriate given the circumstances and environments in which produced formation water is disposed of in the *Operational Area*. A project is planned for 2002 that will aim to develop guidelines that are more appropriate for use in the *Operational Area* (refer *Section 2.6*).

PIRSA formally granted Santos exemption from undertaking this monitoring requirement in 2001. This exemption was granted pending the finalisation and implementation of the *Formation Water Action Plan*. The requirement to undertake this monitoring program is likely to resume in 2002.

Produced formation water ponds at Satellite facilities, were however, included as part of the comprehensive Satellite Facility Audits (refer *Section 1.4*) undertaken during the reporting period (SEA Pty Ltd 2001a, 2001b, 2001c). Key issues identified during these audits that were relevant to produced formation water ponds included:

- Suspected non-compliances with a PIRSA directive under the Petroleum Act 2000 to ensure water discharged to unlined evaporation ponds has less than 30ppm oil in water; and
- Non-conformances with the Santos *Code of Environmental Practice – Production and Processing*, due to pond fences being in a state of disrepair, and providing cattle with access to formation water facilities.

Recommendations raised from these audits were entered onto AIM for the purposes of assigning and tracking remedial actions.

2.5 Reportable Incidents

There were 7 reportable incidents at formation water disposal facilities during the reporting period. These incidents related to:

- excessive crude/condensate on the interceptor pit;
- oil carryover to the evaporation ponds;
- cattle access to formation water facilities; and
- oil contamination outside of pond bund walls.

Appendix 3 provides details of these incidents and initial corrective actions undertaken.

The Spencer Interceptor Pit oil spill was the only significant spill at a formation water disposal facility that required ongoing sampling and analysis during the reporting period. This site was last sampled in April 2001. Monitoring results for this spill site are presented in Appendix 17.

2.6 Operations Proposed for Ensuing Year

A review of formation water storage and disposal facility requirements at Moomba is planned for the ensuing year with a view to constructing an additional pond dedicated to receiving all site stormwater. Separation of plant effluent from the site stormwater will provide for better contaminant management.

A project is planned for 2002 that aims to develop a Soil/Sediment Health Index Approach (SHI) for the management of Produced Formation Water sediments and Landfarm Treated Soils. The SHI Approach will be in the form of an ecological risk assessment in line with the NEPM (National Environment Protection (Assessment of Site Contamination) Measure 1999) risk assessment approach for developing site-specific contaminant criteria to achieve due diligence and regulatory compliance. It is envisaged that this study will also provide site specific guidelines for the disposal of produced formation water.

Section 3: Oil Spill Remediation

3.1 Summary of Activities

The following presents a summary of oil spill management and site remediation that occurred in the reporting period:

- 93 oil spills were recorded on the Santos Incident Management System (IMS). (Refer to Appendix 18 for further details). The total area of soil estimated to have been affected by hydrocarbons as a consequence of these spills is approximately 2.7 hectares.
- Hydrocarbon-contaminated soils were either treated on site (in situ), removed off site for treatment at the Moomba Landfarm, or removed to alternative locations for treatment in temporary remediation areas;
- Monitoring of oil spill sites continued through the reporting period. These results are presented in Appendix 15; and
- 2 oil spills classified as being of *Serious* environmental consequence (Jena #11 Flowline Leak and the Keleary Oil Pipeline leak).

3.2 Compliance Report

All unintended escapes of a processed substance, fuel chemical or petroleum to areas not designed for containment are deemed to be reportable incidents under the *Petroleum Act 2000*, *Petroleum Regulations 2000* and the *Draft Statement of Environmental Objectives: Production and Processing – SA Cooper Basin Joint Venture* (Santos Ltd 2001 DRAFT).

No evidence was identified of non-compliance for provision of *Incident Reports* under Reg 32. *Serious Incidents* were reported in accordance with Regulation 32, and *Recordable Incidents* were reported to PIRSA at quarterly compliance meetings.

Quarterly Meeting to Discuss Compliance Issues

Quarterly compliance meetings were held with PIRSA to discuss a range of issues associated with the environmental management of Santos' activities in the *Operational Area*. Actions arising from these meetings are presented in Appendix 4 of this report.

Issues discussed at these meetings in relation to oil spills included:

- The continued provision of Total Petroleum Hydrocarbon monitoring data to PIRSA;
- Oil Spill End-point Criteria discussion paper. The findings of this paper were introduced into the *Draft Statement of Environmental Objectives: Production and Processing – SA Cooper Basin Joint Venture*; and
- Santos' management of oil spills, in particular the Tirrawarra Trunkline and the Jena #11 flowline spills.

3.3 Management System Audits

There were no audits conducted of management systems during the reporting period that related to management of oil spills.

3.4 Risk Assessment and Other Audits

All oil spill sites were managed in accordance with the environmental objectives detailed in the Santos *Code of Environmental Practice – Production and Processing*, and the *Draft Statement of Environmental Objectives: Production and Processing – SA Cooper Basin Joint Venture*.

On-site Remediation

During the reporting period, on site remediation of hydrocarbon contaminated soils occurred at 39 oil spill sites. No excavation and transfer of soil was deemed necessary at these sites.

Off-site Remediation (Moomba Landfarm)

Excavation and relocation of hydrocarbon contaminated soils to the Moomba Landfarm occurred at 53 oil spill sites. The approximate volume of contaminated soil transported to Moomba was 7130m³.

Off-site Remediation (Goyder and Milluna Temporary Landfarms)

Excavation and relocation of hydrocarbon contaminated soils to alternative nominated temporary landfarms occurred for a single oil spill site - the Jena #11 flowline spill. This incident required the excavation and transportation of 16,560m³ of contaminated soil to the temporary landfarming sites established at the Goyder and Milluna fields.

Appendix 19 provides an account of the remedial activities undertaken at the Jena #11 oil spill site up until the time of reporting.

Three oil spill sites at production facilities were sampled during the reporting period as part of the ongoing monitoring program; these sites were:

- Strzelecki Oil Satellite;
- Spencer Oil Satellite (Interceptor Pit); and
- Dullingari Oil Satellite.

Sampling at the Dullingari Oil Satellite spill site ceased in April 2001 owing to the placement of a drilling rig pit over the site of the original oil spill.

Analysis reports for the ongoing monitoring of all oil spill sites at production facilities are included in Appendix 15.

3.5 Reportable Incidents

There were a total of 93 reportable incidents involving/related to oil spills in the *Operational Area* for the reporting period.

Two of these incidents were classified as having/potentially having a *Serious* environmental consequence. These were the Jena #11 Flowline Leak and the Keleary Oil Pipeline Leak.

Jena #11 Flowline Leak

Internal corrosion to the Jena #11 Flowline resulted in the release of an estimated 480-500m³ of oil/water mixture to ground sometime prior to the

incident being found on the 12th September 2001. A full report on this leak and remedial activities is provided in Appendix 19.

Keleary Oil Pipeline Leak

On the 17th December 2001 a leak was found on the Pipeline linking Keleary Oil to Merimelia Oil. Upon inspection external corrosion to a section of pipe was identified as the cause of release of approximately 2m³ of crude oil.

Appendix 18 presents a summary of all oil spill incidents that were recorded for the reporting period. Appendix 3 provides further details of these incidents and corrective and follow-up actions assigned.

3.6 Operations Proposed for Ensuing Year

A project is planned for 2002 that aims to develop a Soil/Sediment Health Index (SHI) Approach for the management of Landfarm Treated Soils and Produced Formation Water sediments. Refer to *Section 2.6* for further details.

The planned development of an Oil Spill reduction Strategy in 2002 is aimed at addressing what are viewed as the higher risks of Santos operations and infrastructure that have potential to result in oil spills.

5 key asset areas will be focused upon by this Strategy:

- Oil trunkline integrity
 - Internal and external corrosion of oil flow lines
 - Positive wellhead isolation of suspended oil wells
 - Integrity of storage tanks
 - Refurbishment of oil satellite facilities
-

PART 5:
STATEMENT OF EXPENDITURE

FOR REPORTING PERIOD:
1ST JAN 2001 – 31ST DECEMBER 2001

CONFIDENTIAL

PART 6:

LIST OF REPORTS AND DATA

REFERENCES

APPENDICES

**FOR REPORTING PERIOD:
1ST JULY 2000 – 31ST DECEMBER 2001**

LIST OF REPORTS AND DATA

Under Regulation 33(2)(e) of the Petroleum Regulations 2000, Santos are obliged to provide within the Annual Report, a “list of all reports and data relevant to the operation of the Act generated by the licensee during the relevant license year”.

In relation to this requirement, PIRSA have advised that:

PIRSA will be satisfied that Regulation 33 (2) (e) has been complied with if a list of all technical geological reports and data (including those reports required by Regulations 34 to 45) is submitted. This list should include all interpretative geological and reserve reports.

This arrangement may be reviewed at any time by PIRSA, but no change will be required unless at least 2 months warning has been given prior to the required submission date for an Annual Report.

The following list has been compiled in accordance with the above notification.

List of Reports and Data

The following list presents all reports and data generated through the reporting period that relate to the geology and reserves of the SA Cooper and Eromanga Basin *Operational Area*:

- 2001 Reserves Review, Malgoona Oil Data File
- 2001 Reserves Review, Tantanna Oil Data File
- 2001 Reserves Review, Pelican Oil Data File
- 2001 Reserves Review, Carmina Oil Data File
- 2001 Reserves Review, Dirkala, Dirkala South Oil Data File
- 2001 Reserves Review, Dullingari Data File
- 2001 Reserves Review, Calamia West Oil Data File
- 2001 Reserves Review, Tarragon Oil Data File
- 2001 Reserves Review, Sturt, Sturt East Oil Data File
- 2001 Reserves Review, Keleary Oil Data File
- 2001 Reserves Review, Taloola Oil Data File
- 2001 Reserves Review, Meranji Oil Data File, Incl. Meranji Oil Show Evaluation
- 2001 SABU Reserve Review Documentation
- Basal Birkhead Sandstone Potential: Southern Big Lake Field
- Namur Sandstone Member: Porosity Versus Permeability Plots, Cooper/Eromanga Basin
- Geophysical Report for Gidgealpa Field
- Moomba Area Patchawarra Study, Volumes 1 and 2
- 2001 Coonatie 3D Survey, Acquisition and Processing Report, SA01 Seismic Survey, Cooper Basin Region, South Australia
- 2001 Murteree Horst 3D Survey Acquisition and Processing Report, SA01 Seismic Survey Cooper Basin Region, South Australia
- SA00 Seismic Survey Cooper Basin Region, South Australia, Acquisition and Processing Report
- Stratigraphy of the VC50 to Pre-Permian Interval, Swan Lake 3D Seismic Survey area, Cooper Basin
- Fly Lake Integrated Study Group: Fly Lake, Brolga, Quartpot Fields. Patchawarra Formation Gas Field Depletion Plan, Volume 1
- Technical Specification Summary, SA01 Greater Strzelecki 3D Survey
- Technical Specification Summary, SA01 Coonatie 3D Survey
- Water: Supply, Quality and Contribution to Scale Formation in Relation to Fracturing Operations

Other Reports as specified under the Petroleum regulations 2000:

- Geophysical Progress Reports (Reg 34)
- Geophysical Operations Reports (Reg 35)
- Geophysical Interpretation Reports (Reg 36)
- Geophysical Data (Reg 37)
- Daily Drilling Reports (Reg 38)
- Wireline Logs (Reg 39)*
- Well Completion Reports (Reg 40)*
- Quarterly Cased Hole Well Activity reports (Reg 41)*
- Well Test Analysis Reports (Reg 42)*
- Petroleum Reservoir Fluid Analysis Reports (Reg 43)*
- Downhole Diagrams (Reg 44)*
- Production Reports (Reg 45)*

**Denotes reports were either: outstanding for some licensed activities, presented with some data omissions, presented late, or presented in electronic formats not deemed suitable.

REFERENCES

ANZECC. 1992

Australian Water Quality Guidelines for Fresh and Marine Waters.
Australian and New Zealand Environment and Conservation Council.

NSCA. 1997

NSCA Risk Score Calculator. National Safety Council of Australia.

PIRSA. 1998

Statement of Environmental Objectives for Seismic Operations in the Cooper and Eromanga Basins South Australia. Department of Primary Industries and Resources of South Australia.

PIRSA. 2000

Statement of Environmental Objectives for Drilling and Well Operations in the Cooper / Eromanga Basin – South Australia. Department of Primary Industries and Resources South Australia.

Santos Ltd. 1997a

Environmental Procedures for Borrow Pit Management. Santos Ltd.

Santos Ltd. 1997b

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

Santos Ltd. 1997c

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

Santos Ltd. 1998a

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

Santos Ltd 1998b

Dozer Manual – Environmental Procedures for Seismic Line Preparation.
Santos Ltd.

Santos Ltd. 1998c

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

Santos Ltd. 1999a

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

Santos Ltd 1999b

Code of Environmental Practice – Seismic Operations. Santos Ltd.

Santos Ltd 1999c

Environmental Procedures – Seismic Operations. Santos Ltd.

Santos Ltd. 1999d

Santos Procedure 3.4.1: Oil Pipeline Management- System Procedure. Santos Ltd.

Santos Ltd. 2000a

Environmental Procedures for the Construction, Operation and Abandonment of Pipelines in the Cooper Basin. Santos Ltd.

Santos Ltd. 2000b

Formation Water Action Plan. Santos Ltd.

Santos Ltd. 2000c

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

Santos Ltd. 2000d

Stock Proof Fencing Standard. Santos Ltd.

Santos Ltd. 2000 DRAFT

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

Santos Ltd. 2001

Waste Management and General Housekeeping at Drilling and Workover Operations in the Cooper Basin: Aug-2001 to Sep 2001. Santos Ltd.

Santos Ltd. 2001

Environmental Impact Report: Production and Processing Operations. Santos Ltd.

Santos Ltd. 2001

Fitness For Purpose Report – SA Cooper Basin Facilities. Santos Ltd.

Santos Ltd. 2001 DRAFT

Draft Statement of Environmental Objectives: Production and Processing – SA Cooper Basin Joint Venture. Santos Ltd.

Santos Ltd. Undated-a

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

Santos Ltd. Undated-b

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

Santos Ltd. Undated-c

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

Santos Ltd. Undated-d

WP 1500 –10 - W001: Pro-forma Risks Assessment for SA Cooper Basin Gas Flowlines. Santos Ltd.

SEA Pty Ltd. 2000

Audit of Recently Constructed Flowlines in South Australia. November 2000. Social and Ecological Assessment Pty Ltd. Report to Santos Ltd.

SEA Pty Ltd 2001a

Environmental Audit of Satellite Stations Stage 1: Northern Satellites. June 2001. Social and Ecological Assessment Pty Ltd. Report to Santos Ltd.

SEA Pty Ltd 2001b

Environmental Audit of Satellite Stations Stage 2: Eastern Satellites. August 2001. Social and Ecological Assessment Pty Ltd. Report to Santos Ltd.

SEA Pty Ltd 2001c

Environmental Audit of Satellite Stations Stage 3: Central Satellites. October 2001. Social and Ecological Assessment Pty Ltd. Report to Santos Ltd.

Sinclair Knight Mertz. 1999

Assessment of Potential Impacts of a Crude or Condensate Spill – North West Branch Cooper Creek (Stages 1 and 2). Sinclair Knight Mertz. Report to Santos Ltd.

Standards Australia / Standards New Zealand. 1999

AS-4360: Risk Management. Standards Australia / Standards New Zealand. 1999.

Standards Australia. 1997

AS 2885.1-1997. Pipelines – Gas and liquid petroleum – Design and Construction. Standards Australia.

Standards Australia. 1998

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

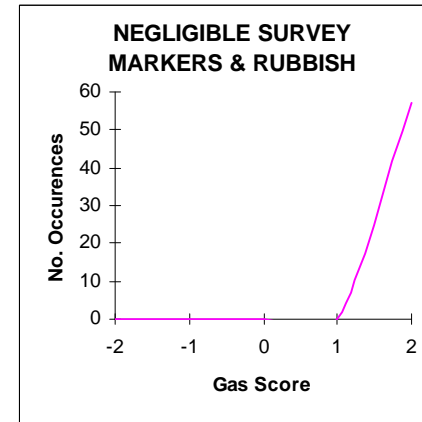
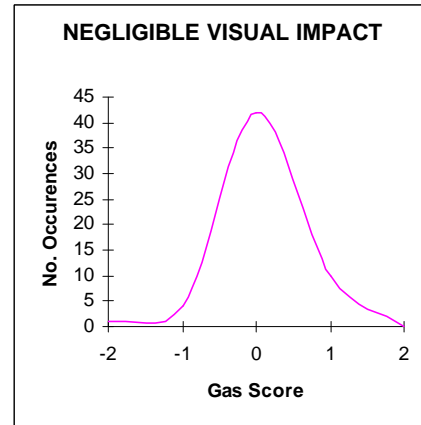
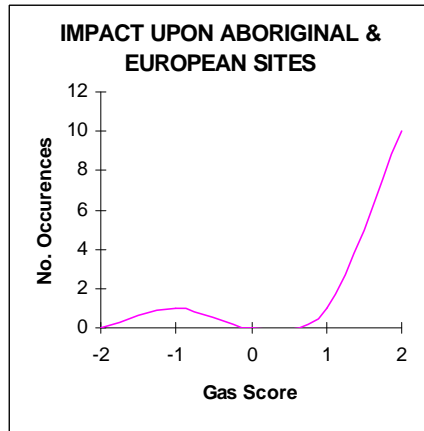
APPENDICES

Appendix 1: Environmental Report Forms Submitted for Seismic Activities

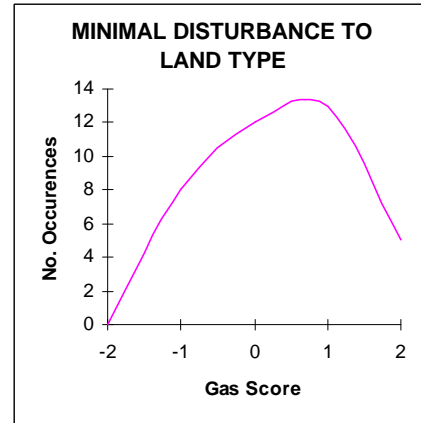
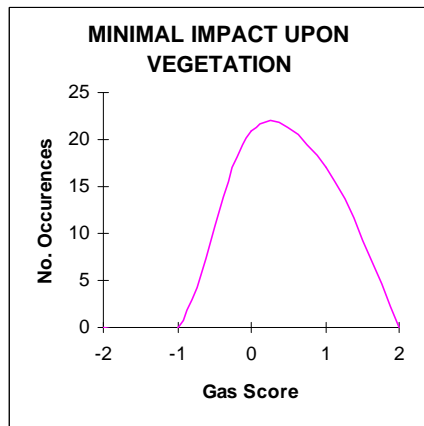
Report #	Date	Site Description	Issue	Action
GOOD PRACTICE				
01/207	5/1/01	Murteree/Horst 3D/S5112/1098	Dozer walked up dune and realised line followed dune on other side. Operator then offset line around to left and saved considerable dune disturbance and improved crew safety	N/A
01/241	22/2/01	Greater Strzelecki 3D/R1376/1634	Excellent line preparation on flats & low sand hills by walking dozer – result is quicker regeneration	N/A
01/259	3/3/01	Greater Strzelecki 3D/R1608/1836	Crest of high dune uncut – access detoured to lower point for crossing	N/A
01/373	26/7/01	Caladan-Daralingie 3D/S5412/1310	VP offset & line detoured to avoid disturbance of Wedge-tailed Eagle nest	N/A
01/381	10/8/01	Caladan-Daralingie 3D/R1760/1144-1162	Blade work kept to a minimum – operator waking machine across smooth ground	N/A
BAD PRACTICE				
00/214	18/1/01	Swan Lake 3D/S5356/1538	Vibrosis Truck stuck in wet patch – deep wheel ruts left.	Site ripped and recontoured
00/215	18/1/01	Swan Lake 3D/R1552 x S5372	Vibrosis Truck stuck in wet patch – deep wheel ruts left.	Site ripped and recontoured
01/220	27/1/01	Coonatie 3D/5020/1096	Dunes cut & sand pushed down to form ramp (graders unable to climb initial steepness).	Dune contours reinstated
01/001	25/2/01	Greater Strzelecki 3D/AR1344/ 1690	No dogleg placed in line at intersection with main Moomba-Dullingari Road.	No action. Walked line will rehabilitate naturally
1/305	9/4/01	Greater Strzelecki 3D/R1704/ 1632	Poor preparation of intersection of receiver line 1704 and Della Road	Grader bladed down the batter slope to give the dune cut a smoother slope
01/326	15/5/01	Greater Strzelecki 3D/2376/ 1313	Sand pushed up from dozing was left in piles rather than spread out.	No action. Respread of piled sand would create further vegetation disturbance
01/345	23/6/01	Caladan-Daralingie 3D/S5820/ 1618	Line cut by dozer crossing in wet conditions – deep ruts left	Site ripped when dried out
01/374	28/7/01	Caladan-Daralingie 3D	General litter at main camp site not removed	Site cleared of all litter debris and ripped
01/375	29/7/01	Caladan-Daralingie 3D/R1592/ 1343-1400	Receiver line cut at incorrect position	Incorrect line ripped and dunes reshaped
PASTORAL ISSUES				
01/331	20/5/01	Greater Strzelecki 3D/ The Bore Track	Dozer deepened an old borrow pit beside Bore Track on Innamincka Station for landholder	No action required
01/332	20/5/01	Greater Strzelecki 3D/ Strzelecki Track	Dozed out a natural depression into a borrow pit for Innamincka Station as requested	No action required
01/333	20/5/01	Greater Strzelecki 3D/ Innamincka Station fence	Dozer re-bladed tracks either side of fenceline from Dillon Highway.	No action required

Appendix 2: GAS-assessed performance against environmental objectives for seismic line preparation.

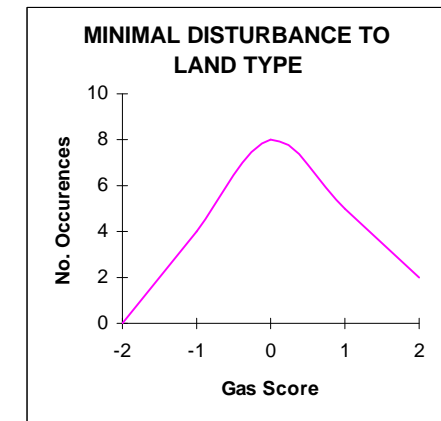
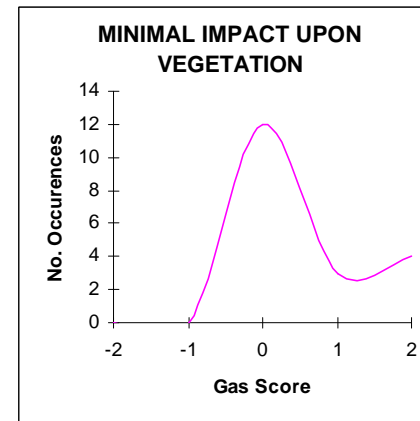
Non-Land System Specific



Dunefield



Flood Plains & Wetlands



Appendix 3: Reportable Incident Summary

Serious Incidents

Date 2001	Report #	Site	Occurrence	Substance Released	Total Vol Unc. (m ³)	Water %	Vol. Hyd Unc. (m ³)	Root Cause	Remedial Actions
07/07/00	RD246/00	Della #20	Annulus pressure due to water coming from the Namur reservoir behind casing. Inadequate cement coverage of Namur formation	Water		100	0	Process or procedural error	Flow well, evaluate productivity, set up on-line monitoring of annulus pressure & assoc. blow-down schedule. Further actions dependent on temperature logs, flow test/pressure response and geological evaluation.
16/06/01	MRES-4XRVHT	Moomba Plant # 1 Liquids Pumping Station	Hydrocarbon release followed by a flash fire resulting in a fatality	Liquid hydrocarbon				Release of liquid hydrocarbon through open points on the #2 Pumpset. Fire likely a result of static electricity buildup	Pump station's automatic deluge system activated resulting in extinguishment of fire. Smaller second fire extinguished by Emergency Services. Investigations undertaken by Santos, the SA Police Dep. and the Dep. of Administrative & Information Services (DAIS). Extensive review of work practices and all emergency procedures. Safety review instigated of all hazardous areas. Re-inductions completed for work permitting and Emergency Shutdown Procedures (ESD). Pump Station rebuilt.
12/09/01	PSSM-52J9T2	Flowline(s) from Jena # 4 & 11	Screwed X52 type flowline failed and allowed produced oil from a free flowing well to discharge into the dry Strzelecki Creek. The volume of the spill suggests a volume of produced oil from the downstream manifold (Alwyn, Jena, Ulandi) backflowed to the flowline failure point due to failure of NRVs at the manifold	Crude Oil/Formation Water	480 to 500	Approx 70%	Approx 170	Internal corrosion to flowline	Fields shut in that flowing into manifold feeding the flowline failure point. Mobilised clean up operation. Area fenced off. Contaminated soil removed from spill site at request of pastoralist. X52 Linepipe removed. Review use of fibre reinforced line. Review Pipeline Management Plan and risk-rank pipelines to ensure focus directed on environmentally sensitive areas.
17/12/01	PSNT-55KCLG	Pipeline - approx 8 km upstream Merrimelia Oil Satellite inlet	Leak identified on section of the oil pipeline in relatively close proximity to the Cooper Creek. The pipeline was isolated at inlet discharge and closest mid line valves.	LI-Crude Oil	2	5	1.9	Corrosion	The failed section of line has been exposed from drift sand and an external pipe clamp applied. Review Pipeline Management Plan and risk-rank pipelines to ensure focus directed on environmentally sensitive areas.

Reportable Incidents

Date 2001	Report #	Site	Occurrence	Substance Released	Total Vol Unc. (m ³)	Water %	Vol. Hyd Unc. (m ³)	Root Cause	Remedial Actions
2/07/00	PSSM-4LUAHD	Moomba#94	Satellite XV-0004 shut in and Moomba 94 kept running. Line pressured up and PSV lifted.	LI-Crude Oil	6	70	1.8	Mechanical / Electrical Failure	Raked spill, spread fertiliser, raised work orders to check LSHH-0004 set point and shut down set points on Moomba 94 and Moomba 104
3/07/00	PSSM-4LVTRC	Caladan#2 flowline. 800mts from tie in	Flow line failed exposing pipe line.	GA-Natural gas	0	0	0	Corrosion	isolated flowline
3/07/00	SSTA-4LVT6F	Tirrawarra #49 flowline, near well head	Operator heard "bubbling" noise coming from flooded area of the Tirrawarra east field, at approx 1645 hrs. Tried to access area by airboat, but unable to get close enough. Finally accessed area by aluminium boat. Located leak on flowline (submerged) near	LI-Crude Oil	1.5	25	1.13	Mechanical / Electrical Failure	Flowline isolated 1815hrs 3/7/00. Area inspected by airboat 0800 hrs 4/7/00.
15/07/00	SSTA-4M97SB	83.4Km from Keleary Satellite	Pin hole leak in Keleary oil trunkline	LI-Crude Oil	0.26	0	0.26	Process or procedural error	Pipeline shut down & inspection carried out
19/07/00	ITHY-4MD6A3	Crude Loadout Pumps Bund Adjacent to 1110 B & C	Drain clogged with sand has overflowed	LI-Crude Oil	0.02	50	0.01	Unknown / Undetermined	Reported to control room
24/07/00	PESS-4MJ2HG	Merupa 1	Hydraulic oil leaked onto the ground from a 200 litre drum. The drum was found to have cracked at the base during transport from Moomba base to lease (four hour drive time)	LI-Lubricating Oil/Hydraulic fluid	0.01	0	0.01	Mechanical / Electrical Failure	Superphosphate was spread and worked into the area.
25/07/00	PSSD-4MM8CE	Narcoonowie facility	Both 1000 bbl tanks situated in bund area had been cleaned of sludge, the jet pump with a resized nozzle had been started and run for two days when the tanks vented crude/water due to high level tank switch malfunction.	LI-Crude Oil	0	0	0	Mechanical / Electrical Failure	Suck truck cleaned up contained area straight away, Instro tech inspected and rectified high level tank switch malfunction.
26/07/00	RCRS-4MM4PG	Fire Ground	Fire Fighting Training being held, oil carried off concrete pad by water spray	LI-Crude Oil	0.01	0	0.01	Design Factor	Maint request raised to clean up contaminated soil MSR 42414

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8/08/00	OSTA-4MZT3U	Meranji Oil Receiver	A pig was retrieved from the Meranji Oil Receiver and returned to service. The Bleed/ Locating Pin was not screwed in fully - on commencing export the oil was discharged through the bleed valve.	LI-Crude Oil	0.25	0	0.25	Human Factor	Secured Locating Pin
10/08/00	ITHY-4N33PM	Exclusion Zone Waste Pit	Waste oil/water being deposited into exclusion zone waste pit incorrectly being spilled into entrance to waste dump. Also disposable overalls left in pit	LI-Crude Oil	0.2	50	0.1	Unknown / Undetermined	Contractor supervision notified of issue, plans made to clean up spillage
16/08/00	SSTA-4N9UFA	Merrimelia interceptor pond - skimming frac tank.	Skimming oil from interceptor pond into frac tank. Frac tank filled quicker than expected and started to overflow. Estimate that the tank overflowed for 15 minutes. Estimate less than 1 cubic meter of oil spilt onto ground surrounding the frac tank.	LI-Crude Oil	1	0	1	Process or procedural error	Organised fertiliser to be spread over the spill and to be raked in.
28/08/00	OSTA-4NMVTG	Leak is 1.3 Km from Keleary Satellite travelling to Telopea	Flow line from Telopea Jet Pump to Keleary Sat failed. Pipe is corroded. Production fluid released onto ground.	LI-Crude Oil	120	95.5	5.4	Mechanical / Electrical Failure	Shut down pumps isolate line and depressured
12/09/00	KFER-4P4W4V	CPI - skim oil pit	While operating the vacuum truck to empty the skim oil pit, the sludge tank ball-cock stuck in the open position allowing crude oil to spill through the overflow pipe	LI-Crude Oil	0.05	0	0.05	Mechanical / Electrical Failure	Check/repair operation of ball-cock covered area with dry-sorb and oily soil to be removed.
14/09/00	PDSM-4P736E	No. 4 Regenerator Tower	Leak noticed coming from Regenerator Tower.	LI-Other liquid			0	Corrosion	Reduced Process flows and Reboiler rates. Affected area bunted off.
17/09/00	OSTA-4P9AM2	Tirrawarra Evaporation Pond	A discharge Wilden Pp. hose split while Skimming the Evap. Pond. Discharging Oil on the Northern side of the bund wall.	GA-Condensate	0.4	0	0.4	Human Factor	Stopped Pump & isolated line to contain a further spill.
22/09/00	SSTA-4PE3J2	Meranji #3 jet pump	Area operator found Meranji #3 jet pump shutdown, and a spillage of water and oil on the lease. The flexible discharge hose had split. The jet pump had shutdown on low discharge pressure, but the well had free flowed. The spillage was mainly water, with a	LI-Crude Oil	2	95	0.1	Mechanical / Electrical Failure	Jet pump shutdown until a new hose can be installed. Area inspected. After the spillage has dried out, fertiliser will be spread and the area raked over.
23/09/00	SSTA-4PF5TS	Merrimelia Oil Lact Unit	Lact filter gasket failure	LI-Crude Oil	0.1	0	0.1	Mechanical / Electrical Failure	Isolated filter and replaced gasket

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26/09/00	SSTA-4PHVQF	Tirrawarra recovery Tank	Recovery oil tank over flowed due to a air lock in the pump	LI-Crude Oil	0	0	0	Mechanical / Electrical Failure	Washed down tank - recover oil back into the system
26/09/00	PSSM-4PL7A8	Close proximity to Lime Stone Creek Satellite	Leak from underground export line from LSC to Strz oil satellite.	LI-Crude Oil	2	85	0.3	Corrosion	S/D field, stop shipping, exposed leak, stop contamination, expose flowline, installed clamp, fence off the contaminated area and restoration of the affected area is being conducted.
30/09/00	LSMA-4PNU6C	No.6 Regen gas Compressor suction filter flange	On opening the flange approximately 500g elemental mercury spilled to ground (mostly on to the concrete pad although some small droplets reached soil areas off the concrete pad).	LI-Other liquid	0.0005	0	0	Natural Hazard	The majority of the spill was collected with dustpan and brush (as hand suction device was ineffective). Many very small droplets remained in the surface textures of the concrete pad and the amount contaminating surrounding soil has not been estimated. T
4/10/00	PSSM-4PSUJB	Moomba North Compressor Facility	Empty 200 litre drums being used to decant waste oil. Waste oil appears to have been spilt whilst decanting.	LI-Lubricating Oil/Hydraulic fluid	0.2	0	0.2	Human Factor	None
29/10/00	PESS-4QK9Z8	Merremelia 39	The well has been recently drilled and fraced and a coil tubing proppant cleanout and fluid unloading had been performed the day before the incident. The well was left on BDTA (blow down to atmosphere overnight), flowing at 1400 psi through a 40/64" fixe	LI-Crude Oil	0.1	0	0.1	Process or procedural error	The laboratory will advise on the best remediation, which will probably be to grade fertiliser into the area affected.
12/11/00	PSSM-4QZSLL	Daralingie flare stack	Operator repaired flare condensate drum butterfly drain valve. This valve had been seized shut for some time. Being a butterfly valve, liquid from the oily water line (which shares a common drain line with the flare drum to the pond) passed back through t	GA-Condensate	1	10	0.9	Design Factor	Isolated drain line from flare condensate drum
16/11/00	OSTA-4R535G	Merrimelia Oil inlet manifold area.	When depressuring PSV line fluid was released from the line that was thought to be depressured.	LI-Crude Oil	0.4	80	0.08	Process or procedural error	Isolated ,depressured and drained line.

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20/11/00	PSSM-4RB2QV	LRP Pipeline booster pumps	During power failure, PSV 18882 vented into bunded area at pipeline booster pumps. Plant vacuum truck was used to remove crude. A small amount of crude seeped out through cracks in concrete and stained the gutter alongside the bund.	LI-Crude Oil	0	0	0	Mechanical / Electrical Failure	Vac truck removed crude, PSV 18842 removed, overhauled and refitted. WO 384162 raised to remove stained soil in gutter.
2/12/00	PSSM-4RN9AA	Jena#4 flowline close to Jena Manifold	Underground barrel union on Jena#4 flow line failed and discharged crude oil to surface as a result of passing isolation valve on the flowline at the manifold.	LI-Crude Oil	5	60	2	Corrosion	Depressured the manifold, removed the oil from the ground by means of vacuum truck, removed the faulty barrel union and plug the line (Jena #4 is not a producing well)
2/12/00	PEBO-4RNDYR	Moomba 118 EPT Facility	Moomba 135 gaseous oil well was being free flowed to a tank farm at Moomba 118. The well was choked back to 32/64ths and the gas venting to atmosphere was enough to carry out a small amount of oil spray.	LI-Crude Oil	0	0	0	Process or procedural error	Choke back the well further. Install extra flame arresters on the wash tanks. Install an in line gas separator upstream of the wash tanks.
4/12/00	PSSM-4RPW3D	Alwyn #1 manifold	Flow line from Jena#13 to Alwyn#1 manifold failed as a result of corrosion and spill approximately 5 m3 of oil+water.	LI-Crude Oil	5	60	2	Corrosion	Depressured the Jena #13 flow line and isolated. Arranged Vacuum truck to remove contaminated soil and free oil. Restoration of the contaminated area to follow.
5/12/00	OSTA-4RQ7HU	Merrimelia #19 Jet Pp.	3/8" Pressuring Sensing line failed- releasing crude oil to grade.	LI-Crude Oil	1	0	1	Mechanical / Electrical Failure	Unit was isolated & Plugged
9/12/00	OSTA-4RUR4C	Keleary Jet Pump.	Leaking Packers on the Jet Pp. over filled sump and ran to grade.	LI-Crude Oil	0.2	90	0.02	Mechanical / Electrical Failure	Pump was shut down, isolating spill and sump was pumped out to Frac. Tank.
11/12/00	PSMA-4RX9FL	Big Lake Condensate Recovery Tanks.	Recovery tank over flowed during skimming operations.	GA-Condensate	1	75	0.25	Human Factor	Inspection carried out and remedial work will be initiated.
16/12/00	PESS-4S48B5	Dillions Hwy, 27 km north of the Della road intersection.	A seam on a hydraulic oil reservoir tank split during a move from Kidman Satellite to Bookabourdie.	LI-Lubricating Oil/Hydraulic fluid	0	0	0	Mechanical / Electrical Failure	A bund wall was constructed of earth to contain the leakage on the western verge of the road.

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25/12/00	PSSM-4SC6TP	Approximately 800 metre from the wellhead	Leak occurred at one of the thread joints on the 3 1/2" EUE tubing (flow line)	LI-Crude Oil	5	95	0.25	Corrosion	Shut the well in, depressured the flow line, inspected by Moomba Maint and Block Oil Engineer for an appropriate repair on flow line as well as removal of contaminated soil and restoration of the affected area.
27/12/00	PSSM-4SEAAB	In the satellite 20 metres from the shipping pumps	A leak detected on the buried section of LSC oil export line at close proximity of the shipping pumps at the satellite	LI-Crude Oil	0.1	50	0.05	Corrosion	Shut the shipping pumps, depressured the line, exposed the pipe and installed a 4" x 5000# pipe clamp and recommenced shipping.
27/12/00	PSSD-4SEVNG	Narcoonowie 4 wellhead.	The Wellhead stuffing box began to leaking over night spraying area with fluid.	LI-Crude Oil	1	92	0.08	Mechanical / Electrical Failure	Operator shut Beam pump down in the morning and changed the packers in the stuffing box.
28/12/00	OSDI-4SF4LG	Strzelecki oil satellite #2 oil inlet skid.	leakage through a 1/2in loose nipple connection on the chemical injection line to the oil skid discharge pipe	LI-Crude Oil	0.25	90	0.03	Corrosion	Tightened loose nipple connection and stopped leakage
28/12/00	PSSM-4SH6AV	Moomba Plant Warm Separator V-2275B	Mercury leaked from an annubar flange to grade on the Warm Separator condensate dump line. Mercury pooled on the ground and ran into ant holes in the soil.	LI-Other liquid	0.02	0	0	Natural Hazard	Mercury cleaned up by laboratory personnel and removed from site. Mercury vapour analysis performed and reported (ref: ar2585.doc).
3/01/01	ASSD-4SN8W4	Moomba Stores	Valve on corrosion inhibitor not fully closed, leading to spill	Chemical	0.2	0	0	Human Error	Valve closed. Soil removed to stockpile. Toolbox meeting held
3/01/01	SSTA-4SM8FS	Tirrawarra Oil Trunkline	Pinhole in trunkline causing release.	Crude oil	1	0	1	Corrosion	Soil removed to landfarm. Line fixed. Pipeline being mothballed.
12/01/01	ASSM-4SWUV6	Moomba Loadout Facility	Dry brake on inhibitor tank manifold failed open during loading from tanker.	Chemical	0.05	0	0	Mech Failure	Toolbox meeting held. Dry brake to be replaced.
16/01/01	PSSM-4SZT3V	Moomba Plant	During skimming of frac tank, overflow drain blocked by sludge and tank overflowed.	Crude oil	1	0	0	Design	Soil removed to landfarm. Grating to be removed.
19/01/01	TBAT-4TAVSD	Tirrawarra Road	Metal on road propelled into fuel tank causing rupture of tank.	Diesel	10	0	10	Mech/Elec	Spill left to remediate in situ.
20/01/01	PSSM-4T6CTL	Moomba 104 tank farm	Actuator valve misaligned, leading to test fluid from well overflowing test tank	Crude oil	20	70	0	Human Error / Design	Soil left to remediate in situ. Procedure changed to reduce risk. Engineering examining addition of valve to remove risk.

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28/01/01	OSTA-4TE9FV	Merrimelia #19 jet pump	Sensing line vibrated to point of failure	Crude oil	1	0	1	Mech / Design Failure	Line repaired. Re-occurrence risk still exists.
29/01/01	PSSD-4TF34M	Dullingari Diesel Storage tank	Sight glass valve left open and sight glass tube failed. Time and cause unknown.	Diesel	3	0	3	Human Error	Soil to be removed to landfarm. Hole plugged.
30/01/01	PSSM-4TRNE5	Moomba TK 1000	Spill from water draining on southern side of tank. Time and cause unknown.	Crude	3	90	0.3	Unknown	Water line drain hose to be removed and valve blanked off.
17/02/01	SSTA-4TZU44	Tirrawarra workshop waste pit	Hole in can in waste pit leaked engine sump oil.	Diesel	0.2	0	0.2	Corrosion	Oil cleaned up for disposal.
23/02/01	OSTA-4U95RC	Meranji #6 well head	Water in underground sump tank being drained to ground. Left unattended to do other priority work and oil drained to ground.	Crude oil	7	80	1.4	Design / Human Error	Soil left to remediate in situ.
26/02/01	PSSM-4UB3Z3	Moomba Tank 104	Excess stormwater pumped to tank, overloading overflow. Oil on top of tank overflowed.	Other Liquid	0.5	0	0	TBA	Investigation of causes and solutions
3/03/01	CSMA-4UMVAQ	Coonatie #1 wellhead	Leaking inhibitor pump piston seal.	Chemical	0	0	0	Design	Spill cleaned up. Spill tray fabricated. ~85% of wells do not have such a tray.
5/03/01	OSTA-4UJ5JD	Tirrawarra satellite	Opening of pig barrel led to residual oil in barrel spilling to soil	Condensate	0.25	10	0.2	Design	Design of drainage system being investigated.
10/03/01	PSSM-4UP5ZB	Tantanna #5 line	Old redundant pipeline failed.	Crude oil	0.2	90	0.02	Corrosion	Soil removed to landfarm. Pipeline isolated.
15/03/01	OSTA-4UW97V	Tirrawarra satellite	Inlet separator water dump valve failed open, overloading washtank and recovered oil tank, leading to overflow to unlined bunded area.	Crude oil	1	0	1	Design/ Mech	Recommendation to install high level alarm connected to Moomba field control.
15/03/01	PSSD-4UTUEF	Dullingari satellite	Oil metering skid improperly commissioned following maintenance. Valve left open to blocked drain.	Crude oil	0.15	0	0.2	Human Error	Soil left to remediate in situ. Procedure reinforced. Drain to be unblocked.
17/03/01	PSSD-4UWS9Y	Strzelecki 15 nodal compressor	Condensate from compressor package vented to stack due to passing suction valves that needed greasing.	Condensate	0.2	0	0.2	Mech Failure/ Human Error	Soil left to remediate in situ. Valves greased.

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18/03/01	PSSM-4UZPA9	Patchawarra Flare Gas Recovery Compressor	Clamps pulled out from lube oil line from pre-lube pump, causing leak.	Lube oil	0.01	0	0	Mech/Elect Failure	Line replaced.
19/03/01	PSSD-4V3SBP	Dullingari Load-out facility	Chemical facility load-out hose leaked.	Chemical	0	0	0	Mech/Elec Failure	Hose replaced.
19/03/01	PSMA-4UYSVF	Lake Hope trunkline	PSV nipple at Tantanna pig launcher cracked and oil leaked to ground	Crude oil	3	0	3	Mech/Elec Failure	Soil left to remediate in situ. Engineering investigating whether support for PSV is required.
20/03/01	PSSM-4V2GQ4	Moomba Area 60 LRP compressors	Pads have no drains or bunds, so washdown water chased across roadway.	Lube oil	1	40	0.6	TBA	Soil left to remediate in situ.
20/03/01	PSSM-4UZFHG	Big Lake Evaporation Pond	Hose failed while transferring oily produced formation water from gas evaporation pond to oil pond.	Formation water	100	99.9	0	Mech failure	Hose replaced.
20/03/01	PSSM-4UZFCN	Sturt #7 beam pump	Stuffing box packers leaked.	Crude oil	2	90	0.2	Mech failure	Soil left to remediate in situ. Packers replaced.
20/03/01	PSSM-4UZF6Q	Sturt #4 beam pump	Stuffing box packers leaked.	Crude oil	2	1	2	Mech failure	Soil left to remediate in situ. Packers replaced.
20/03/01	PSSM-4V3E2V	Sturt #6 stuffing box	Stuffing box packers leaked	Crude oil	2	1	2	Mech Failure	Soil left to remediate in situ. Polish rod and packers replaced.
20/03/01	PSSM-4V3EBC	Moomba South Central	Compressor waste fluid sump overflowed due to evaporative cooling system leaking water.	Other Liquid	5	1	0	Design	Solution being investigated.
22/03/01	PSSD-4V3TLT	Dullingari Satellite	Oil weeping from LACT unit sensor steam seal	Crude Oil	0.02	0	0.02	Mech failure	Soil left to remediate in situ. Leak fixed.
26/03/01	PSSM-4V7VVE	Limestone Creek shipping pump	Shipping pump B suction valve failed, causing sump to overflow.	Crude oil	3	0	1	TBA	Increase in sump size being investigated.
27/03/01	PSSM-4V7W4S	Moomba SC Unit 2 compressor	Condensate discharged to ground from unit 2 compressor suction boot. Due to filter controller failing at night due to oil in instrument air.	Condensate	1	1	1	Design	Solutions being investigated.
27/03/01	PSSM-4V863N	Gidgealpa 44 ESP fuel tanks	ESP fuel tanks overflowed when being filled up.	Crude oil	0.2	0	0.2	Process /Procedural Error	Suitable sight gauge to be provided.

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27/03/01	PSSM-4V86JL	Mawson Kurunda Compressor	Emptying condensate into sumps. Sumps overflowed rather than draining into pit due to restriction and elevation of drain pipe	Condensate	1	1	1	Process /Procedural Error	Solution being investigated.
29/03/01	DSMA-4VD4DR	Moomba #133 lease	Contractor transferred drilling fluid from sump onto lease rather than flare pit. Sump too small for fluids.	Water based drilling fluid	31.7	98	0	Human Error / Design Error	Soil left in place to dry. Investigation occurring.
30/03/01	CSMA-4VB6ZN	Big Lake #25 wellhead	Inhibitor pump leak due to piston seal failure.	Chemical	0.01	0	0	TBA	Soil removed. Seal replaced.
1/04/01	PSMA-4VESQT	MSC condensate recovery tank	Overflow line appears to have blockage.	GA-Condensate	0.1	50	0.05	Process or procedure error	Switched to gun barrel operation.
3/04/01	SSTA-4VLTQZ	Meranji #9	Jet pump plunger stuffing box leaked. Sump high level switch failed to shutdown pump on high level.	LI-Crude Oil	3	95	0	Mech/ Elec	High level switch repaired. Stuffing box repaired. Some liquids recovered.
14/04/01	PSSM-4VSVNV	Tantanna shipping facility	XSV on the Gidgealpa oil trunkline at Moomba plant inlet closed caused high pressure on Tantanna T/L and lifted the line PSV releasing crude oil into the sump and overflow to surrounding.	LI-Crude Oil	1.5	20	0.4	Unknown/Un-determined	Stopped shipping at Gidgealpa to reduce the line pressure. Vacuum truck arranged to empty the sump and clean up the area.
18/04/01	PSSM-4VYF8F	Alwyn 3	The crude oil fuel line to the beam pump was found to have a pin hole.	LI-Crude Oil	0.1	0	0.1	Mech/ Elec	Replaced crude fuel line.
22/04/01	PSSD-4W348V	Toolachee satellite	Loading into a vacuum truck	GA-Condensate	0.03	0	0.03	Human Factor	Area raked and sprayed with water. Talked to driver how to avoid a repeat of incident.
22/04/01	PSSM-4W2EPN	Tantanna 8 jet pump	The jet pump discharge bypass 1" nipple cracked.	LI-Crude Oil	5	1	4.95	Mech/ Elec	Jet pump shut down section of pipe removed for repairs.
27/04/01	PSSM-4VEAUV	Biala#3 fuel supply line to beam pump	Fuel tank contents drained as a result of corroded underground fuel line. The well recently worked over after being shut down for about 2.5 years.	LI-Crude Oil	3	15	2.55	Corrosion	Removed the contaminated soil and restored the affected area. The new fuel line has been installed.

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7/05/01	PSMA-4WMUQZ	Biala #3	Oil spill from stuffing box. Well has been Off-line from the 6th of May but only began leaking oil overnight(7/5 - 8/5) Suspect increase in tubing head pressure while shut down contributed to leak.	LI-Crude Oil	0.25	1	0.25	Mech/ Elec	Well placed Back on line. Stuffing box adjusted and packing will be replaced should leak occur.
8/05/01	OSTA-4WJTCH	Tirrawarra Satellite Lact Skid	Lact Sampler seals failed and fluid was released onto the skid via the air vent in the solenoid valve.	LI-Crude Oil	0.03	0	0.03	Mech/ Elec	Isolate sampler and solenoid, clean area of oil.
9/05/01	PSSD-4WL8GD	Kidman LP inlet separator	Crash dump valve leaking moderately at packing gland.	LI-Produced water	0.01	100	0	Mech/ Elec	Tried to nip up gland. No result. MJR 340683 raised 9/5/01.
9/05/01	PSSD-4WL934	Della Satellite	Diesel fuel tank and diesel water pump been on location at ground level for some years without a spill tray	LI-Diesel	0.2	0	0.2	Design Factor	Reported incident.
10/05/01	PSSD-4WL2G2	Dullingari pig launcher	1" A/G valve opened when depressurising body of 30" pig launcher ball valve	GA-Condensate	0.01	0	0.01	Design Factor	Work order 406380, raised 10/5/01, to connect valve to drain system.
12/05/01	PSSD-4WR87Z	Toolachee 28	13 LED acid batteries found smashed in a heap.	LI-Chemical	0	5	0	Human Factor	Removed batteries for disposal.
20/05/01	PSSM-4WY2MB	Limestone creek facility	Operator found crude oil leak at Limestone creek on the shipping pump 'B'.	LI-Crude Oil	4.5	0	0.1	Mech/ Elec	Shipping pump'B' shut down and isolated awaiting repairs.
22/05/01	PSSM-4X25VM	Big Lake #8 wellhead	Bleed valve nipple on williams Pump was open, leaking corrosion inhibitor.	LI-Chemical	0.1	0	0	Human Factor	Closed the bleed valve nipple.
29/05/01	PSSM-4X8VKX	Big Lake 58/59 Jet pump	XSV closed downstream of the PSV on discharge line, PSV lifted prior to the jet pump shut down as a result of instrument problem on jet pump and released oil and water to grade.	LI-Crude Oil	1	20	0.8	Unknown/Un-determined	Replaced faulty regulators on the jet pump, cleaned up the affected area. The PSV discharge should be drained into a contained area and therefore an action is required to collect PSV drains in an contained area.

Date 2001	Report #	Site	Occurrence	Substance Released	Total Vol Unc. (m ³)	Water %	Vol. Hyd Unc. (m ³)	Root Cause	Remedial Actions
29/05/01	PSSM-4X8UXZ	Inside LSC satellite	The operator noticed oil flowing to surface above the trunkline downstream of the shipping pump at LSC satellite.	LI-Crude Oil	12	20	9.6	Unknown/Undetermined	Informed Moomba Production, shut down shipping pumps, redirected all production into the tanks. Excavated contaminated soil, removed all fluids from the trench, installed a clamp and recommence shipping. It is now appropriate to replace the clamped section of the pipe (approximately 15 metres of the pipe which are repaired with 3 pipe clamps). With winter approaching expected increase risk of the line failure (higher pressure to transport fluids) so engineering input required.
30/05/01	PSSM-4X7PZC	Early Patch	CSP upset, slug catchers, Gidgealpa pig arrived, full tk 103/102 overflowing to slug catcher area sump and recovered oil tank sump overflowed.	LI-Crude Oil	1	50	0.5	Unknown / Undetermined	Suck truck called out twice, unit oil directed back to CSP.
31/05/01	PESS-4XF9D4	Nulla 1	There was a hydraulic oil leak from a blown oil filter seal.	LI-Lubricating Oil/Hydraulic fluid	0.07	0	0.02	Mech/ Elec	Stopped the job, secured the well, shut down the power pack, banded the small amount of oil that made it to the ground, spread and raked in bio-remediation material.
3/06/01	PSMA-4XL4DL	Murta South Nodal	Frac tanks overflowing into bund wall.	LI-Produced water	10	99	0.1	Design Factor	Unit shut down and isolated.
3/06/01	PSMA-4XL5F2	Murta Sth Nodal	On start up of unit when pre lube button pressed condensate stream (approx 20Lts) sprayed out of the vent onto the ground.	GA-Condensate	0.02	0	0.02	Design Factor	Unit shut down awaiting response.

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6/06/01	PSSM-4XGEUX	Plant Stormwater Tank (TK-1000-104) and Stormwater Surge Pond	All Plant sumps and drain pits located within the CO2 removal, LRP and CSP sites are directed to the Plant stormwater system which is subsequently directed to the Northern Interceptor/Evaporation pond area for final disposal. Heavy local ambient precipitation (measured at 31 mm for the 24 hour period) resulted in the Plant Stormwater Tank (TK-1000-104) overflowing oily water to grade and the Stormwater Surge Pond bund wall failing and discharging oily water (currently lying underneath the LT Flare).	LI-Lubricating Oil/Hydraulic fluid	20	0.98	0.2	Design Factor	Clean-up and repair requirements assessed - currently waiting for area to dry prior to repair and remediation.
7/06/01	PSSD-4XGA6Y	Toolachee Satellite	Because of recent heavy rain, water from the compressor house shed roof and surrounding concrete drained into the underground sumps and they overflowed.	LI-Lubricating Oil/Hydraulic fluid	5	95	0.01	Design Factor	Sumps emptied.
10/06/01	PSSD-4XMS4L	Narcoonowie 4	Stuffing box packing allowed product to pass to atmosphere.	LI-Crude Oil	0.1	98	0	Mech/ Elec	Changed packing.
12/06/01	PSSD-4XMSZJ	Strzelecki satellite	Operator found stain on ground. Appeared to have happened some days before and not reported at the time	LI-Crude Oil	5	95	0.25	Human Factor	Reported and area to be raked.
12/06/01	PSSD-4XNRE3	Munkarie nodal	Droplets of oil from engine and compressor hitting ground.	LI-Lubricating Oil/Hydraulic fluid	0.01	50	0.01	Design Factor	Field Engineering have a project in place to fit a metal sheet under the unit to catch oil.
14/06/01	PSSD-4XP5RX	Strzelecki 15 evaporation pond	Interceptor pond full of condensate and this has now spilled over to the evaporation pond. Checked instrumentation and valving. Initial check looked OK but will need to monitor further discharge into pond for any passing block valves or instrumentation that may require recalibrating.	GA-Condensate	1	0	1	Unknown/Un-determined	Arranged for suck truck to clean up site on 15/6/01. Clean-up delayed due to wet roads.

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15/06/01	DSMA-4Y5U3C	Rig carrier area - Dullingari 54	Hydraulic hose between hydraulic pump unit and powertong burst while running surface casing.	LI-Lubricating Oil/Hydraulic fluid	0.08	0	0.08		Area cleaned up - removal of contaminated soil.
24/06/01	PDSM-4XZBG8	Moomba load out facility	Wancoocha storage facility northern load out line has pinhole leak western side of the tanks.	LI-Crude Oil	0.1	0	0.1	Corrosion	Line isolated at both ends.
24/06/01	PSSM-4Y29RR	On common flowline from Gidgealpa 27&22	Gidgealpa #27 and 22 have been shut in at the wellheads for some times. The leak identified during survey of the field. Failure occurred on the below ground section of the flow line.	LI-Crude Oil	0.4	80	0.08	Corrosion	Ensure the wellheads connecting to the flowline are shut in. Informed corrosion department and arrangement has been made to clean up the contaminated soil and replace, excavate the failed section and assess the reason for the failure and overall line condition.
25/06/01	SSTA-4Y2A4H	Tirrawarra #49 flowline approx 500 metres from well head	Operator found an film of crude oil approx 5 meters by 20 meters in a pond of "flood" water. The pond is a remnant of flooding of the Embarka swamp during 2000, the pond itself is approx 35m X 35m. Also observed was bubbling of gas from 2 points approx 3 meters apart.	LI-Crude Oil	0.2	0	0.2	Corrosion	Tirrawarra #49 immediately shut in.
27/06/01	PSSM-4Y4KWJ	PS1 sump	While purging pipework with nitrogen to the closed drain system, water was forced out of area sump via vacuum truck unloading point.	LI-Produced water	0.05	99	0	Human Factor	Vacuum truck removed fluid and clean fill spread over site.
3/7/01	PSMA-4YCUHM	Tantanna #9	Leak on flow line	LI-Crude Oil	20	95	1	Corrosion	Need to put a 3" clamp on flow line

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9/7/01	PSSM-4YH84X	Moomba south oil.	Operator arrived on site to find the inlet manifold sump overflowing due to the Moomba 136 flowline PSV lifting to the sump.	LI-Crude Oil	5	0	5	Human Factor	Manifold isolation valves to the tanks were opened to depressure the flowline and reset the psv. The flow line was isolated due to Moomba 136 having a workover rig installing an esp down hole. The workover rig decided to circulate fluid to the Moomba oil facility without informing the facility operator to open the inlet manifold valves. Earlier in the day the workover rig had circulated fluid and informed the facility operator who had opened the inlet manifold valves for that operation.
17/7/01	SSTA-4YQTRG	Keleary jet pump unit B	Operator found crude fuel leaking from engine fuel hand primer pump. A fine spray of crude fuel from the hand primer was directed over unit B and onto the adjacent unit A jet pump.	LI-Crude Oil	0.1	0	0.1	Mech/Elec Failure	Shut down unit B. Initiate repairs/replacement to hand primer pump.
17/7/01	OSDI-4YR7HW	Narcoo-nowie #4 well head	Small leak from around the thread of the well head discharge pressure switch	LI-Crude Oil	0.01	25	0	Mech/Elec Failure	Replaced switch
21/7/01	SSTA-4YU7Y9	Merrimelia oil satellite interceptor pit	Operator was draining water and emulsion from the first compartment of production tank A (1000 bbl tank). The compartment was being drained to the satellite interceptor pit, then pumped via Wilden pump to the interceptor pond recovery system. This had been in operation for 2 hours. The operator left the area for approximately 45 minutes. On return he found the Wilden pump had stopped pumping and the interceptor pond was overflowing.	LI-Crude Oil	10	85	1.5	Mech/Elec Failure	Draining ceased. Wilden pump to be inspected by Maintenance. Area bioremediation in progress.

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22/7/01	PEGE-4YVSV8	Tirrawarra 71	It is typical practice to unload a well to atmosphere to clean up after initial perforation. When possible it is flared (burnt), unless the mixture is too wet to burn. On this occasion, after the well was perforated for the first time, it was too wet to burn, and was a windy night, thus the mist spread over a large area. The next morning it was found the trees and vegetation downwind of the flare pit were covered in a waxy condensate like substance. This covered a visible area of approximately 200 x 50 m.	GA-Condensate	0.5	0	0.5	Process or procedural error	Flare lit the following night, but not able to light the previous night due to high initial water content.
25/7/01	PSSM-4YZS7Z	At Big Lake 58 Jet Pump Lease	High level switch in the sump activated (actual sump level was not at high level), the switch signal activated the ESD and closed however it did not shut down the jet pump. The jet pump continued pumping against the closed valve and lifted the suction PSV. The secondary shut down system on the pump (high pump discharge pressure did not operate to s/d the pump.	LI-Crude Oil	0.2	80	0.04	Mech/Elec Failure	Work order raised and all shut down systems were checked. The PSV to be reset for correct set point and requested to extend the PSV discharge into the sump to eliminate spill into environment in the case of recurrence. This will also applies to B/L #57 and 59 jet pumping wells.
27/7/01	OSTA-4Z26YB	Merrimelia oil # 19	Jet Pump vibrations caused a fracture in instrumentation line leaking fluid to ground.	LI-Crude Oil	0.5	0	0.5	Mech/Elec Failure	Clean up in progress.
4/8/01	LSMA-4ZATVY	Moomba Creek and stormwater drains	Oil flushed through the stormwater drain system has entered the Moomba Creek area. It is uncertain at this stage if there is more oil still to come out of the drain system.	LI-Crude Oil	1	98	0.02	Human Factor	Photos taken of the extent at this stage. A small sample collected. Process Supt notified.
4/8/01	PSSD-4ZBRPL	Satellite test tank	Operator draining water from test tank into open drain system to interceptor pond, continued with satellite routines, on return discovered drain system had backed up casing oily water contamination around drain area. No oil discharged from test tank.	LI-Crude Oil	0.01	95	0	Human Factor	Reported to field Superintendent, contractor hired to remove contaminated soil, and replace with rubble, affected area within satellite boundary fence.
9/8/01	PSSM-4ZG3VM	Moomba 127	6 dead Dusky Hopping mice (endangered species) found in cellar		0	0	0	Human Factor	Reinstalled cellar plates

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6/8/01	OSTA-4ZCTFZ	Merrimelia #21	Jet Pump discharge hose ruptured discharging water around pump onto the skid & lease	LI-Produced water	1	100	0	Design Factor	Pump shutdown and hose replaced
7/8/01	CRTA-4ZD368	Tirra Sat cond pump area.	On passing the satellite condensate area it was noticed that the area around the pumps was contaminated with condensate due to packer failure and drain blockage.	GA-Condensate	0.15	0	0.15	Mech/Elec Failure	Fertiliser spread around contaminated area, raked and watered in.
14/8/01	PSSM-4ZM6C6	Taloola # 2 & 4 flow line - At road crossing in close proximity to the Tantanna Oil Facility	The Tantanna oil facility inlet valves closed as a result of power generator failure early in the morning. Taloola #2/4 jet pump shut down on High Discharge Pressure (9000 Kpa), Taloola #2/4 flow line failed under this pressure due to localised internal corrosion (1/4" hole at buried section of 4" flow line at the edge of the satellite)	LI-Crude Oil	2	99	0.02	Corrosion	Excavated the failed section of the 4" line, removed all contaminated soil, inspected the pipe and installed a pipe clamp. Put the wells back on line. Please note that the discharge PSV was not lifted (set pressure 9200 Kpa) and the pipe failure occurred after the jet pump shut down.
14/8/01	PSSM-4ZM6C6	Taloola # 2 & 4 flow line - At road crossing in close proximity to the Tantanna Oil Facility	The Tantanna oil facility inlet valves closed as a result of power generator failure early in the morning. Taloola #2/4 jet pump shut down on High Discharge Pressure (9000 Kpa), Taloola #2/4 flow line failed under this pressure due to localised internal corrosion (1/4" hole at buried section of 4" flow line at the edge of the satellite)	LI-Crude Oil	2	99	0.02	Corrosion	Excavated the failed section of the 4" line, removed all contaminated soil, inspected the pipe and installed a pipe clamp. Put the wells back on line. Please note that the discharge PSV was not lifted (set pressure 9200 Kpa) and the pipe failure occurred after the jet pump shut down.
15/8/01	DBRN-4ZMAJF	P1183 Auto mix pump.	Diesel had leaked from the top plug on the seal pot of the auto mix pump, the pump is in a bunded area but the wind had blown a small amount of diesel onto the crusher dust next to the bund. The pump has not been used since being test run after a major overhaul, it appears that the hot weather had caused the diesel to expand, the top plug was only finger tight and the diesel leaked from this point	LI-Diesel	0	0	0	Human Factor	Level dropped in sight glass and plug tightened. Bunded area washed out and crusher dust cleaned up.

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20/8/01	PSSM-4ZULV4	Early Patchawarra facilities	During the de-commissioning of the temporary pumping facility at PS1, the suction line was being flushed with fire water that was then pumped to the oily water handling system. This overloaded the system causing a tun dish at TK-4570 to overflow	LI-Other liquid	0.4	90	0.04	Process or procedural error	Vac truck cleaned up liquids.
5/9/01	PSSD-52C5R6	Dullingari well head #30	Bourdan tube on 5000 psi pressure gauge broke. The liquid spilled through the gauge casing onto the well head cellar and surrounds.	LI-Produced water	2	100	0	Mech/Elec Failure	Replaced pressure gauge.
10/9/01	PSMA-52FUHM	Big lake #57 & #69	Instrument line failure from plunger pump sensor line(discharge). Power fluid leaking from instrument line	LI-Crude Oil	1	1	0.99	Mech/Elec Failure	1/4" instrument line repaired
1/10/01	PSED-535AR5	Plant - Northern end of N-S header, above field to flare valve station	Flange at the end of the oily water header leaked - dripping under normal operation, spray whenever a scrubber water dump valve opened	LI-Produced water	0.01	1	0	Mechanical/Elec Failure	Attempted to "nip up" flange - unsuccessful. Removed flange, replaced gasket and rebolted flange - successful
2/10/01	PSED-535EQJ	Kapinka #1 Lease	Operator arrived at the lease and found contents of the Inhibitor Tank on the ground. The leak was between the tank and the sight glass	LI-Chemical	0.1	0	0	Corrosion	Air supply to pump isolated. Tank valve isolated. Valves tagged. MJR raised for piping repair
2/10/01	PSSM-537TZA	Big Lake Satellite	Inhibitor leaking from bulk tank due to reducing bush not being nipped up with inhibitor leaking from around the seal	LI-Chemical	0.4	0	0	Mechanical/Elec Failure	Tightened reducing bush to eliminate leak
3/10/01	CMOE-5363FV	Inside the bunded area of tank-04-2304B	Release from mobile fuel tank	LI-Diesel	0.1	0	0.1	Mechanical/Elec Failure	Raised hose end to top of tank & padlocked
5/10/01	PSMA-53A5TS	Caladan #1 wellhead	Broken sight glass on inhibitor tank, Inhibitor has leaked onto ground.	LI-Chemical	0.35	0	0	Mechanical/Elec Failure	Pump and inhibitor isolated.
5/10/01	PSSM-53EBT6	Plant LRP B Train	Exp/Comp tripped and was not isolated immediately and consequently sealoil system overpressured and pushed oil out of breather pipe.	LI-Lubricating Oil/Hydraulic fluid	1	0	1	Human Factor	Vacuum truck cleaned up spill immediately after incident.

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6/10/01	AJOS-53B8XP	At main seismic camp SE of Woomanooka HS	During strong winds a piece of burning paper was blown from the main camp fire cage and ignited dry grass near by. The fire was rapidly beaten out and the fire cage hosed down to prevent reoccurrence.	Solids			0	Natural Hazard	1.All personnel informed of incident at following toolbox meetings. 2. Water extinguisher placed next to fire cage. 3.
8/10/01	PSSM-53BTH4	Moomba south oil interceptor pond	oil carry over to the pond	LI-Crude Oil	100	0	0	Unknown / Undetermined	Equalising flow to each wash tank as one wash tank was receiving little flow, and what flow there was seemed to be was mostly oil.
9/10/01	PSSM-53FAN8	Plant Early Patch sump TK-4590	Recovered oil tank Tk 1000-103 overflowed to the slugcatcher area sump Tk 4590 which consequently backed up the flow into the area sump and flowed out of a tun dish and the area sump. The spill stained about 20 sq. m. and collected in an excavation for a fire main repair job adjacent to the spill area. The sump pump was running but could not keep up with the inflow.	LI-Crude Oil	4	0	4	Design Factor	Vac truck has recovered oil from excavation.
10/10/01	CSMA-53Q6UA	Moomba #114 well lease	Leaking pump, tray plug was found removed	LI-Chemical	0.02	0	0	Mechanical/ Elec Failure	none
26/10/01	PSSM-53V2BD	Northern Interceptor Pond Frac Tank Bund.(Moomba Plant Offsites)	Contractor Skimming Oil/Water off of Interceptor Pond into Frac Tank, inadvertently allowed a small quantity to Overflow from Tank into Bunded Area.	LI-Other liquid	0.03	95	0	Human Factor	Soil removed & Area cleaned up.
26/10/01	PASM-53X95S	Biala #3 flowline	Routine inspection of flowline, found flange leaking.	LI-Crude Oil	1	85	0.15	Unknown / Undetermined	Replaced incorrect rated gasket with correctly rated flange gasket.
27/10/01	PASM-53YUQU	Moomba Oil Satellite evap pond	Failure of williams pump of reverse emulsion breaker.	LI-Crude Oil	3	0	0	Mechanical/ Elec Failure	Another chemical pump installed.Interceptor pond skimming in progress.
27/10/01	PASM-53X8VS	Jena 5 manifold	Manifold leak	LI-Crude Oil	2	75	0.5	Corrosion	Shut in Jena 5 and Jena 7

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28/10/01	PSED-53Y5D8	Narcoonowie Truck Loadout Pump	Crude oil leaked through a discharge hose pinhole.	LI-Crude Oil	0.01	0	0.01	Mechanical/Elec Failure	Hose replaced
28/10/01	PASM-53YTR5	Keena #2 well lease	Inhibitor leaking from inhibitor pump onto ground.	LI-Chemical	0.1	0	0	Mechanical/Elec Failure	Tank isolated and pump turned off.
28/10/01	PASM-53X9ES	Moomba 114 well lease	When instrument gas liquid blow down initiated the inhibitor blown over area.	LI-Chemical	0.4	0	0	Mechanical/Elec Failure	Contaminated soil removed from site ,and area cleaned up.
29/10/01	PSED-53YEMR	Dullingari Gas Satellite Interceptor Pond/loadout facility	Pond skimming storage tank overflowed, releasing approx 2m3 of pond skimmings into bunded area	LI-Crude Oil	2	0	0	Process or procedural error	Gunbarrel de-isolated and valve chained & locked open. Pond skimmings pumped from bunded area back into frac tank.
29/10/01	PASM-53YTNB	Jena #2 manifold	Routine checks of field,discovered manifold leaking from existing clamp at Jena #2.	LI-Crude Oil	1	70	0.3	Corrosion	Shut in Jena #2 ,isolate affected half of the manifold, oil recovered.
30/10/01	PSED-542JEJ	Plant - Aroona Nodal Compressor	Compressor shutdown. Fuel gas filter continued to drain liquids due to passing non-return valve backflowing condensate from the discharge header into the filter. Local sump overflowed into bund area.	GA-Condensate	0.5	50	0.25	Mechanical/Elec Failure	Discharge manual lock valve closed

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31/10/01	PSNT-545SZL	Plant - Blowdown Oil Tank		GA-Condensate	0.25	0	0.25		An investigation of the performance of the liquid condensate pumps - following the pigging - revealed that an additional two (2) of the three (3) remaining pumps had also failed. This left the satellite with only one (1) effective pump from four (4). All of these pumps have since been overhauled. The Inlet Separator has significant drain line blockages which will be resolved during a shutdown and clean out of the vessel starting on the 11th November 2001. And finally Patchawarra East Pipeline pigging operations have been suspended until after the clean out of the normal level control drain nozzles and lines on the Inlet Separator.
6/11/01	OSDI-547ULK	Plant - Natural gas oil bulk tank in the Dullingari Satellite	Worker completed transfer of oil from the bulk tank into the service truck. When the flexible hose was disconnected from the connection to the truck, oil spilled to the ground	LI-Lubricating Oil/Hydraulic fluid	0.01	0	0.01	Human Factor	Spilled oil was removed by pumping it into the waste oil tank.
9/11/01	PASM-54B5JF	Ulandi # 3 [Non flowing well] flowline	Pin hole leak developed	LI-Crude Oil	0.03	90	0	Corrosion	Clamped pin hole area removed and replaced contaminated soil
15/11/01	PCMA-54KVM3	Pipeline - Approx 300 mts west of Moomba #104 WH.	Small oil stain observed in the vicinity of a 'WEKO' pipe fitting associated with the Mba #104 to Mba Oil above ground pipeline.	LI-Crude Oil	0.04	0	0.04	Process or procedural error	None
16/11/01	PCMA-54KVAN	Moomba #148 WH beam pump.	A fine mist of crude oil was observed discharging to atmosphere. The mist originated from the polished rod packers. Some of the mist has stained approx 3 sq meters of ground, the bulk of the release has been contained within the WH cellar.	LI-Crude Oil	0.3	0	0.3	Mechanical/Elec Failure	Packer housing tightened.
18/11/01	PCMA-54MSWQ	Moomba Oil Satellite truck loadout facility	Suction hose to pump fractured. Pump was stationary at the time of release.	LI-Crude Oil	0.01	0	0.01	Mechanical/Elec Failure	Maintenance attended incident site and completed repairs to hose. Action to remove contaminated soil in progress.

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18/11/01	DCRG-54QEYN	Plant - Narcoonowie Oil Facility	Water leaking from 150NB line from washtanks to interceptor pond	LI-Produced water	3	100	0	Mechanical/Elec Failure	Retightened 150NB victaulic clamp where leak appeared to be originating.
20/11/01	DCRG-54QEAK	Plant - Toolachee North Nodal Compressor package	Broken 25NB HP gas line sprayed water and condensate over the compressor and onto the earth foundation pad	GA-Condensate	2	50	1		Free water and condensate removed with suck truck and contaminated soil outside of the foundation removed by backhoe for remediation.
20/11/01	DCRG-54TDU7	Strzelecki Satellite Interceptor Pond	Oil blown from Interceptor pond over the Northern bund wall, fence and area North of the fence. The incident occurred during a very windy day, on or about 16th November. This situation has arisen due to the recently identified need to prevent pond skimmings being returned to the process (and potentially introduce SRB's to the pipeline system) - no other method of dealing with pond skimmings has been available at this Satellite.	LI-Crude Oil	1	0	1	Design Factor	Temporary skimming facilities completed on 21/11/01.
26/11/01	PSED-54UGDL	Dullingari #23 lease	Inhibitor tank sight glass found broken during routine inspection of the lease. No evidence of failure mechanism. Contents of tank spilled to ground	LI-Chemical	0.2	0	0	Unknown / Undetermined	arrangements made for sightglass repair and removal of contaminated soil for remediation offsite
27/11/01	DCRG-54WT32	Mettika #2 lease	On arrival at lease, Operator observed Inhibitor tank sightglass leaking inhibitor to the ground.	LI-Chemical	0	0	0	Mechanical/Elec Failure	Sightglass isolated
29/11/01	CRTA-54WSTP	Tankfarm - inside bund wall	LH level alarmed in control room.Went to investigate, found pd p/p cavitating ,bled p/p ,determined level was decreasing and continued on with other work.Went back in approx one hour and level was HH.Found p/p cavitating again and diverted produced water to evap. pond	GA-Condensate	0.05	0	0.05	Design Factor	Bled p/p again
5/12/01	OSTA-556985	Meranji #14 lease	Out board Ball valve on an Overhead Fuel tank inadvertently opened by livestock in the area.	LI-Diesel	0.4	0	0.4	Process or procedural error	Tank valves isolated.

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8/12/01	PSSM-559VBS	Plant - Early Patchawarra facilities	Area was checked at 0630 hrs - all normal. At approx 0830 hrs it was discovered that the sump had overflowed. The high alarm had not activated in the control room and the pump had not started.	LI-Produced water	2	95	0	Mechanical/Elec Failure	WO 439670 raised to have level magnatrol overhauled and request to have area cleaned up is in the system.
12/12/01	PCMA-55D2GQ	Plant - MSC compressor house.	Wash down (fire) hose was incorrectly isolated. Uncontrolled water flow raised level to overflowing.	LI-Other liquid	0.1	0	0	Human Factor	Vac truck employed to carry out clean up. Discussion of isolation procedure with supervisor.
12/12/01	PCMA-55D2GQ	Plant - MSC compressor house.	Wash down (fire) hose was incorrectly isolated. Uncontrolled water flow raised level to overflowing.	LI-Other liquid	0.1	0	0	Human Factor	Vac truck employed to carry out clean up. Discussion of isolation procedure with supervisor.
16/12/01	PCMA-55HVZB	Tank Farm - Gidgealpa #44 test separator.	Tank overflowed during testing of well.	LI-Crude Oil	15	99	0	Human Factor	Well returned to production.
17/12/01	OSDI-55L62U	Dullingari Gas satellite LA 40 bulky tank	On start up of oil transfer from road tanker to bulky tank, oil leaked through the lose hose connection on the inlet of the transfer pump.	LI-Lubricating Oil/Hydraulic fluid	0.1	0	0.1	Process or procedural error	Repaired lose connection. Advised tanker driver to check all connections prior to initiating oil transfer.
17/12/01	PSNT-55KCLG	Pipeline - approx 8 km upstream Merrimelia Oil Satellite inlet	Whilst transporting personnel from Keleary to Merrimelia the helicopter pilot flew along the oil pipeline route to check for leakage. This leak was identified and reported. The pipeline was isolated at inlet discharge and closest mid line valves	LI-Crude Oil	2	5	1.9	Corrosion	The failed section has been exposed from drift sand and an external pipe clamp applied
17/12/01	OSDI-55L62U	Dullingari Gas satellite LA 40 bulky tank	On start up of oil transfer from road tanker to bulky tank, oil leaked through the lose hose connection on the inlet of the transfer pump.	LI-Lubricating Oil/Hydraulic fluid	0.1	0	0.1	Process or procedural error	Repaired lose connection. Advised tanker driver to check all connections prior to initiating oil transfer.
20/12/01	OSTA-55N2UT	Bookabourdie # 4 well lease	On a routine inspection of the well it was found that damage to the Inhibitor tank had occurred and part of the fluid had leaked on to the ground.	LI-Chemical	0.2	0	0	Natural Hazard	Informed Supervisor clean up underway.
28/12/01	PSCM-55UAA9	Moomba 41 wellhead.	The wellhead inhibitor tank valve leaking due to being split.	LI-Chemical	0.03	0	0	Mechanical/Elec Failure	The inhibitor tank has been emptied to stop the leak.

Date 2001	Report #	Site	Occurrence	Substance Released	Total Vol Unc. (m ³)	Water %	Vol. Hyd Unc. (m ³)	Root Cause	Remedial Actions
28/12/01	PSNT-55V8TM	Flowline - Tirrawarra Oil 'C' Manifold Tie In	Whilst going for a jog after hours, one of the Tirrawarra personnel noticed a fluid leak (as a spray) coming from some above ground piping - near the 'C' manifold tie in point. He immediately returned to site, contacted supervision and two operators were sent out to investigate the cause of the leak. It was discovered that the leak was coming from a valve which had been opened.	LI-Crude Oil	0.05	0	0.05	Natural Hazard	Operator closed the valve. There was no plug on the downstream side of the valve - this has now been installed. The tie in point is clearly visible from the roadway and no leak had been observed by personnel returning to Tirra at the end of the day (1700-1800 hrs). It is more than likely that cattle seen in the immediate local area may have opened the valve inadvertently.
31/12/01	PSCM-55Y342	Big Lake gas satellite evaporation pond	Over night cattle pushed through the fence to the big lake interceptor and evaporation ponds. The cattle consumed water and condensate, resulting in three cattle dying.	GA- Condensate	0	0	0	Design Factor	The fences have been repaired to the cattle proof standard. Discussions held with the landowner regarding compensation and evaporation pond management.

Appendix 4: Actions Arising from PIRSA Quarterly Environmental Management Meetings

PIRSA Meetings:

2 November 2000

23 February 2001

30 April 2001

30 July 2001

MINUTES forming ENCLOSURE to: 00/0294

TO: T AUST
FROM: MICHAEL MALAVAZOS
SUBJECT: NOVEMBER 2000 SANTOS QUATERLY COMPLIANCE MEETING
DATE: 3 NOVEMBER 2000

The following key issues and actions arose from yesterday's quarterly compliance meeting with Santos:

Agenda Item	Actions/Issues
1	<ul style="list-style-type: none"> Santos reported they removed tanks from Jena #2 site. Santos will now restore the abandoned ponds. Action: Tony Wright will visit this site on his next trip and monitor it as needed. Action: S Tunstill to amend incident reports to include close out column.
2	<ul style="list-style-type: none"> Action: Santos to incorporate TA's comments provided in letter dated 3/8/00. Santos to incorporate this guideline into their DQMS and advise PIRSA of the updated procedure.
3	<ul style="list-style-type: none"> SABU incidents for "important incidents" show trend above the acceptable target. The low number of these incidents and the management response taken has satisfied Santos board that these are being adequately managed. Action: John Hudson will look into a means of reporting quarterly at these meetings on the effectiveness of Santos' management against potential catastrophic incidents.
4	<ul style="list-style-type: none"> Action: I emailed S Tunstill to modify incident report so as to address "Rehabilitation Actions" and "Actions to Prevent Recurrence" as under previous reports.
5	<ul style="list-style-type: none"> Action: S Tunstill to send latest 6 monthly TPH analysis results and graphs for Jena 1 & 2, Ulandi 1, LSC-Strzelecki trunkline and Strzelecki satellite spill sites. Action: PIRSA to review draft report on bioremediation end point criteria and get back to Santos ASAP.
6	<ul style="list-style-type: none"> Action: Water contaminant analysis report for 2000 will be available to PIRSA shortly. Santos have recently completed taking sediment samples from various new and old interceptor pits and evaporation ponds in the CB. Analysis and assessment of the results are currently under way. Action: Report on the above analysis and assessment from Golder Associates is expected within the next month. <p>The next stage will be to incorporate these results in determining relevant objectives and performance criteria for formation water disposal facilities in the CB.</p>
7	<ul style="list-style-type: none"> The next stage of the Cooper Creek Spill study is still about 6 months away due to hold ups in the toxicological analyses.
8	<ul style="list-style-type: none"> In addition to your serious concern with the monitoring and analysis progress of the LTUs, Santos reported that they will be increasing the frequency of monitoring and data gathering for establishing a better understanding of the bioremediation rates at the LTUs. Action: LTU monitoring and performance review to remain on the agenda for discussion at all future quarterly meetings.
9	<ul style="list-style-type: none"> Action:

	<p>Andrew DeGaris will provide a presentation at the next meeting to clarify the casing integrity risk scores used in Table 3 of the annual report.</p> <p>Santos to present at the next meeting the NCSA Risk Score process used to establish table 4 in the annual report.</p> <ul style="list-style-type: none">• Action: PIRSA to provide a list to Santos of the remaining restored P&A well sites reported to PIRSA and awaiting PIRSA inspection, for Santos to check with its own records.• Action: PIRSA to contact S Tunstill to arrange a meeting to discuss the preparation of an EIR and draft SEO for production and processing activities in the CB. <p>J Hudson to be involved in relation to the EIR process being undertaken in parallel with Santos' fitness-for-purpose (FFP) assessment.</p> <ul style="list-style-type: none">• Action: J Hudson to involve PIRSA in the preparation of the FFP assessment report as considered necessary.
10	<ul style="list-style-type: none">• Next meeting 18 January 2001.

MINUTES forming ENCLOSURE to:

00/0294

TO: T AUST; R A LAWS
FROM: MICHAEL MALAVAZOS
SUBJECT: FEBRUARY 2001 SANTOS QUARTERLY COMPLIANCE MEETING
DATE: 23 FEBRUARY 2001

The following key issues and actions arose from yesterday's quarterly compliance meeting with Santos:

Agenda Item	Actions/Issues
1	Actions from Previous Minutes <ul style="list-style-type: none"> All action items from previous meeting adequately addressed.
2	SABU Environmental Incident Targets SABU progress against its environmental incident targets for 2000 was tabled (Attachment #1). Key points: <ul style="list-style-type: none"> Uncontained liquid hydrocarbon spills released in 2000 were well below the 25% target of the 1999 total volume released. The number of 'important' environmental incidents in 2000 was slightly higher than the 1999 total. ACTION: Santos to review its definition of 'important' environmental incidents and its reporting procedures of such incidents.
3	Incident Reports A summary of all 'important' environmental incidents for the period 1 October to 31 December 2000 was tabled (Attachment #2). ACTION: <ul style="list-style-type: none"> Tony Wright to enter these into PEPS database. Andrew Disney to ensure that all close out actions are entered into the rehabilitation/preventative actions column in the table and until such time the table will remain as a running list of incidents awaiting close out.
4	Oil Spill Site Rehabilitation Monitoring <ul style="list-style-type: none"> No scheduled monitoring results and 6 monthly TPH analyses were tabled. I recommended that until such time that the end point spill rehabilitation criteria are finalised, Santos may want to suspend their scheduled monitoring. Susan Smith of Santos tabled a summary discussion paper (Attachment #3) of the oil spill remediation end point criteria report. The findings of the final report will be incorporated into the EIR and SEO currently being prepared for Santos' production and processing activities. Action: Susan Smith to submit final draft of end point criteria report to PIRSA within a week for comment and discussion.
5	Produced Formation Water Assessment Criteria <ul style="list-style-type: none"> Sediment sampling of existing evaporation ponds completed and currently being analysed. Soil in abandoned and disused evaporation ponds will also be undertaken shortly, eg at the Mudallee, Wancoocha facilities. The outcome of the above sampling will be to determine the soil contamination profile so as to establish the rehabilitation requirements on the basis of the NEPM risk assessment process. Actions: <ul style="list-style-type: none"> Santos to use these findings of the sampling to finalise the formation water disposal criteria and to incorporate the risk assessment findings into the production and processing EIR/SEO. Santos also reviewing performance and management of Moomba 3 hot water, Lake Brooks, Northern Evaporation Pond and Truck wash down water disposal facilities. The excessive vanadium issue in relation to the Northern Evaporation pond is also being addressed through a review of the plant process.
6	Cooper Creek Oil Spill Project Ecotoxicological analysis of samples currently underway and expected to be finalised within a

	<p>month.</p> <p>Action: Santos to meet with PIRSA to discuss results once received.</p>
7	<p><u>Moomba Land Farm (LTU)</u></p> <p>Action: Andrew Disney advised draft report on the Moomba LTU performance with recommended management practices (including end point criteria) will be sent to PIRSA and the EPA at the end of February for comment.</p> <p>The final report for inclusion into the EIR/SEO process will be available by the end of March 2001.</p>
8	<p>Production and Processing EIR/SEO Santos advised that a draft of the front end of the EIR is almost complete and the risk assessment section of the report is commencing which will incorporate the findings of the Fitness for Purpose Assessment as they come to hand and the results of the oil spill end point criteria and formation water disposal studies.</p> <p>Action:</p> <ul style="list-style-type: none"> • Susie Smith and myself to meet on Monday 26 February to go through contents of draft EIR so far and discuss content and format of risk assessment section of EIR and content of SEO. • Susie Smith to be involved in future discussions between PIRSA and Santos on the Fitness for Purpose Assessment to ensure that the information from the FFP is incorporated into the EIR.
9	<p>Fitness for Purpose Assessment Report Allan Rooney – a consultant engaged by Santos to prepare the FFP assessment report – reported that he is about 40% through compiling the report as required under Regulation 30. His compilation is based on information extracted from various risk assessment reports already undertaken by Santos and other consultants and those undertaken on behalf of insurers etc.</p> <p>Action: John Hudson to forward a first draft of the FFP assessment report to PIRSA by the end of March for PIRSA review and discussion with Santos and Allan Rooney on an informal basis.</p>
10	<p>Drilling Risk Assessment Andrew DeGaris of Santos explained the Santos well integrity risk assessment report (Attachment #4). This presentation clarified the rationale and meaning behind the well risk factors specified in last years annual compliance report.</p> <p>NCSA Risk Score Procedure</p> <p>Action: Myself to arrange a time with John Hudson for a few of us to sit down and go through the NCSA risk assessment process used at Santos.</p> <p>PIRSA Report on Restored Well Sites I provided a summary of our latest assessment of Santos restored well sites and advised that PIRSA is satisfied from the sample of well sites assessed with Santos' restoration practices.</p> <p>Action:</p> <ul style="list-style-type: none"> • PIRSA to submit final well site assessment report to Santos ASAP. <p>PIRSA Site Visits S Tunstill requested copies of any reports on PIRSA's recent inspections.</p> <p>Action:</p> <ul style="list-style-type: none"> ▪ PIRSA to submit report ASAP on its recent field inspections on the integrity of the information provided in Santos' last annual compliance report.
11	<p>Della 20 Incident Andrew DeGaris of Santos advised of a recently detected surface casing pressure increase at Della 20. Preliminary investigations have identified the source of the pressure to be a result of water coming from the Namur reservoir behind casing.</p> <p>Action: This incident will be treated as a serious incident, as defined in the CB drilling SEO, and therefore reported formally to PIRSA in accord with Regulations 32(3) and (4).</p>
	Next meeting 23 April 2001.

MINUTES forming ENCLOSURE to:

00/0294

TO: T AUST; R A LAWS
FROM: MICHAEL MALAVAZOS
SUBJECT: APRIL 2001 SANTOS QUARTERLY COMPLIANCE MEETING
DATE: 30 APRIL 2001

The following key issues and actions arose from the 27 April quarterly compliance meeting with Santos:

Agenda Item	Actions/Issues
1	Actions from Previous Minutes <ul style="list-style-type: none"> All action items from previous meeting adequately addressed.
2	SABU Environmental Incident Targets SABU progress against its environmental incident targets for 2000 was tabled (Attachment #1). ACTION: SABU and QNTBU to meet with review definition of 'important' environmental incidents and its reporting procedures of such incidents.
3	Incident Reports A summary of all 'important' environmental incidents for the period 1 January 2001 to 31 March 2001 was tabled (Attachment #2). Key finding is that the statistics show that jet pump spills appear to be a recurring incident. ACTION: <ul style="list-style-type: none"> Tony Wright to enter these into PEPS database. Need to review jet pump incident spills in next quarterly report. Tirrawarra Trunkline January 2001 Spill Incident Martyn Cooper of Santos reported the following on this spill incident. <ul style="list-style-type: none"> Cause appears to be sulphur reducing bacteria. Corrosion occurred on previous defect detected by 1996 pig survey. This incident has demonstrated that the SRB monitoring and control in this pipeline is not complete. Short term solution to this problem consists of biocide treatment, weekly helicopter surveillance and removing source of SRB as found in Tirrawarra stormwater disposal sumps. An audit of the block oil system was initiated to reveal and manage any potential SRB sources, the final report is due by 30 June 2001. Long term solution could involve mothballing the existing pipeline using the existing ethane pipeline between Moomba and Tirrawarra. A feasibility study into the use of the ethane line is underway. This SRB failure has raised concerns with the liquids line to Port Bonython. Action: <ul style="list-style-type: none"> Santos to present to PIRSA at the next compliance meeting its diligence strategy for corrosion detection and management of the liquids line to Pt Bonython from Moomba. Santos to investigate feasibility of leak detection in the Tirrawarra line.
4	Oil Spill Site Rehabilitation Monitoring Nothing reported until the spill end point criteria are finalised. End Point Criteria Santos reported that final report will be submitted to PIRSA within next 3 weeks. Report shows TPH levels are OK however heavy metals and implication on Organic Beef requirements need to be addressed. Action: <ul style="list-style-type: none"> Santos to submit to PIRSA final end point criteria report by 19 May.

5	<p>Produced Formation Water Assessment Criteria</p> <ul style="list-style-type: none"> Sediment sampling of existing evaporation ponds completed and analysed. <p>Actions:</p> <ul style="list-style-type: none"> Santos to arrange a meeting with PIRSA by no later than 21 May 2001 to discuss the results of the findings and to agree on a way forward.
6	<p>Cooper Creek Oil Spill Project</p> <p>Ecotoxicological analysis of samples completed and final report due to be received by Santos within the next 3 weeks.</p> <p>Action:</p> <p>Santos to meet with PIRSA to discuss results and report once received.</p>
7	<p><u>Moomba Land Farm (LTU)</u></p> <p>Action:</p> <ul style="list-style-type: none"> Santos to submit final interim report on the Moomba LTU performance with recommended risk based action plan to PIRSA and the EPA. Santos and PIRSA to have discussed and agreed by end of May 2001 the future actions to be undertaken by Santos to address the LTU problems covered in the interim report.
8	<p>Production and Processing EIR/SEO</p> <p>Santos tabled final draft of EIR for PIRSA comment and a very early draft of the SEO.</p> <p>Action:</p> <ul style="list-style-type: none"> PIRSA to review draft EIR and get back to Santos with comments by Friday 4 May. Once PIRSA have submitted comments, Santos to finalise EIR and draft SEO and submit them to PIRSA for formal assessment. <p>Fitness for Purpose Assessment Report</p> <p>M Malavazos reported that he provided comments to Allan Rooney on preliminary draft of FFP report which will result in substantial changes in the next draft and which will likely involve inclusion of much of the material covered in the comprehensive FFP report. PIRSA suggested that it may be suitable and time and effort saving for Santos to submit its comprehensive draft as the FFP report required under Regulation 30.</p> <p>Action:</p> <p>John Hudson to meet with M Malavazos and T Aust by Thursday 3 May to address this issue.</p> <p>Pipeline (PLs 2, 5 and 9) SEOs</p> <p>Action:</p> <ul style="list-style-type: none"> Santos to formally accept PIRSA SEO proposal for PL 2 once comments from Pt Bonython and Epic have been received. For PLs 5 and 9, PIRSA to correspond directly with QNTBU.
9	<p>Quarterly Cased Hole Well Report</p> <p>M Malavazos reported that some omissions in the last quarterly report were detected by PIRSA and reported to Santos.</p> <p>Action:</p> <p>Santos will discuss and clarify these internally before providing PIRSA with amended report.</p>
10	<p>Della 20 Incident</p> <p>PIRSA reported that the incident report submitted by Santos on the Della 20 incident was unacceptable and a letter explaining PIRSA's reasons was on its way.</p> <p>Action:</p> <p>PIRSA and Santos to meet once Santos have received the letter to discuss and resolve PIRSA's concerns with the report.</p>
11	<p>Next meeting 2.30pm, Friday 27 July 2001.</p>

MINUTES forming ENCLOSURE to: 00/0294

TO: MICHAEL MALAVAZOS
FROM: ANGELA CRIMES
SUBJECT: JULY 2001 SANTOS QUARTERLY COMPLIANCE MEETING
DATE: 30 JULY 2001

The following key issues and actions arose from the 27 July quarterly compliance meeting with Santos:

Agenda Item	Actions/Issues
1	Actions from Previous Minutes <ul style="list-style-type: none"> No issues arising from previous minutes.
2	Pipelines Santos were notified that PL's 2, 5 & 9 not compliant with the Act because not covered by an SEO or equivalent. Warren Kruger presented details of Santos' corrosion detection and management strategy for Moomba to Port Bonython Liquids Pipeline (power point presentation attached). ACTION: <ul style="list-style-type: none"> Santos to liaise with Epic on preparation of PL 2 SEO. Santos to get back to PIRSA on the status of SEO's for PL's 5&9. Santos to follow up with Epic unauthorised activity on PL2 near Port Bonython.
3	Quarterly Cased Hole Report <ul style="list-style-type: none"> Cased hole well activity report submitted. Presentation of latest casing annuli pressure monitoring results deferred to next meeting. ACTION: <ul style="list-style-type: none"> Santos to present latest casing annuli pressure results at the next quarterly meeting. Della 20 ACTION: Final report on Della 20 expected from Santos by the end of August.
4	SABU 2001 Targets and Measures Change in Santos reporting of important incidents, as they are now required to report all spills under the Act.
5	Incident Report for the period 1st April 2001 to 30th June 2001 Santos reported that pump failure and pipework issues have been resolved. ACTION: <ul style="list-style-type: none"> Santos required to change the location field on the quarterly incident report to be more site specific. Santos to update and resend quarterly incident report.
6	Oil Spill End Point Criteria Report being finalised and results will be incorporated into Production and Processing EIR and SEO. ACTION: <ul style="list-style-type: none"> Santos to submit end point criteria report with Production and Processing SEO.
7	Water Disposal Facilities Inspection Santos have implemented a number of initiatives in reducing the amount of entrained oil into the ponds since PIRSA inspection was undertaken. Therefore, the incidents observed by PIRSA and reported in its report are considered by Santos to have been addressed. Santos are looking at installing 10-12 permanent skimming facilities on existing oil satellites to prevent sludge buildup. Revised Formation Water Disposal Action Plan Level 1 and 2 assessments carried out under the NEPM are currently being undertaken by Golder Associates in association with land farm assessments. Results will be available by end of August 2001 and will be incorporated into the Production and Processing EIR/SEO. A level 3 assessment may then be undertaken subject to the results of level 1 and 2 assessments. ACTION: <ul style="list-style-type: none"> Final report on level 1 and 2 assessments to be submitted to PIRSA by end of August 2001

	<p>and incorporated into the Production and Processing EIR/SEO.</p> <ul style="list-style-type: none"> Site specific remediation criteria for disposal ponds will complete by end of January 2002. <p><u>Produced Formation Water Criteria</u></p> <p>ACTION:</p> <ul style="list-style-type: none"> Santos to prepare and provide a proposal for establishing formation water disposal criteria to PIRSA by December 2001 along the lines of the ANZECC risk based guidelines. <p>Due to timing this proposal and firm deadlines will need to be included in the Production and Processing SEO.</p>
8	<p>Status of the Cooper Creek Oil and Condensate Spill Project</p> <p>Has been delayed; still finalising toxicity study.</p> <p>ACTION:</p> <ul style="list-style-type: none"> Santos to include the results in the Production and processing EIR.
9	<p>Moomba Landfarm</p> <p>Landfarm report from Flinders Uni due the day of the meeting. Had not arrived.</p> <p>ACTION:</p> <ul style="list-style-type: none"> Santos to submit Moomba Landfarm report to PIRSA next week.
10	<p>Production and Processing EIR and SEO</p> <p>ACTION:</p> <ul style="list-style-type: none"> Direction required from John Hudson on Greenhouse Gas. Next draft of EIR and SEO due to PIRSA by end of August. <p>Fitness For Purpose</p> <p>ACTION:</p> <ul style="list-style-type: none"> Allan Rooney accommodating PIRSA comments in next.
11	<p>Flaring</p> <p>Santos yearly fuel use and flare tonnage per year were tabled.</p> <p>ACTION:</p> <p>John Hudson to supply annual fuel/flare data with monthly breakdown.</p> <p>Provision of Well Data</p> <p>PIRSA decided to extent the scope of these meetings to include data compliance issues also, therefore it would be appropriate to rename these quarterly meetings to “Quarterly Compliance Meetings” rather than Environmental Management Meetings.</p> <p>ACTION:</p> <ul style="list-style-type: none"> Santos directed to supply WCR’s in digital format from now on and deal with the backlog later. Santos need to follow the BRS/AAPG well naming convention. John Hudson to review the WCR submission process and late submission of WCR’s. Santos required to submit cased hole logs in digital format. Santos required to follow up the supply of underweight log samples. <p>Formal response required from John Hudson on landowner notification. Expected within a week of this meeting.</p>
12	<p>Next meeting 2.30pm, Friday 26 October 2001.</p>

Appendix 5: Well Lease Construction Activity

WELL NAME	No.	WELL STATUS	Drill MTH	Drill YR	B/PITS	Back Fill MTH	Back Fill YR	PHOTOS	KM ROAD
BECKLER	3	C&S	10	2000	1	8	2001	YES	1.4
BECKLER	4	C&S	11	2001	2				1.8
BECKLER	5	C&S	12	2001	3				3.5
BIG LAKE	66	C&S	10	2000	1	9	2001	YES	0.5
BIG LAKE	67	C&S	9	2000	1	9	2001	YES	0.7
BIG LAKE	68	C&S	3	2001	2				0.5
BIG LAKE	69	C&S	7	2001	1				0.5
BIG LAKE	65	C&S	10	2000	1	9	2001	YES	0.4
BIG LAKE	70	C&S	8	2001	1				0.4
BOW	1	C&S	12	2000	4	8	2001	YES	5
BOW	2	C&S	10	2001	1				1.5
BURKE EAST	1	C&S	10	2000	1	5	2001	YES	0.7
CABERNET	4	C&S	10	2001	2				2.1
CASTALIA	1	P&A	5	2001	4				6.9
CROWS NEST	1	C&S	8	2001	1				1.2
DULLINGARI	52	C&S	3	2001	1				1.4
DULLINGARI	53	C&S	3	2001	1				2
DULLINGARI	54	C&S	4	2001	1				0.3
DULLINGARI NTH	10	C&S	1	2001	2				0.5
DULLINGARI NTH	11	C&S	2	2001	1				0.5
DULLINGARI NTH	12	C&S	3	2001	1				0.5
DULLINGARI NTH	13	C&S		2001	2				0.5
FLY LAKE	11	C&S	11	2001	1				1.1
GOORANIE	4	C&S	11	2000	1	11	2001	YES	0.5
MERANJI	22	C&S	8	2000	1	4	2001	YES	0.8
MERANJI	23	C&S	9	2000	1	11	2001	YES	1.4
MERANJI NTH	1	C&S	10	2001	1				1
MERRIMELIA	40	C&S	9	2000	1	10	2001	YES	2.4
MERRIMELIA	41	C&S	10	2000	2	10	2001	YES	1.8
MERRIMELIA	39	C&S	11	2000	2	11	2001	YES	1
MILLUNA	2	C&S	9	2000	1	8	2001	YES	1
MILLUNA	3	C&S	11	2000	1	8	2001	YES	1.1
MILLUNA N/E	1	C&S	3	2001	1	10	2001	YES	1.2
MOOMBA	115	C&S	7	2000	1	4	2001	YES	1.3
MOOMBA	120	C&S	8	2000	1	6	2001	YES	0.5
MOOMBA	121	C&S	11	2000	1	11	2001	YES	0.5
MOOMBA	122	C&S	8	2000	1	5	2001	YES	0.5
MOOMBA	123	C&S	8	2000	1	6	2001	YES	2
MOOMBA	124	C&S	10	2000	2	5	2001	YES	2.5
MOOMBA	125	C&S	12	2000	1	11	2001	YES	1.2
MOOMBA	126	C&S	12	2000	1	5	2001	YES	0.5
MOOMBA	128	C&S	12	2000	1	9	2001	YES	0.5
MOOMBA	130	C&S	12	2000	1	8	2001	YES	0.5
MOOMBA	135	C&S	12	2000	1	7	2001	YES	0.5
MOOMBA	127	C&S	2	2001	2	11	2001	YES	2.4
MOOMBA	129	C&S	2	2001	1				0.6
MOOMBA	131	C&S	1	2001	1	8	2001	YES	0.9
MOOMBA	132	C&S	3	2001	1	11	2001	YES	0.4
MOOMBA	133	C&S	3	2001	4	12	2001	YES	5.4
MOOMBA	134	C&S	1	2001	2				3.5
MOOMBA	136	C&S	3	2001	1	12	2001	YES	0.4
MOOMBA	140	C&S	3	2001	2				2.5
MOOMBA	137	P&A	1	2001	1	7	2001	YES	1.3
MOOMBA	114	C&S	7	2000	1	1	2001	YES	1.3
MOOMBA	119	C&S	9	2000	1	9	2001	YES	0.6
MOOMBA	138	C&S	2	2001	2				1.8
MOOMBA	139	C&S	7	2001	0				2.8
MOOMBA	141	C&S	4	2001	2				1.5
MOOMBA	142	C&S	4	2001	2				1.8

WELL NAME	No.	WELL	Drill	Drill	B/PITS	Back Fill	Back Fill	PHOTOS	KM
		STATUS	MTH	YR		MTH	YR		ROAD
MOOMBA	143	C&S	5	2001	1				3.1
MOOMBA	144	C&S	4	2001	1				0.5
MOOMBA	145	C&S	4	2001	2				0.8
MOOMBA	146	C&S	5	2001	2				1.6
MOOMBA	147	C&S	4	2001	1				0.7
MOOMBA	148	C&S	3	2001	1	12	2001	YES	1
MOOMBA	149	C&S	10	2001	1				1.3
MOOMBA	151	C&S	10	2001	1				1
MOOMBA	153	C&S	9	2001	1				0.5
MOOMBA	167	C&S	12	2001	2				1.7
MOOMBA	168	C&S	12	2001	1				0.5
MOONA	1	C&S	2	2001	2	11	2001	YES	2.1
MOOTANNA	1	P&S	4	2001	4	12	2001	YES	3.4
PELICAN	7	C&S	11	2001	3				0.5
PONDRINIE NTH	2	P&S	6	2000	1	10	2001	YES	0.5
PONDRINIE NTH	2	P&S	6	2000	1	10	2000	YES	1.3
PONDRINNIE	17	C&S	7	2000	1	5	2001	YES	1.8
RAVEN	2	C&S	11	2000	1	7	2001	YES	0.5
REG SPRIGGS	2	P&A	7	2001	2				0.3
SWAN LAKE	5	C&S	8	2001	0				0.8
TARANGO	1	C&S	12	2000	1		2001		0.8
TIRRAWARRA	71	C&S	4	2001	2	11	2001	YES	1.1
TOOLACHEE	52	C&S	12	2000	1		2001		1.1

Appendix 6: Well Drilling and Lease Backfill and Restoration Activity

WELL NAME	No.	WELL	Drill	Drill	B/PITS	B/F	B/F	PHOTOS	KM
		Status	Mth	Yr		Mth	Yr	Taken	Rd
BECKLER	3	C&S	10	2000	1	8	2001	YES	1.4
BIG LAKE	66	C&S	10	2000	1	9	2001	YES	0.5
BIG LAKE	67	C&S	9	2000	1	9	2001	YES	0.7
BIG LAKE	65	C&S	10	2000	1	9	2001	YES	0.4
BOW	1	C&S	12	2000	4	8	2001	YES	5
BURKE EAST	1	C&S	10	2000	1	5	2001	YES	0.7
CUTTAIRRRIE	7	P&A	4	2000		11	2000	YES	1
CUTTAIRRRIE	6	C&S	2	2000	7	10	2000	YES	5.4
DARMODY	1	P&S	3	96		10	2000	YES	2.5
DELLA	19	C&S	10	99	1	7	2000	YES	0.5
DULLINGARI	51	C&S	3	99	2	12	2000	YES	2
EPSILON	10	P&A	11	99		9	2000	YES	1
GOORANIE	4	C&S	11	2000	1	11	2001	YES	0.5
MERANJI	22	C&S	8	2000	1	4	2001	YES	0.8
MERANJI	23	C&S	9	2000	1	11	2001	YES	1.4
MERRIMELIA	40	C&S	9	2000	1	10	2001	YES	2.4
MERRIMELIA	41	C&S	10	2000	2	10	2001	YES	1.8
MERRIMELIA	39	C&S	11	2000	2	11	2001	YES	1
MILLUNA	2	C&S	9	2000	1	8	2001	YES	1
MILLUNA	3	C&S	11	2000	1	8	2001	YES	1.1
MILLUNA N/E	1	C&S	3	2001	1	10	2001	YES	1.2
MOOMBA	137	P&A	1	2001		7	2001	YES	1
MOOMBA	104	C&S	11	99	1	9	2000	YES	0.6
MOOMBA	105	C&S	12	99	1	11	2000	YES	1
MOOMBA	108	C&S	1	2000	3	11	2000	YES	1.3
MOOMBA	112	C&S	4	2000	2	12	2000	YES	1.1
MOOMBA	127	C&S	2	2001	2	11	2000	YES	2.4
MOOMBA	115	C&S	7	2000	1	4	2001	YES	1.3
MOOMBA	120	C&S	8	2000	1	6	2001	YES	0.5
MOOMBA	121	C&S	11	2000	1	11	2001	YES	0.5
MOOMBA	122	C&S	8	2000	1	5	2001	YES	0.5
MOOMBA	123	C&S	8	2000	1	6	2001	YES	2
MOOMBA	124	C&S	10	2000	2	5	2001	YES	2.5
MOOMBA	125	C&S	12	2000	1	11	2001	YES	1.2
MOOMBA	126	C&S	12	2000	1	5	2001	YES	0.5
MOOMBA	128	C&S	12	2000	1	9	2001	YES	0.5
MOOMBA	130	C&S	12	2000	1	8	2001	YES	0.5
MOOMBA	135	C&S	12	2000	1	7	2001	YES	0.5
MOOMBA	127	C&S	2	2001	2	11	2001	YES	2.4
MOOMBA	131	C&S	1	2001	1	8	2001	YES	0.9
MOOMBA	132	C&S	3	2001	1	11	2001	YES	0.4
MOOMBA	133	C&S	3	2001	4	12	2001	YES	5.4
MOOMBA	136	C&S	3	2001	1	12	2001	YES	0.4
MOOMBA	106	C&S	1	2000	2	11	2000	YES	2.3
MOOMBA	109	C&S	3	2000	1	11	2000	YES	0.6
MOOMBA	114	C&S	7	2000	1	1	2001	YES	1.3
MOOMBA	119	C&S	9	2000	1	9	2001	YES	0.6
MOOMBA	148	C&S	3	2001	1	12	2001	YES	1
MOONA	1	C&S	2	2001	2	11	2001	YES	2.1
MOOTANNA	1	P&S	4	2001		12	2001	YES	3.4
PONDRINIE NTH	2	P&S	6	2000		10	2001	YES	0.5
PONDRINIE NTH	2	P&S	6	2000		10	2000	YES	1.3
PONDRINNIE	16	C&S	2	2000	1	10	2000	YES	1.6
PONDRINNIE	17	C&S	7	2000	1	5	2001	YES	1.8
RAVEN	2	C&S	11	2000	1	7	2001	YES	0.5
SWAN LAKE	4	C&S	8	99	1	7	2000	YES	0.4
TARANGO	1	C&S	12	2000	1		2001		0.8
TIRRAWARRA	71	C&S	4	2001	2	11	2001	YES	1.1
TOOLACHEE	52	C&S	12	2000	1		2001		1.1
TOOLACHEE WEST	1	C&S	6	2000	2	11	2000	YES	2.7

Appendix 7: Well Leases Scouted and Not Constructed

Scout #	Scout Name	Scout Date	Location	
			Lat.	Long.
00-054	MMB #2000K	14-Jul-00	28 01 26.77	140 09 37.96
00-067	MMB #19 twin	24-Sep-00	28 13 07.11	140 11 28.9
95-038/2	Gidgealpa 57	27-Nov-00	28 01 22.32	139 58 11.58
98-029/4	QUARTPOT #2	10-Dec-00	27 34 05.88	140 05 24.45
00-082/1	Dull 2001 A	17-Dec-00	28 07 28.31	140 53 04.17
00-085/1	Dull 2001 D	17-Dec-00	28 06 27.48	140 53 00.89
00-019	Hacket East #1	18-Dec-00	27 54 09.29	139 58 51.33
99-026/1	Tool East Flank	11-Jan-01	28 24 06.82	40 50 58.18
01-012	Gidgealpa 57dw	01-Feb-01	28 01 22.45	139 57 51.36
01-017	VARANUS #	08-Mar-01	27 44 27.96	140 01 55.30
01-018	NEPH NTH #1	14-Mar-01	27 51 36.18	139 53 35.48
01-026	MMB #152	23-Apr-01	28 05 40.93	140 17 08.76
01-024/1	MMB #150	30-Apr-01	28 06 21.48	140 18 06.47
01-025/2	MMB #151	30-Apr-01	28 05 16.07	140 19 03.01
01-020/2	Big Lk #69 twin	12-Jun-01	28 13 57.7	140 17 18.56
00-052	Meranji #24	21-Jul-01	27 51 30.06	140 05 19.49
01-033	Big Lk 2001B	29-Jul-01	28 12 55.32	140 19 13.83
01-041/1	MMB 2002F	22-Aug-01	28 02 55.66	140 11 00.50
01-047/1	MMB 2002L	27-Aug-01	28 02 17.01	140 12 40.88
01-045/1	MMB 2002J	27-Aug-01	28 02 29.81	140 12 25.43
01-046/1	MMB 2002K	27-Aug-01	28 02 38.83	140 11 35.11
01-056/1	MMB 64 udip	17-Sep-01	28 13 57.96	140 14 09.91
01-054	MMB Sth U/dip	18-Sep-01	28 14 21.97	140 12 54.41
01-050/3	Bow 2002 A	10-Oct-01	28 01 31.7	
01-052/2	Bow 2002B	14-Oct-01	18 00 17.41	140 58 58.06
01-043	MMB 2002H	14-Oct-01	28 02 43.07	140 12 08.04
01-027/2	MMB #155	16-Oct-01	28 07 48.78	140 18 56.22
01-042/1	MMB 2002G	20-Oct-01	28 02 55.46	140 11 43.1
01-076	TIRRA #72	18-Dec-01	27 41 56	140 04 38

Appendix 8: Workover Operations

WELL FIELD	WELL #	WORKOVER RIG ACTIVITY*	Well Fracture Stimulated
MOOMBA	73	SINGLE COMPLETION	yes
MOOMBA	117	SINGLE COMPLETION	no
MOOMBA	86	SINGLE COMPLETION	yes
MERUPA	1	SINGLE COMPLETION	yes
BIG LAKE	50	SINGLE RECOMPLETION TO MONOBORE	yes
BIG LAKE	30	SINGLE RECOMPLETION	no
MOOMBA	117	WELL DEEPENING & RECOMPLETION	no
MOOMBA	118DW	SINGLE COMPLETION	yes
MOOMBA	135DW	SINGLE COMPLETION	no
BIG LAKE	15	RECOMPLETION FOR FRAC	yes
WANTANA	1	SINGLE COMPLETION	yes
TOOLACHEE	38	SINGLE COMPLETION	no
DELLA	8	SINGLE RECOMPLETION	no
BOOKABOURDIE	8	TUBING REPAIR	no
MOOMBA	30	TUBING REPAIR	no
TARWONGA	3	TANDEM COMPLETION	no
STURT	6	SINGLE RECOMPLETION	no
TANTANNA	1	SINGLE RECOMPLETION	no
PIRA	1	TUBING SPACEOUT	no
MOOMBA	85	SINGLE COMPLETION TO MONOBORE	no
TIRRAWARRA	70	RECOMPLETE FROM OIL TO GAS WELL	yes
TALLERANGIE	1	SINGLE GAS COMPLETION	no
BIG LAKE	5	RECOMPLETION FOR FRAC	yes
LELEPTIAN	1	RECOMPLETION FOR FRAC	yes
TIRRAWARRA	22	RECOMPLETION FOR FRAC	yes
COOPERS CREEK	2	RECOMPLETION FOR FRAC	yes
MOOMBA	135DW	ESP INSTALLATION (TUBING CHANGED)	no
MOOMBA	119DW1	TCP COMPLETION (Sidetrack drilled as Moomba 119DW1 - Now referred to as Moomba 119DW2)	no
MOOMBA	119DW2	TCP COMPLETION (refer Moomba 119DW1 above)	no
BIG LAKE	8	SINGLE RECOMPLETION FOR FRAC	yes
MOOMBA	136	SINGLE COMPLETION	no
MOOMBA	118DW	SINGLE RECOMPLETION (ESP to DH Pump)	yes
BIG LAKE	11	SINGLE RECOMPLETION FOR FRAC	yes
BIG LAKE	1	SINGLE RECOMPLETION FOR FRAC	yes
BIG LAKE	16	SINGLE RECOMPLETION FOR FRAC	yes
MOOMBA	148DW	SINGLE COMPLETION	no
BIG LAKE	6	SINGLE RECOMPLETION FOR FRAC	yes
BIG LAKE	57	SINGLE RECOMPLETION FOR FRAC	yes
METTIKA	2	TUBING REPAIR	no
BOONGALA	1	PLUG & SUSPEND	no
MERRIMELIA	38	SINGLE RECOMPLETION	no
BIG LAKE	57	POST FRAC RECOMPLETION	yes
BIG LAKE	69	SINGLE COMPLETION	yes
LAKE MACMILLAN	1	SINGLE COMPLETION	no

WELL FIELD	WELL #	WORKOVER RIG ACTIVITY	Well Fracture Stimulated
KUDRIEKE	2	SINGLE COMPLETION	yes
BROLGA	3	SINGLE RECOMPLETION	yes
MOOMBA	40	TUBING REPAIR	no
MOOMBA	136	ESP INSTALLATION (TUBING CHANGED)	no
MITCHIE	1	PRE FRAC COMPLETION	yes
FLY LAKE	6	RECOMPLETION FOR FRAC	yes
NAPPACOONGEE EAST	1	SINGLE COMPLETION	no
MOOLION	1	SINGLE COMPLETION	yes
MITCHIE	1	POST FRAC COMPLETION	yes
MOOMBA	153	SINGLE COMPLETION	no
FLY LAKE	6	RECOMPLETION FOR FRAC	yes
MOOMBA	87	SIPHON STRING INSTALLATION	no
MOOMBA	21	SIPHON STRING INSTALLATION	no

*NOTE: Only includes wells where the workover resulted in a change to the downhole configuration.

Appendix 9: Flowline and Lease Pipework Construction Activity

Gas Flowline Installations - 2000

July			Aug			Sep			Oct			Nov			Dec		
Line	Dia	Length	Line	Dia	Length	Line	Dia	Length	Line	Dia	Length	Line	Dia	Length	Line	Dia	Length
Meranji 20	100	250	Moomba 116	100	800	Meranji 22	100	700	Moomba 122	100	400	Meranji 23	100	1114	Big Lake 65	100	800
Pondrinie 17	150	2700	Moomba 114	100	1200	Big Lake 30	100	300	Moomba 123	100	650	Moomba 121	100	400	Big Lake 66	100	900
Beckler 2	150	150	Moomba 86	100	1900	Meranji 20	100	250	Merrimelia 39	100	345	Big Lake 67	100	150	Tool 38	100	200
Merupa 1	100	800	Bindah 1	100	1600	Moomba 115	100	1100	Moomba 45	100	25	Milluna 2	100	900	Raven Bypass	200	25000
									Moomba 46	100	470	Moomba 85	150	1000	Mba Nth Spine	200	7500
									Pondrinie 16	100	1400	Raven Twin	150	7500	Merrimelia 40	100	350
									Milluna 2	100	870	M Nth Spine ext	200	3400	Moomba 124	100	220
												Eastern Fields	100	1300			
													150	6400			
													200	4800			
TOTAL		3900	TOTAL		5500	TOTAL		2350	TOTAL		4160	TOTAL		26964	TOTAL		34970

Gas Lease Pipework installations - 2000

July			Aug			Sept			Oct			Nov			Dec		
Line			Line			Line			Line			Line			Line		
Pondrinie 17	1		Moomba 73	1		Merupa 1	1		Moomba 122	1		Merrimelia 40	1		Moomba 121	1	
Della 20	1		Moomba 72	1		Meranji 22	1		Moomba 123	1		Moomba 46	1		Toolachee 38	1	
Della 21	1		Moomba 107	1		Big Lake 30	1		Pondrinie 16	1		Milluna 2	1		Eastern Fields	1	
Della 22	1		Moomba 116	1		Meranji 20	1					Meranji 23	1		Big Lake 65	1	
Pira 1	1		Moomba 114	1		Moomba 115	1					Merrimelia 39	1		Big Lake 66	1	
Moomba 113	1		Moomba 86	1								Moomba 120	1		Moomba 124	1	
Moomba 112	1		Bindah 1	1								Mba Nth Spine	1				
Moomba 110	1																
Beckler 2	1																
TOTAL	9		TOTAL	7		TOTAL	5		TOTAL	3		TOTAL	7		TOTAL	6	

Appendix 9 (cont): Flowline and Lease Pipework Construction Activity

Gas Flowline Installations - 2001

Jan			Feb			Mar			Apr			May			June		
Line	Dia	Length	Line	Dia	Length	Line	Dia	Length	Line	Dia	Length	Line	Dia	Length	Line	Dia	Length
Burke East 1	100	2200	Raven 2	150	350	Moomba 127	100	900	Gooranie 4	100	350	Big Lake 68	100	400	Dull Nth 13	150	1400
Tarwonga 3	100	3065	Raven 1 repair	150	100	Tirrawarra 70	100	550	Moomba 134	150	3850	Tarrango 1	100	600	Moona 1	100	2700
Tool West 1	100	1900	Moomba 125	100	900	Moomba 130	100	750	Moomba 129	100	1000	Toolachee 38	100	200	Dullingari 53	100	100
Miluna 3	100	1350	Moomba 128	150	700	Mba Nth to MSC	150	9510	Moomba Nth 2 twin	150	1950	Tallerangie 1	100	6500	Dullingari 52	100	460
Big Lake 67	100	150	Gooranie 4	100	350	Moomba 131	100	1100	Moomba 140	100	950	Moomba 148	3.5	2900	Moomba 143	100	400
Beckler 3	150	900	Tirrawarra 70	100	550				Wantana 1	100	5800	Waukatana 2	100	700	Moomba 141	100	1800
Moomba 126	100	100							Moomba 132	100	650	Dull Nth 11	150	1400			
									Dull Nth 10	150	850	Dull Nth 12	150	510			
TOTAL		9665	TOTAL		2950	TOTAL		12810	TOTAL		15400	TOTAL		13210	TOTAL		6860

July			Aug			Sep			Oct			Nov			Dec								
Line	Dia	Length	Line	Dia	Length	Line	Dia	Length	Line	Dia	Length	Line	Dia	Length	Line	Dia	Length						
Dilchee	150	5250	Lake McMillan 1	100	4480	Moomba 146	100	250	Swan Lake 5	150	500	Moolion 1	100	2400	Moomba 149	100	200						
KMT	150	100	Kudriekie 2	100	1300	Moomba 147	100	1100	Big Lake 70	100	750	Bow 2	150	2000	Napacoongie East 1	100	9160						
Tirrawarra 71	100	1700	Big Lake 69	80	800	Moomba 138	100	230				Mitchie 1	100	2500									
Tirrawarra 22	100	1000	Moomba 139	100	2200	Brolga 3	100	1800															
Moomba 144	100	1000	Moomba 145	100	450	Dullingari 54	100	350															
			Merrimelia 42	100	400	Kudrieke 2	100	1300															
			Jack Lake 3	100	1200																		
			Moomba 142	100	1400																		
			Moomba 139	100	2200																		
TOTAL			9050	TOTAL			14430	TOTAL			5030	TOTAL			1250	TOTAL			6900	TOTAL			9360

Appendix 9 (cont): Flowline and Lease Pipework Construction Activity

Gas Lease Pipework Connections - 2001

Jan			Feb			Mar			Apr			May			June		
Line			Line			Line			Line			Line			Line		
Big Lake 67	1		Burke East #1	1		Raven Bypass	1		Big Lake 5	1		Moomba 132	1		Toolachee 38	1	
Moomba 126	1		Milluna #3	1		Raven 1 rebuild	1		Gooranie 4	1		Mba Nth to MSC	1		Wantana 1	1	
East'n Fields de-bottle	1		Tarwonga #3	1		Raven 2	1		Moomba 127	1		Mba 45	1		Moomba 140	1	
			Toollachee West #1	1		Raven Twin	1		Moomba 134	1		Waukatanna 2	1		Moomba North Twin	1	
			Mba Nth Central	1		Moomba 128	1		Dull Nth 10	1		Moomba 148	1		Moomba 129	1	
			Beckler 3	1		Moomba 121	1		Tirrawarra 70	1		Big Lake 11	1		Tarrango 1	1	
						Moomba 125	1					Tallerangie 1.	1		Big Lake 16	1	
						Moomba 130	1					Big Lake 8	1		Big Lake 68	1	
						Moomba 85 raw gas	1								Moomba 141	1	
															Big Lake 6	1	
TOTAL	3		TOTAL	6		TOTAL	9		TOTAL	6		TOTAL	8		TOTAL	9	

July			Aug			Sep			Oct			Nov			Dec		
Line			Line			Line			Line			Line			Line		
Dullingari North 13	1		Dilchee to Boongala	1		Merrimalia 42	1		Brolga 3	1		Swan Lake 5	1		Bow 2	1	
Dullingari North 12	1		Moomba 143	1		Lake MacMillan 1	1		Moomba 145	1		Tirrawarra 49	1		Napacoongie East 1	1	
Dullingari North 11	1		Tirrawarra 71	1		Big Lake 69	1		Moomba 146	1		Moolion 1	1		Moomba 149	1	
Moomba 134	1		KMT Xover	1		Moomba 142	1		Moomba 138	1		Big Lake 70	1		Fly Lake Decom	1	
Big Lake 1	1		Moona 1	1		Tirrawarra 40	1		Moomba 147	1		Mitchie 1	1				
			Tirrawarra 22	1		Dullingari 54	1										
			Cooper Creek 2	1		Dullingari 53	1										
			Dullingari 52	1		Kudrieke 2	1										
			Moomba 144	1													
			Jack Lake 3	1													
			Moomba 139	1													
TOTAL	5		TOTAL	11		TOTAL	8		TOTAL	5		TOTAL	5		TOTAL	4	38

Appendix 9 (cont): Flowline and Trunkline Construction Activity

Oil flowline and trunkline installations and connections (Jul 2000-Dec 2001)

Flowline		Length	Commission Date	Construction	
From	To	(m)		Diam	Type
Moomba #104	Moomba South Oil Facility	1460	Dec-00	3 ^{1/2} inch	EUE Screw Tubing
Moomba #135	Moomba South Oil Facility	1640	Dec-00	3 ^{1/2} inch	EUE Screw Tubing
Moomba #118	Moomba South Oil Facility	1550	Apr-01	2 ^{7/8} inch	EUE Screw Tubing
Moomba #119	Moomba South Oil Facility	2690	Jan-01	3 ^{1/2} , 2 ^{7/8} inch*	EUE Screw Tubing
Moomba #136 (line 1)	Moomba South Oil Facility	5800	Mar-01	3 ^{1/2} inch	EUE Screw Tubing
Moomba #136 (line 2)	Moomba South Oil Facility	5800	Jul-01	3 ^{1/2} inch	EUE Screw Tubing
Moomba #148	Moomba South Oil Facility	4000	Aug-01	3 ^{1/2} inch	EUE Screw Tubing
Moomba South Oil Product Oil Line	Wancoocha Oil Trunkline	1620	Dec-00	114.3mmOD (100mm pipe)	
Wancoocha Oil Trunkline (previously mothballed) conversion to Moomba South Product Oil Line	Moomba South Oil Facility	6500		114.3mmOD (100mm pipe)	

*Moomba #119 line converted from 3^{1/2} inch to 2^{7/8} inch in Nov 2001

Appendix 10: Summary of AS2885-1997 Compliance Requirements for Block Oil Lines

AS2885 - 1997		Flow lines & Test Lines	Gathering Lines	Trunklines	Power Fluid Lines
Clause Ref.	Description				
AS2885.1	DESIGN & CONSTRUCTION				
2	SAFETY	+			
2.3	Risk Identification	+	+	+	+
2.4	Risk Evaluation	+	+	+	+
2.5	Risk Management	+	+	+	+
2.6	OH&S	+	+	+	+
2.7	Electrical Safety		+	+	
2.8	Construction Safety	+	+	+	+
3	MATERIALS & COMPONENTS	+	+	+	+
4	PIPELINE DESIGN				
4.2.1	Design Criteria	+	+	+	+
4.2.2	Design Life	+	+	+	+
4.2.3	MAOP	+	+	+	+
4.2.4	Route	+	+	+	+
4.2.5	External Interference Protection	+	+	+	+
4.2.6	Control & Management			+	
4.3	Pipeline Design - Mechanical	+	+	+	+
5	MITIGATION OF CORROSION				
5.3	Rate of Degradation	+	+	+	+
5.4 to 5.6	Corrosion Mitigation Methods	+	+	+	+
6	CONSTRUCTION				
6.2	Survey		+	+	+
6.3	Handling of Components	+	+	+	+
6.18	Records		+	+	
7	INSPECTIONS AND TESTING				
7.4	Pressure Testing	+	+	+	+
7.6	Records	+	+	+	+
AS2885.3	OPERATION & MAINTENANCE				
1.7	General Records	+	+	+	+
2	PREPARATION FOR OPERATION	+	+	+	+
3	OPERATING REQUIREMENTS				
3.2.1	Operating to design conditions	+	+	+	+
3.2.2	Pipeline surveillance	+	+	+	+
3.2.3.2	Controls & pressure protection equipment	+	+	+	+
3.2.8	Leakage survey and detection			+	
3.3	Safety and Operating Plan	+	+	+	
3.4	Emergency Plans	+	+	+	
3.6	Purging Procedures	+	+	+	+
4	OPERATING CONDITION CHANGES	+	+	+	+

AS2885 - 1997		Flow lines & Test Lines	Gathering Lines	Trunklines	Power Fluid Lines
Clause Ref.	Description				
AS2885.3					
5	MAINTENANCE REQUIREMENTS				
5.1	Pipeline Integrity	+	+	+	+
5.1.2	Monitoring Plan	+	+	+	
5.1.3	Audit		+	+	
5.2	Pipeline Inspection and Assessment		+	+	+
5.3	Coatings	+	+	+	+
5.4.3	Assessment of corroded pipework	+	+	+	+
5.5.3	Pipe supports		+	+	
5.7	Cathodic Protection Inspection		+	+	
5.8	Pressure Control & Protective Equipment Inspection	+	+	+	+
6	PIPELINE REPAIRS				
6.1	General	+	+	+	+
6.2	Supervision	+	+	+	+
6.3	Communication and Control	+	+	+	+
6.4	Working on Pipelines	+	+	+	+
6.5	Repair Strategy	+	+	+	+
6.6	Welding onto an in-service pipeline	+	+	+	+
6.7	Hot Tapping Operations	+	+	+	+

+ = indicates Santos equipment/facility requires the application of Clause 1,2,....,6 as specified under AS2885-1997.

Appendix 11: Operations Support Guides and Specifications Listing

Document	Rev	Title
1500-00-S001	1	PREPARATION OF ENGINEERING DRAWINGS
1500-10-G002	1	HAZARDOUS AREA CLASSIFICATION
		Hazardous Area Classification Schedule (form FR-804-006)
		Hazardous Area Material Schedule (form FR-804-007)
		Hazardous Area Property Schedule (form FR-804-008)
1500-10-G003	0	VENTS TO ATMOSPHERE
1500-10-G004	0	GAS SATELLITE EMERGENCY SHUTDOWN SYSTEMS
1500-10-G005	0	GAS WELLHEAD CONNECTION DESIGN
1500-10-G006		OIL FLOWLINE SIZING AND SPECIFICATION
1500-10-G007	0	FLUID FLOW CALCULATIONS
1500-10-G008	0	WATER DISPOSAL SYSTEM DESIGN
1500-10-G010	0	TWO AND THREE PHASE SEPARATORS
1500-10-G012	0	GAS SATELLITE DESIGN
1500-10-G014	0	RELIEF DEVICE SIZING
1500-10-G015	0	DEPRESSURISING
1500-10-G016	0	GAS BREAKTHROUGH AND RO SIZING
1500-10-G017	1	RELIEF SYSTEM DESIGN
1500-10-G018	0	FLARE DESIGN
1500-10-G019	0	MOOMBA AREA DESIGN CONDITIONS
1500-10-G020	0	PORT BONYTHON DESIGN CONDITIONS
1500-10-G021	0	DESIGN OF PACKAGED COMPRESSOR INSTALLATIONS
1500-10-G022	0	FIREPROOFING OF STEELWORK
1500-10-S001	0	PACKAGED RECIPROCATING COMPRESSOR - PROCESS SPEC
1500-10-W001	0	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	5	UNFIRED PRESSURE VESSELS
1500-30-G001	0	PUMPS - CENTRIFUGAL
1500-30-G002	1	PACKAGED RECIPROCATING COMPRESSORS
1500-30-G003	0	RECIPROCATING PUMPS
1500-30-S002	0	PACKAGED RECIPROCATING COMPRESSORS - MECHANICAL AND GENERAL
1500-50-G006	1	HOT TAPPING
1500-50-G007	3	PIPELINE GATHERING SYSTEM
1500-50-S003	2	HOT BENDS
1500-50-S008	1	PIG LAUNCHER AND RECEIVER BARRELS
1500-50-W001	2	HOT TAPPING
1500-60-G001	0	ELECTRICAL DESIGN
1500-69-G001		CATHODIC PROTECTION SYSTEM DESIGN
1500-70-S019	0	PACKAGING OF FIELD COMPRESSION CONTROL SYSTEMS
1500-70-S020	1	PROGRAMMABLE/CONFIGURABLE SYSTEMS
1500-90-S001	0	SKIDS AND SKID MOUNTED ASSEMBLIES
1500-120-S003	0	CONCRETE CONSTRUCTION
1500-120-S012	0	ABOVE GROUND PROTECTIVE COATING
1500-120-S020	1	BURIED FIELD PIPELINE SYSTEMS
1500-120-S021	0	FIELD JOINT COATING
1500-120-S023	0	COATING REPAIR TO OPERATING PIPELINES
1500-120-S025	0	SHOP APPLICATION OF LIQUID APPLIED HIGH BUILD EPOXY

Document	Rev	Title
1500-120-S027	1	ABOVE GROUND PIPELINE SYSTEMS
1500-120-S028	0	LABORATORY TESTING OF LIQUID APPLIED POLYMERIC COATINGS
1500-120-S029	0	CONSTRUCTION OF IMPRESSED CURRENT CATHODIC PROTECTION SYSTEM
1500-120-S030	0	INSTALLATION OF CATHODIC PROTECTION TEST POINTS ON BURIED PIPELINE
CORPORATE STANDARDS		
1515-40-D001	0	Design Practice for Roads
1515-50-D001	0	Design Practice for Piping
1515-50-D002	0	Design Practice for Valves
1515-50-S001	0	Specification for Piping and Valves
1515-50-S004	0	Specification for High Pressure Steel Linepipe
1515-120-S001	0	Design Practice for Bulk Earthworks
1515-120-S002	0	Specification for Excavation and Backfilling
1515-120-S004	0	Specification for Fabrication of Steelwork
1515-120-S005	0	Specification for Erection of Steelwork
1515-120-S006	0	Specification for Roadworks
1515-120-S007	0	Specification for Construction of Earthen Bund Evaporation or Storage Ponds
1515-120-S009	0	Specification for Installation of Mechanical Equipment
1515-120-S011	0	Specification for Grouting Plant, Equipment and Structural Steelwork
1515-120-S015	0	Specification for Fabrication, Installation of Process and Utility Piping
1515-120-S018	0	Specification for Pressure Testing of Process and Utility Piping

Appendix 12: Environmental Goals for Flowline Construction and Right-Of-Way Restoration[†]

Ref	GOAL	GOAL ATTAINED	MINOR SHORTFALL	SIGNIFICANT SHORTFALL
1.0	R.O.W. PREPARATION			
1.1	Minimise R.O.W. width:			
	• standard (15m)	R.O.W. does not exceed 15m on the standard section.	R.O.W. sometimes exceeds 15m of the standard section(<25% of R.O.W.).	R.O.W. often exceeds 15m on the standard section(>25% of R.O.W.).
	• creek crossings (5m)	R.O.W. width does not exceed 5m at creek crossings.	R.O.W. width exceeds 5m at creek crossings.	R.O.W. width exceeds 9m at creek crossings.
	• dense vegetation	R.O.W. width does not exceed 9m on the "dense vegetation" sections.	R.O.W. width sometimes exceeds 9m of the "dense vegetation" sections (25% of R.O.W.).	R.O.W. width often exceeds 9m of the "dense vegetation" sections (>25% of R.O.W.).
1.2	Minimise terrain disturbance	Route appropriately aligned to avoid difficult terrain.		Route traverses difficult terrain which could have been avoided.
1.3	Leave trees on R.O.W.	Occasional trees left on R.O.W.		All trees removed from R.O.W.
1.4	Correct protocol followed for sites discovered during construction	Either no sites encountered, or records show correct procedures were followed to avoid damage to additional sites.		Evidence that additional sites have been disturbed, and there are no records of ameliorative measures having been taken to avoid damage.
1.5	Trim (rather than clear) trees in dense woodland	Extensive tree trimming in designated areas.	Minor tree trimming in designated areas. Some evidence of tree removal where trimming appropriate.	No tree trimming evident. Obvious evidence of tree removal where trimming appropriate.
1.6	Leave root-stock (ie. minimal grading of R.O.W.)	No evidence of root-stock removal on R.O.W. beyond 3m of trench line. R.O.W. is either only lightly graded or not graded.	Evidence of some root-stock removal beyond 3m of trench line (<25% of R.O.W.).	All root-stock removed. R.O.W. generally deeply graded for full R.O.W. width (>25% of R.O.W.).
1.7	Public track intersections:			
	• Reduce R.O.W. width to less than 9m	R.O.W. width 9m at track crossing.	R.O.W. width greater than 9m at track crossing.	R.O.W. width greater than 15m at track crossing.
	• Dog-leg R.O.W. to break line-of-sight	R.O.W. dog-legs at track crossing so that less than 100m is visible either side of the track.	R.O.W. dog-legs at track crossing, but 250m of R.O.W. is visible either side of the track.	R.O.W. does not bend at track crossing and greater than 250m of R.O.W. is visible either side of the track.
	• Leave vegetation on R.O.W. to conceal R.O.W.	Some trees and/or shrubs have been left on the R.O.W. to break the line-of sight.		All vegetation has been cleared from the R.O.W.
	• Re-establish the verge	Verge has been adequately re-established.		Verge has not been adequately re-established.
2.0	R.O.W. REHABILITATION			
2.1	Remove all windrows	No windrows associated with the pipeline evident (except on dunes where some windrows are inevitable after reprofiling, but will quickly disappear).	Occasional windrows remain on the R.O.W. (<10% of R.O.W.).	Regular windrows remain on the R.O.W. (>10% of R.O.W.).
2.2	Follow crown protocol	No crown present, or crown present over the trench with periodic breaches.	Crown over trench but periodic breaches (where required) not evident.	Backfill insufficient to fill trench.
2.3	Avoid subsidence	No subsidence evident on pipe trench.	Minor subsidence (<50mm) evident (<10% of the trench).	Significant subsidence (>50mm) evident, or regular minor subsidence (>10% of the trench).

[†] Taken from SEA Pty Ltd (2000). *Audit of Recently Constructed Flowlines in SA, November 2000*. Social and Ecological Assessment Pty Ltd.

Ref	GOAL	GOAL ATTAINED	MINOR SHORTFALL	SIGNIFICANT SHORTFALL
2.4	Respread cleared vegetation	Where vegetation removed it has been respread over full width of R.O.W., excluding access track.	Vegetation respread over the R.O.W., but some areas have been missed.	Little evidence of vegetation respread over the R.O.W. Stockpiled vegetation left unspread.
2.5	Reprofile dunes to pre-existing contours	Dune profiles have been restored consistent with surrounding dune profiles for all dunes crossed.	Dune profiles have generally been restored consistent with surrounding dune profiles with occasional exceptions (<10% of dunes).	Dune profiles have not been restored consistent with surrounding dune profiles for numerous dunes crossed (>10% of dunes).
2.6	Reprofile creek banks to pre-existing contours	Creek/channel banks restored to original profile.		Creek/channel banks not restored to original profile.
2.7	Rip compacted areas (eg. access tracks)	All compacted soil ripped along length of R.O.W.	Some areas of compacted soil have not been ripped (<25%).	Numerous areas of compacted soil have not been ripped (>25%).
3.0	RUBBISH			
3.1	Remove all rubbish	No evidence of waste on R.O.W. or at campsites.	Evidence that rubbish has been cleaned up, but some rubbish still on R.O.W.	Little or no evidence that rubbish has been cleaned up.
4.0	R.O.W. STABILITY			
4.1	No erosion of the R.O.W.	No evidence of erosion on R.O.W.	Minor rills or deflation forming or likely to form on R.O.W., but unlikely to be a major issue (<200mm deep).	Significant gully or blow-out forming or likely to form on R.O.W. (>200mm deep).
5.0	PASTORAL			
5.1	Repair fences to "as before" standard	Fences repaired to "as before" standard.	Fences repaired, but slightly poorer than before (but still stock-proof).	Fences either not repaired, or very poorly repaired (not stock-proof).
6.0	TECHNICAL			
6.1	Above ground pipeline on plastic stands	Pipeline on plastic stands and not in contact with ground.	Stands used but put occasionally in contact with ground.	No stands used, or stands ineffective and often in contact with ground.
6.2	Pipeline markers installed appropriately	Markers installed at regular intervals.	Occasional marker missing or ineffective.	Very few or no markers.

Appendix 13: Environmental Audit Corrective Actions.

Issues identified during the Annual Audit of Recently Constructed Flowlines

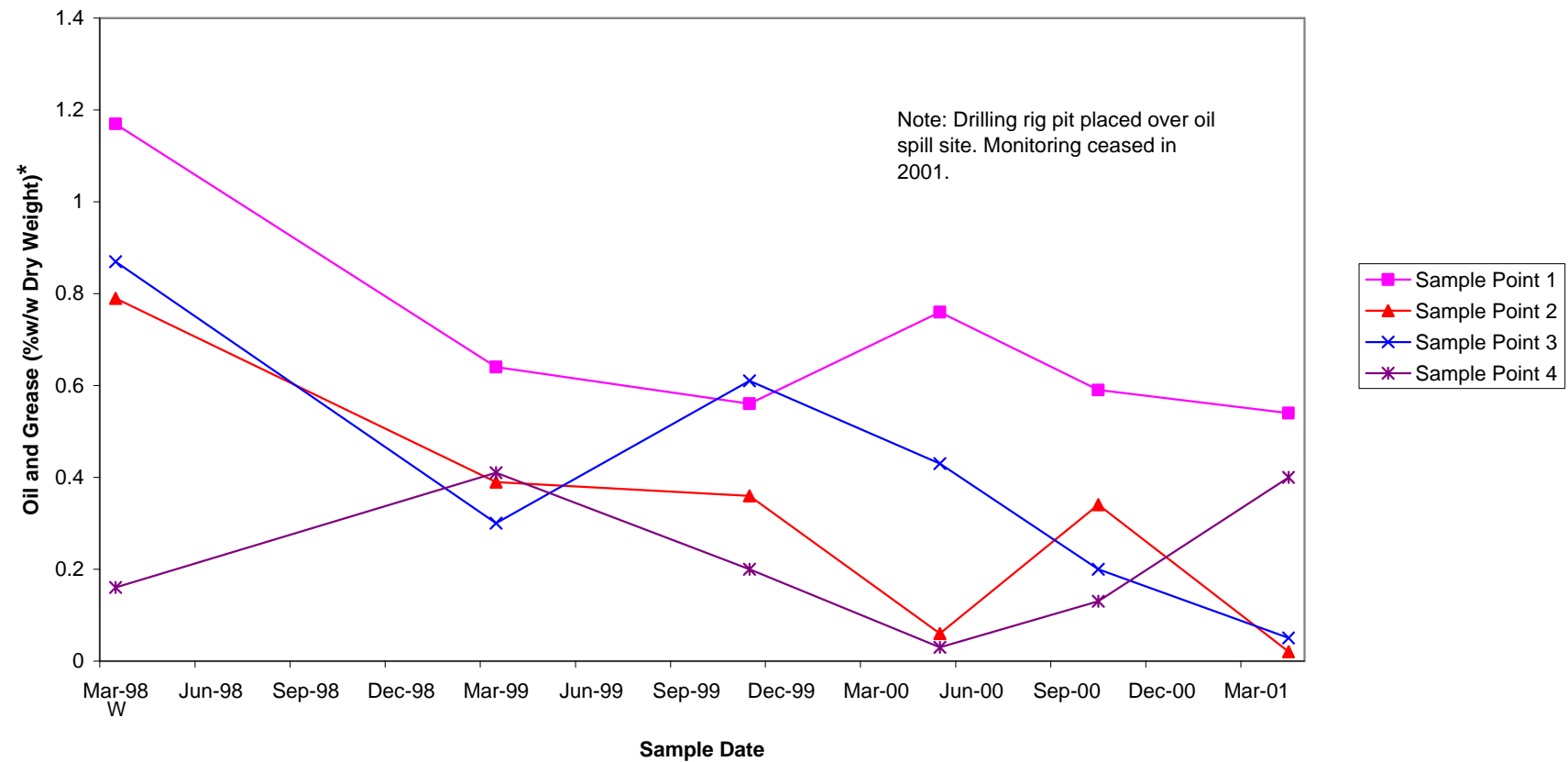
No.	Issue	Contravention	Recommended Action
1.	Pondrinie North # 1 Flowline: erosion gully forming along trenchline owing to subsidence.	Non-conformance with Santos Seismic <i>Environmental Procedures</i> and <i>Codes of Practice</i> , and Production and Processing SEO.	Fill erosion gully and divert run off away from the trenchline. Ensure construction crews are aware of appropriate practices and standards specified in Santos Codes of Practice.
2.	Nephrite # 2 flowline: erosion gullies across R.O.W. Unlikely to worsen.	Due-diligence/ Observation	Monitor erosion gullies for deterioration. If this occurs, implement remedial action to remediate erosion and prevent recurrence.
3.	Barina #5 flowline: mild dune deflation	Due-diligence/ Observation	Monitor the slight dune deflation to ensure that the flowline is not exposed.
4.	Pipeline markers fallen over at several locations	Due-diligence/ Observation	Evaluate methods to prevent pipeline markers falling over. Consider whether to increase the base size/weight of the markers.
5.	Tirrawarra #13 and #41 flowlines have no markers.	Due-diligence/ Observation	Determine whether pipeline markers need to be installed at these flowlines. Install if required.
6.	Above ground pipelines are invariably in contact at points where they cross sand dunes.	Due-diligence/ Observation	Evaluate the risk of oil flowlines suffering external corrosion from contact with sand dunes. Evaluate the option of using methods to prevent such external corrosion. Consider whether pipe coating is appropriate, especially where sand dunes are mobile.

Appendix 14: Repairs undertaken to flowlines, trunklines and pipelines

Date	Oil Line Repair Description
01/09/2000	Telopea – Keleary Flowline: Approx 20 metres x 100 mm pipeline replaced 1.4 km from Keleary.
04/12/2000	Jena 13 flowline: Repair to screwed flowline due to external failure caused by sand coverage.
04/12/2000	Jena 4 flowline: Repair to screwed flowline due to external failure caused by sand coverage.
27/09/2000 27/12/2000 29/05/2001	LSC – Strzelecki 100 mm trunkline. Failure in 100 mm dia buried section first 80 metres from LSC. Temporary Line clamps installed. Buried pipe (80 metres) near LSC satellite replaced January 2002.
25/12/2000	Carmina – LSC flowline: Replaced section of failed screwed tubing which failed where sand covered line. Sand removed, line placed on pipe supports.
03/01/2001	Tirrawarra – Moomba Oil line: Section of line replaced near Meranji flowline Tiein. Plans to abandon this line during 2002.
25/06/2001	Gidgealpa 27 flowline failed whilst shut in. Isolation valves inspected and repaired. Line to be abandoned.
14/08/2001	Taloola to Tantanna flowline: Line failed at buried road crossing. Pipe clamp installed.
11/09/2001 29/10/2001	Failures at Jena #11 flowline, Jena #5 & Jena 2 manifolds. All now shut in awaiting repairs. Manifolds being replaced. Jena #11 flowline being replaced connecting to Jena #5 manifold (previously Jena #4 manifold).
17/12/2001	Keleary – Merrimelia trunkline. Pinhole leak applied where line covered by sand 8 km from Merrimelia satellite. External pipe clamp applied
Date	Gas Line Repair Description
11.03.01	Big Lake # 63. Flowline - The pipeline failed due to internal erosion downstream of the transition weld to the meter run riser. Piping repaired, review in progress of “high” velocity wells
11.02.01	Raven #1. Flowline -Erosion of flowline immediately down stream of transition piece. Piping repaired, review in progress of “high” velocity wells
04.05.01	Moomba #76. Flowline -Approx. 2 Km from M#76 well. Pipeline isolated, future of well under review
18.01.01	Cuttaparrie #6. Lease Piping -Internal erosion of choke valve next to the No 1 Spool. Choke replaced, review in progress of “high” velocity wells
26.02.01	Meranji #18. Lease Piping- Internal erosion of No 2 Well spool reducing spool. Reducer replaced, review in progress of “high” velocity wells
25-06-01	Tirrawarra #49. Flowline- External corrosion due to coating joint failure. Corroded section replaced, coating defect survey conducted of Embarka Swamp wells. Coating refurbishment program to be developed.

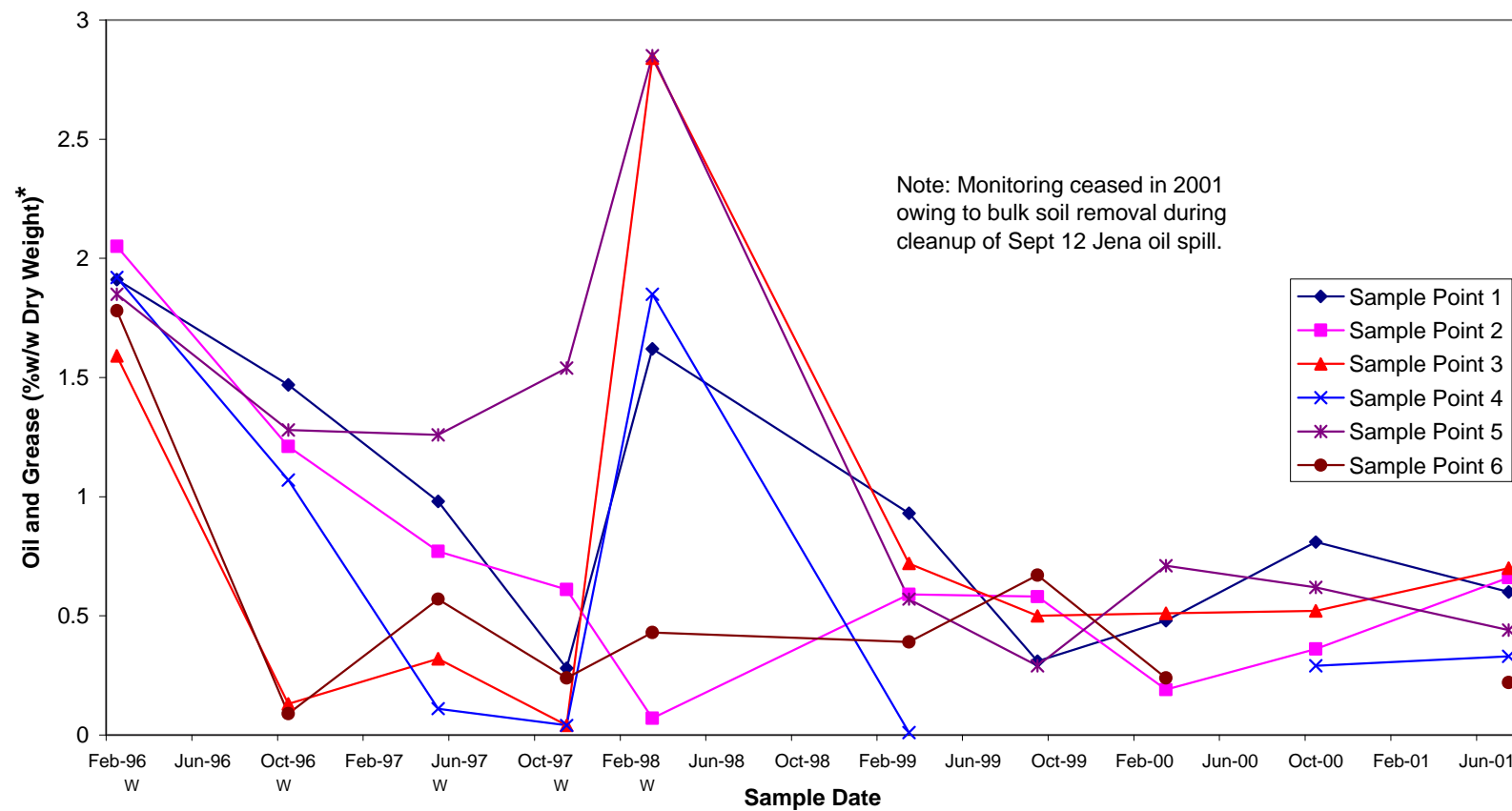
Appendix 15: Monitoring results for soils sampled from oil spill sites

Dullingari Oil Satellite Oil Spill



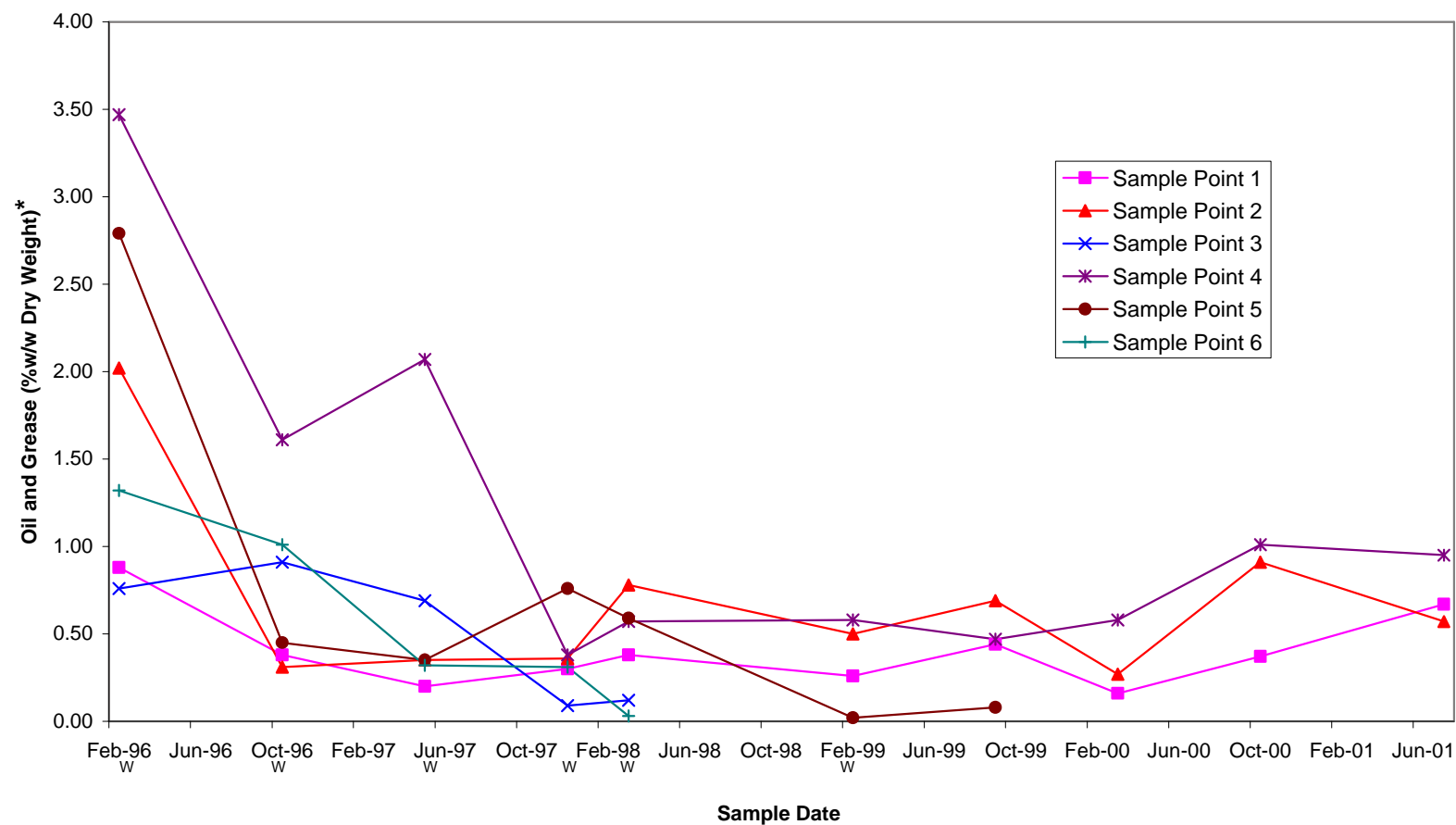
* Note: Sampling dates identified with a "W" indicate results presented as % **Wet Weight**. All other results expressed as % Dry Weight.

Jena 1 Flowline Oil Spill

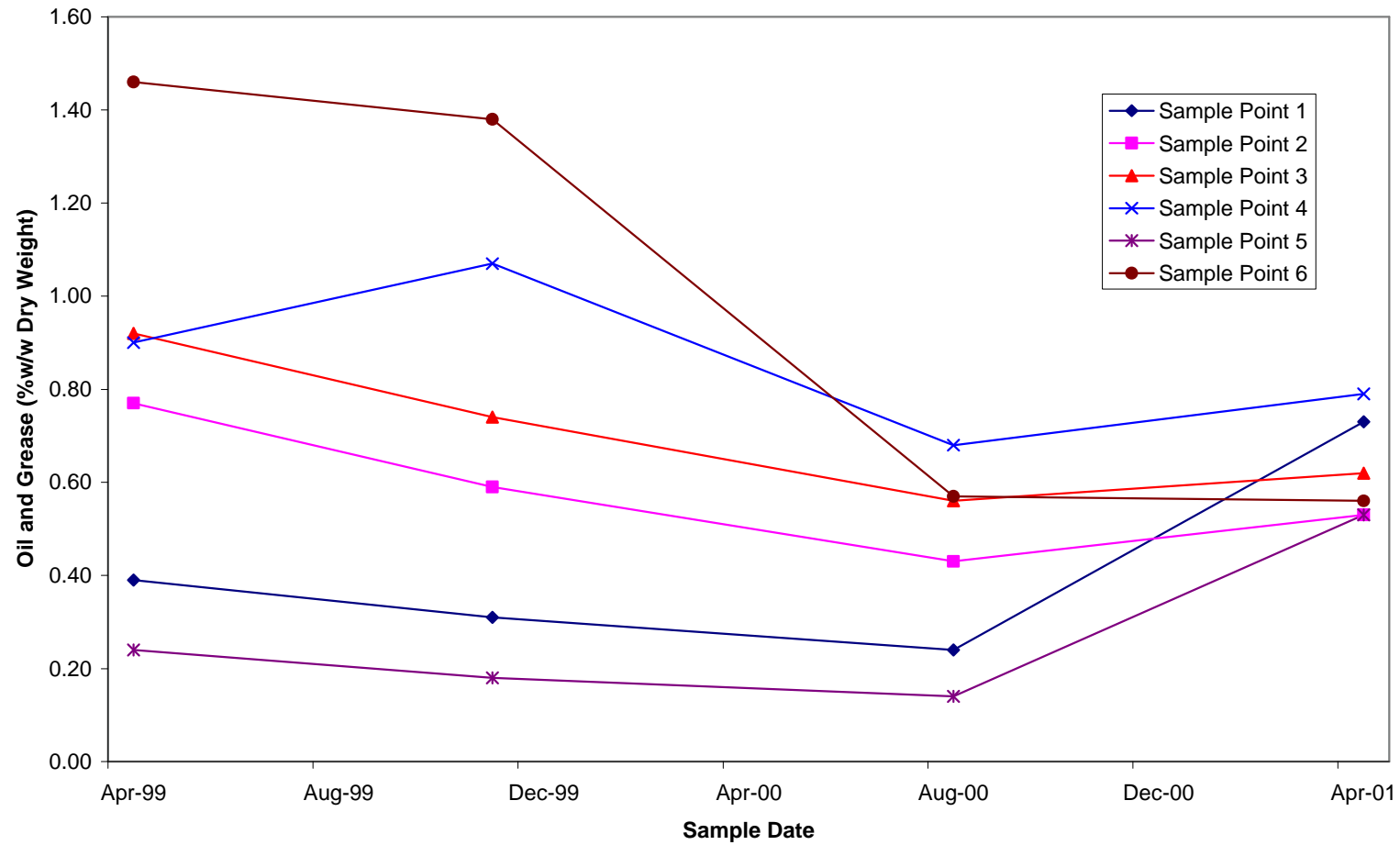


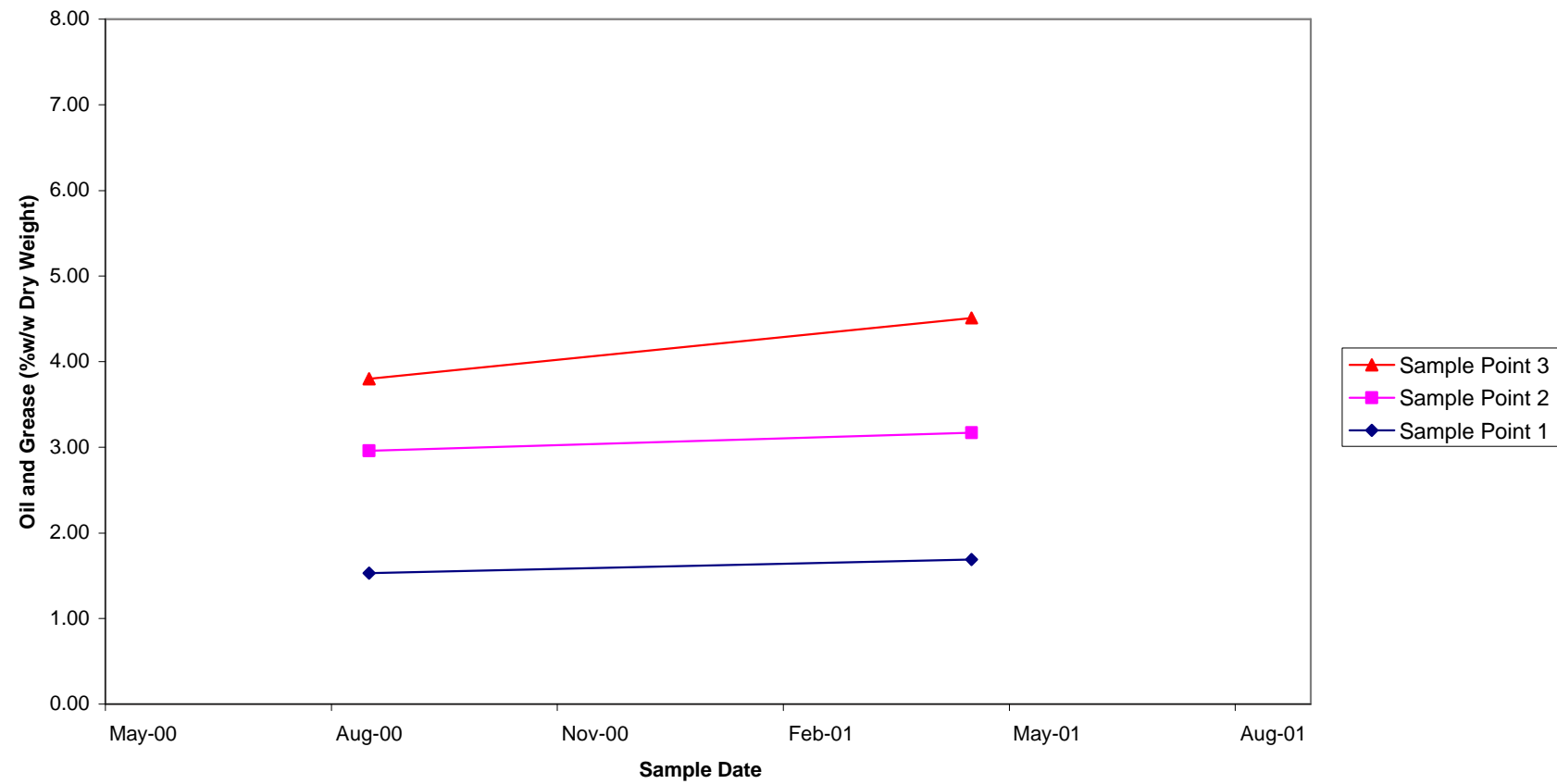
*Note: Sampling dates identified with a "W" indicate results presented as % **Wet Weight**. All other results expressed as % Dry Weight.

Jena 4 Trunkline Oil Spill

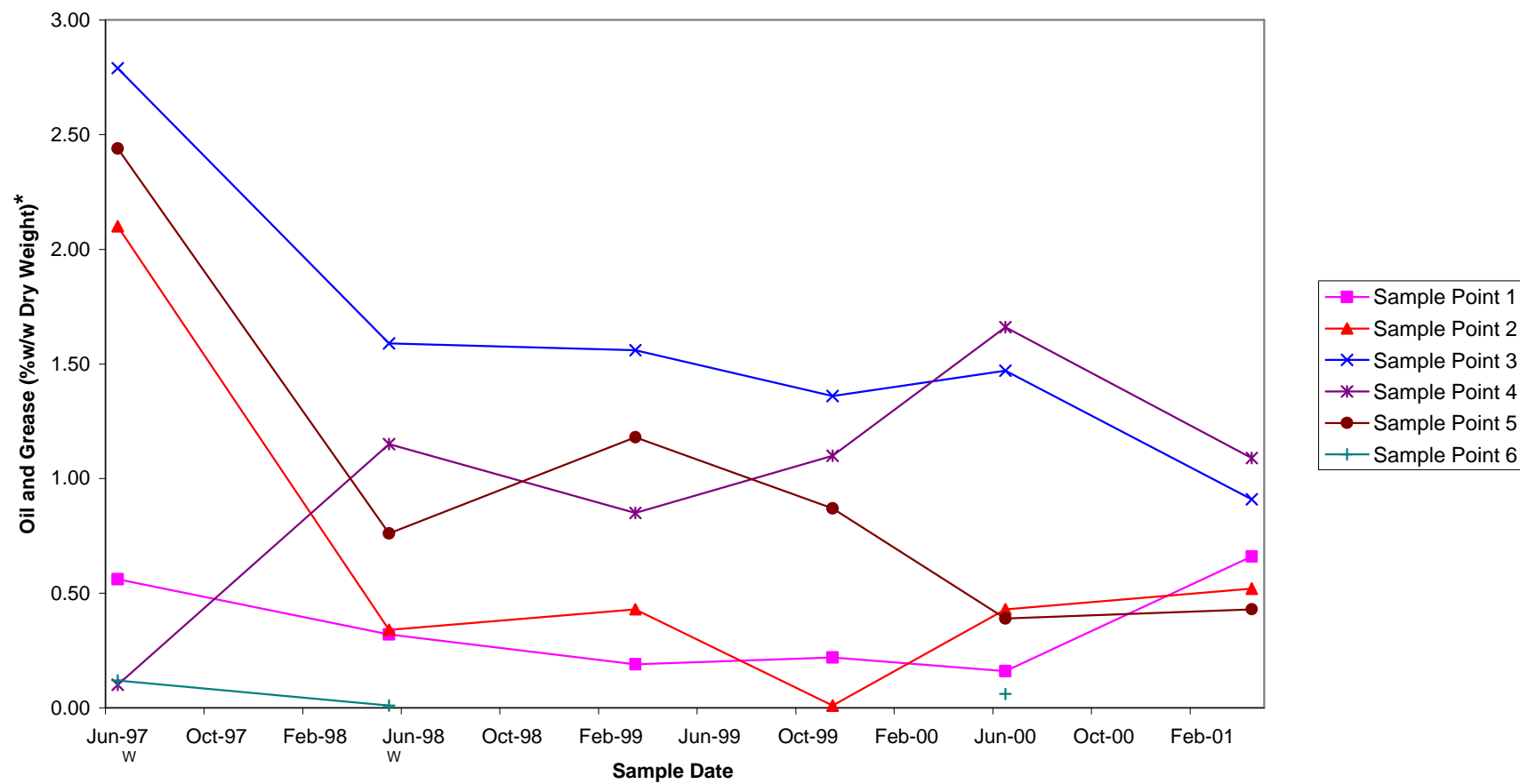


* Note: Sampling dates identified with a "W" indicate results presented as % **Wet Weight**. All other results expressed as % Dry Weight.

Keleary Trunkline Oil Spill (19km)

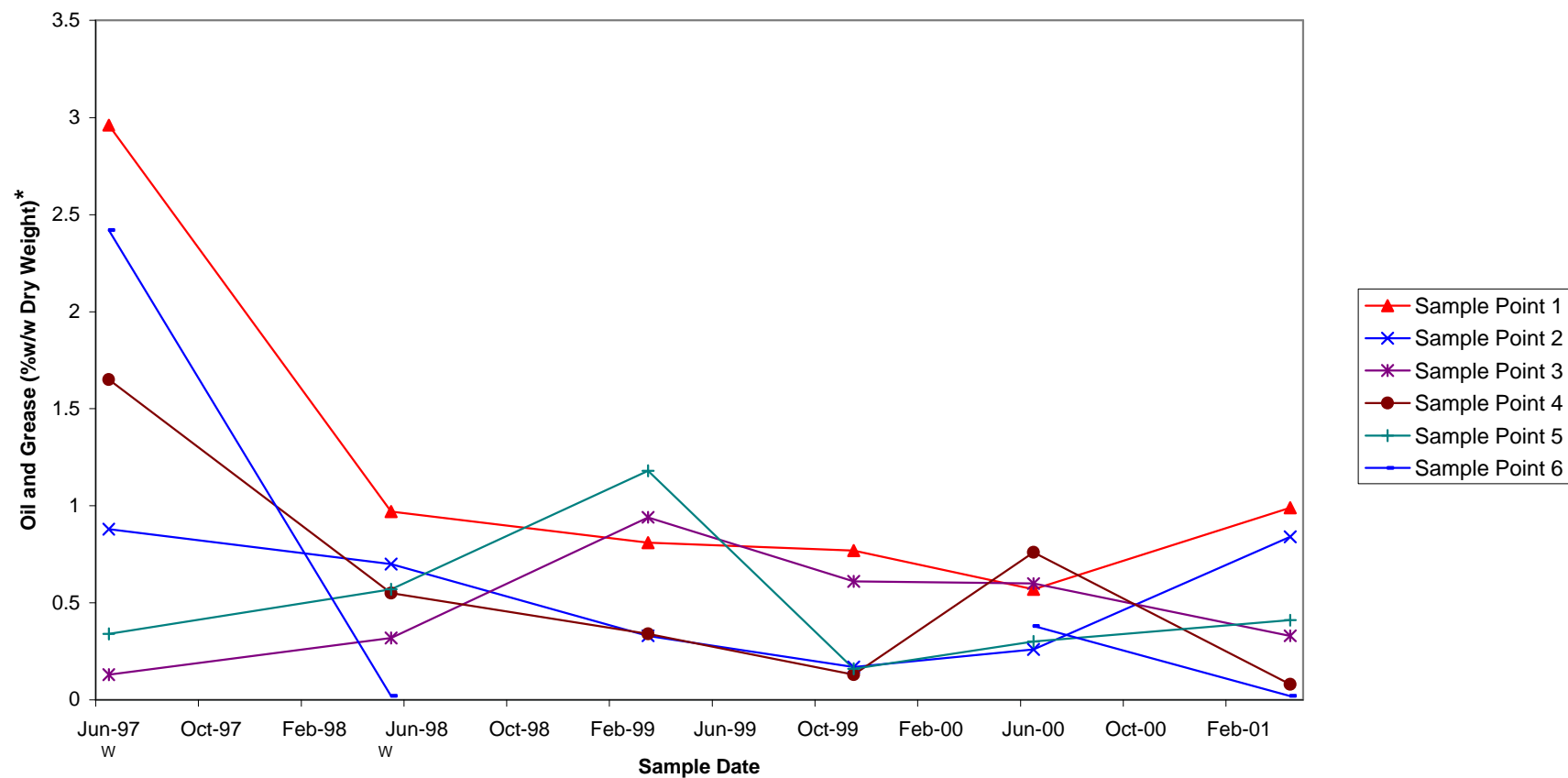
Keleary Trunkline Oil Spill (66km)

Lake Hope Trunkline Oil Spill 3.9km from Tantanna



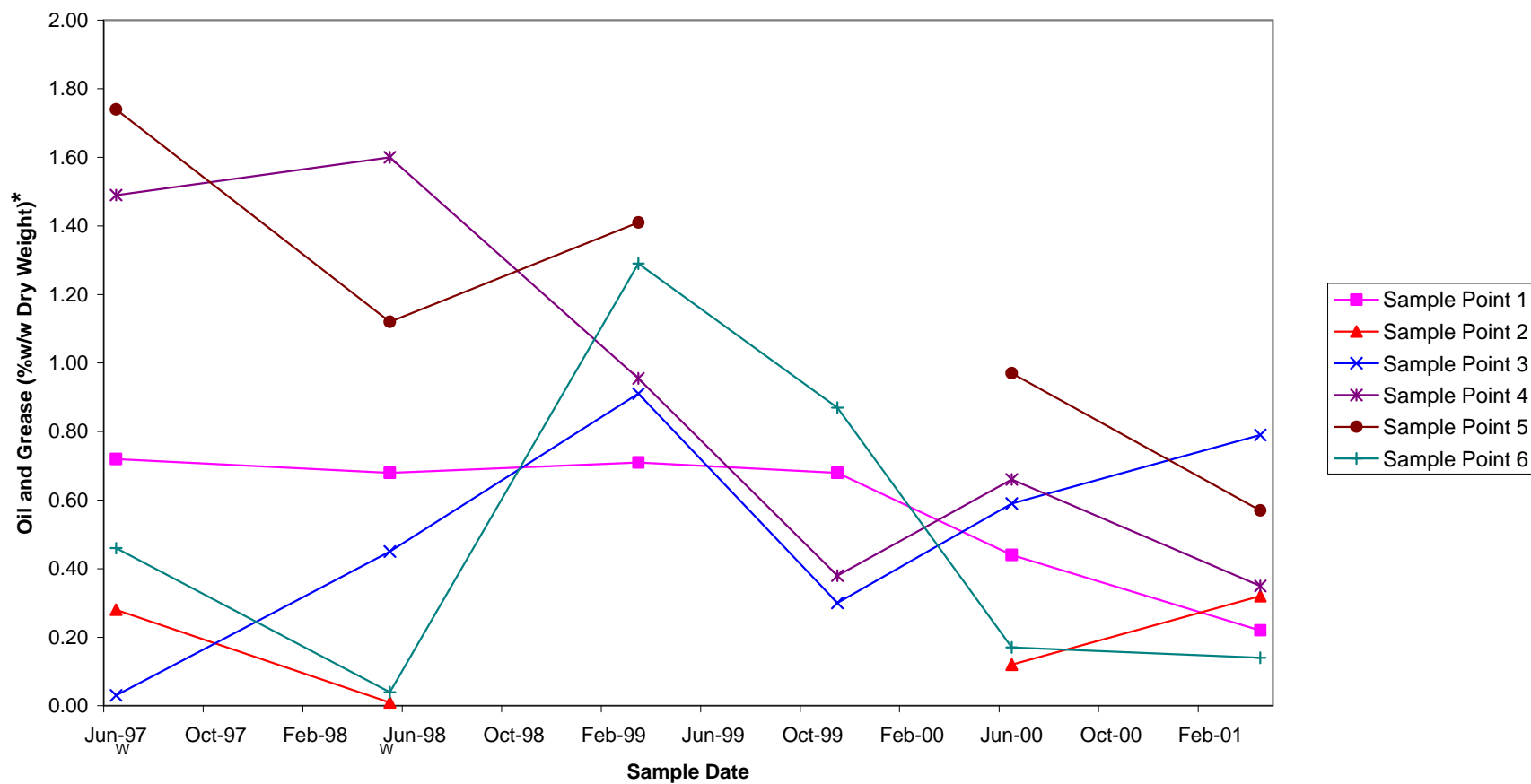
* Note: Sampling dates identified with a "W" indicate results presented as % **Wet Weight**. All other results expressed as % Dry Weight.

Lake Hope Trunkline Oil Spill 13.1km from Tantanna



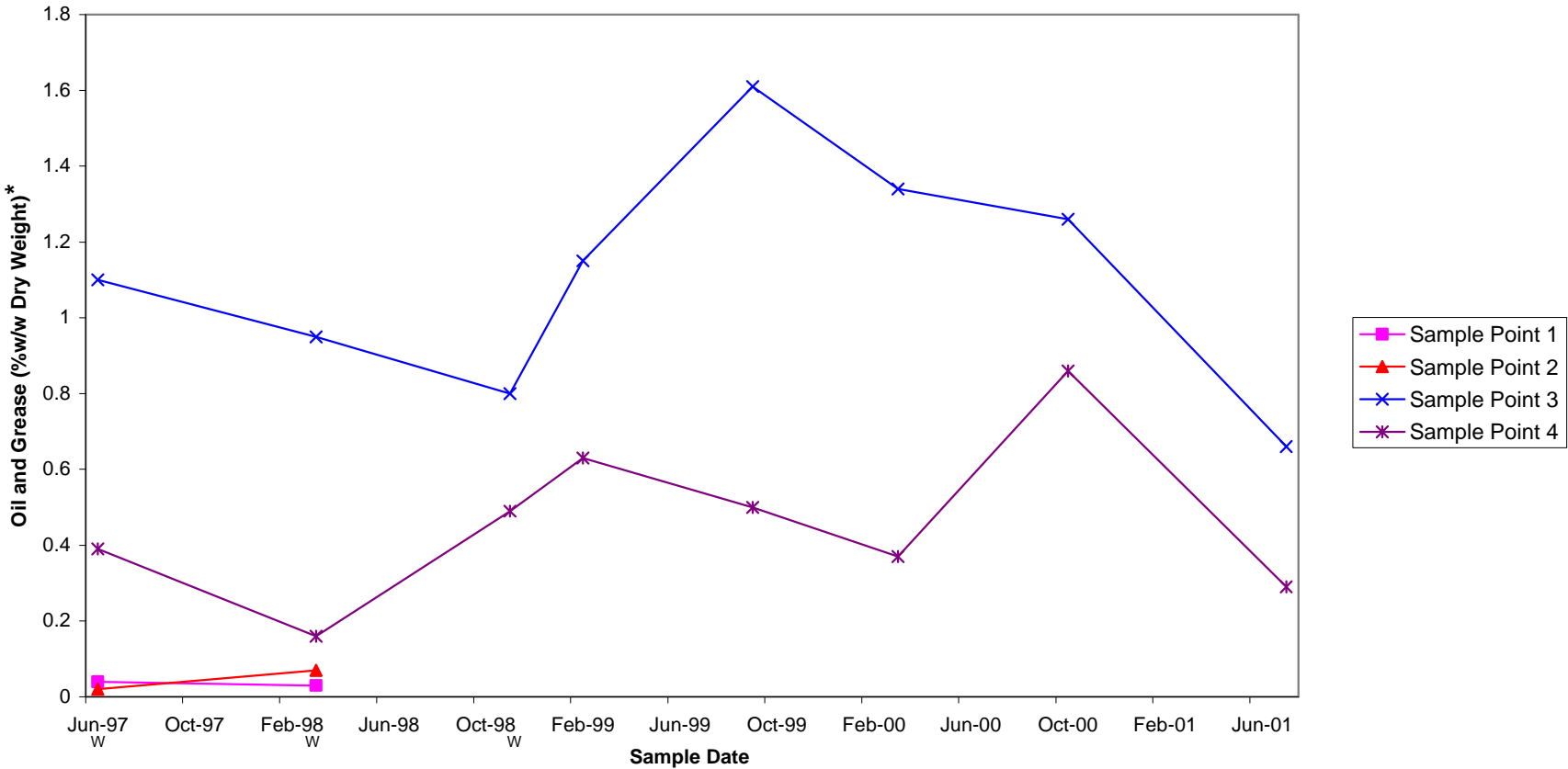
* Note: Sampling dates identified with a "W" indicate results presented as % **Wet Weight**. All other results expressed as % Dry Weight.

Lake Hope Trunkline Oil Spill 24.4km from Tantanna



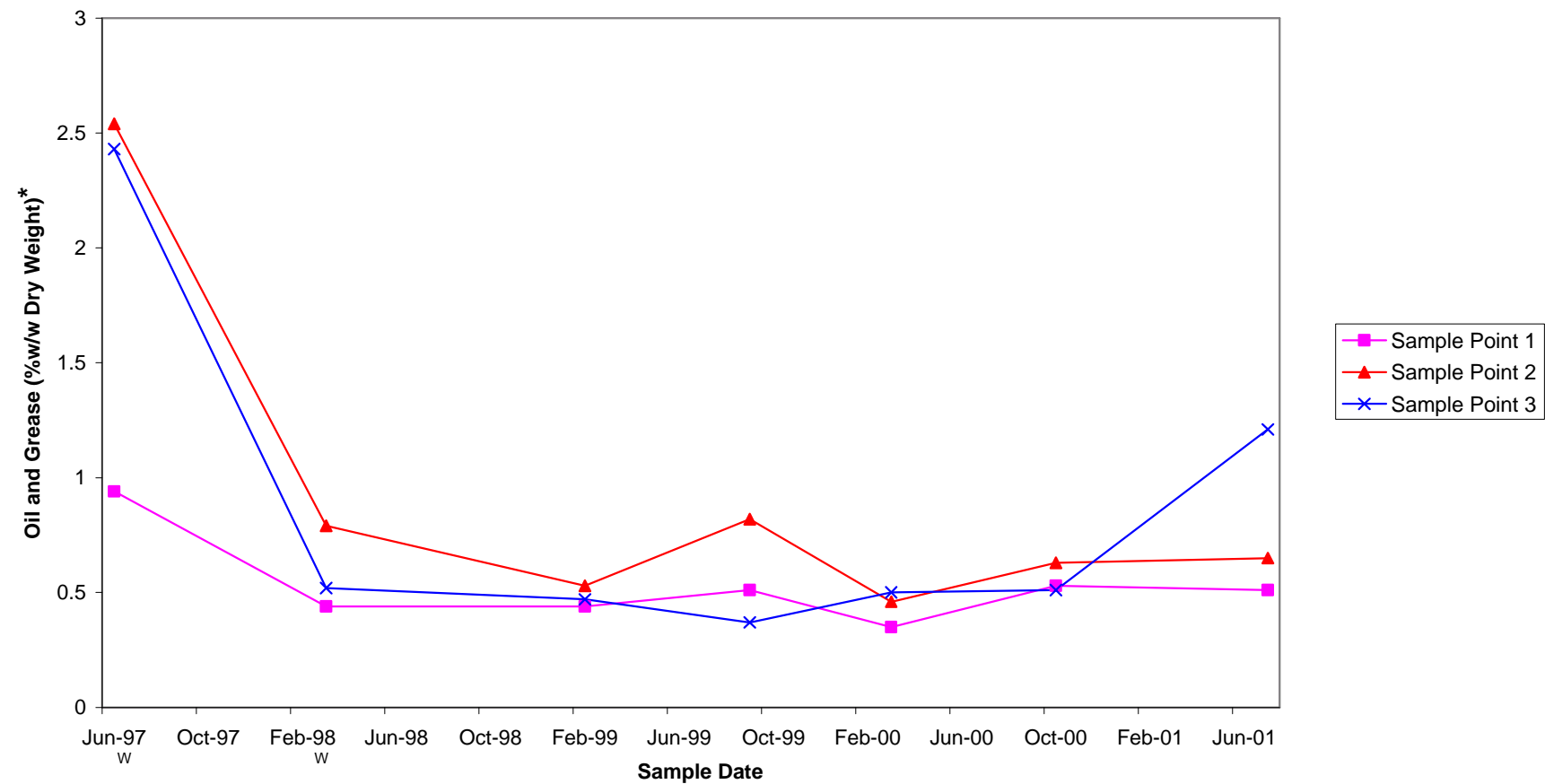
* Note: Sampling dates identified with a "W" indicate results presented as % **Wet Weight**. All other results expressed as % Dry Weight.

Limestone Creek - Strzelecki Trunkline Oil Spill (3.8km from LSC)

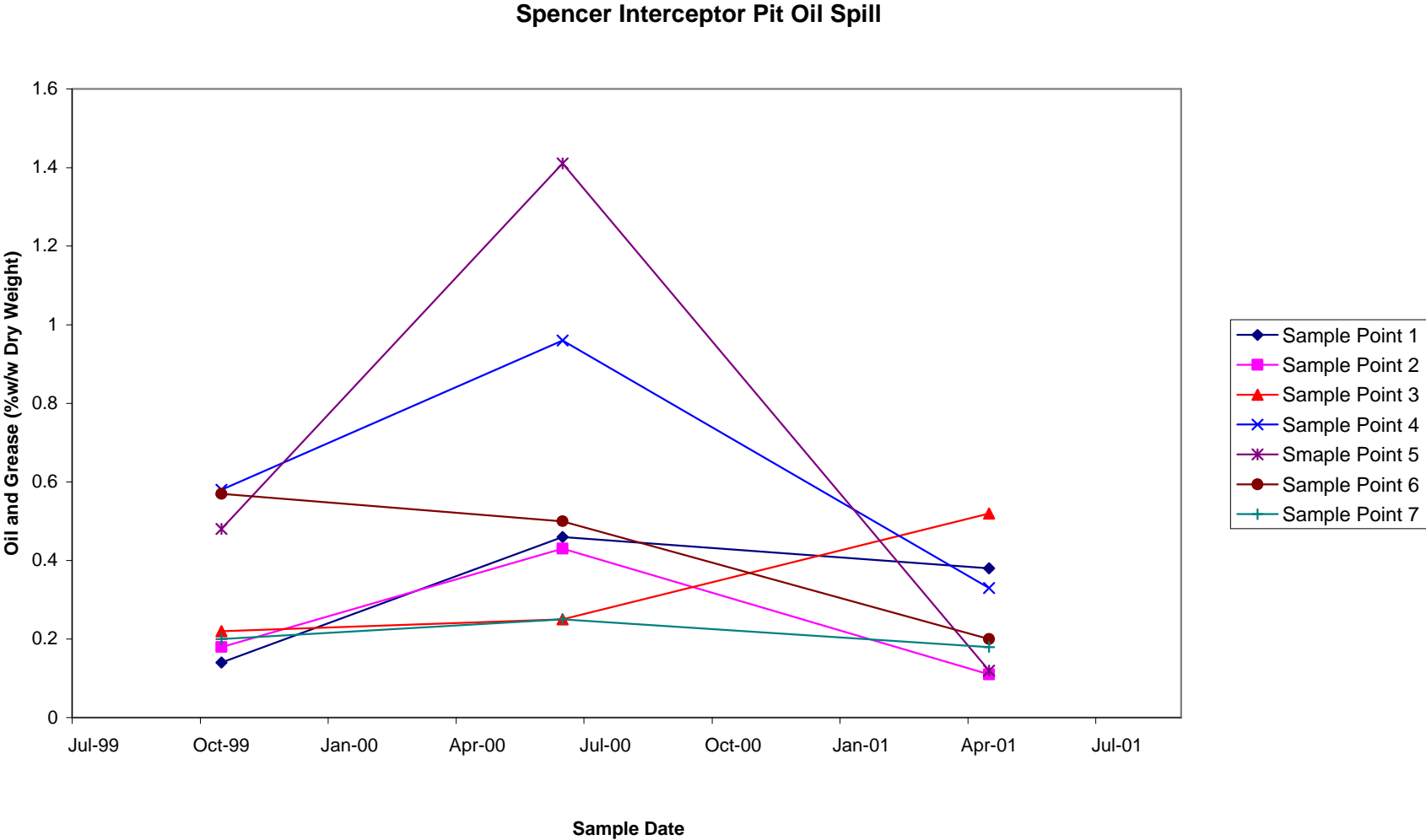


* Note: Sampling dates identified with a "W" indicate results presented as % **Wet Weight**. All other results expressed as % Dry Weight.

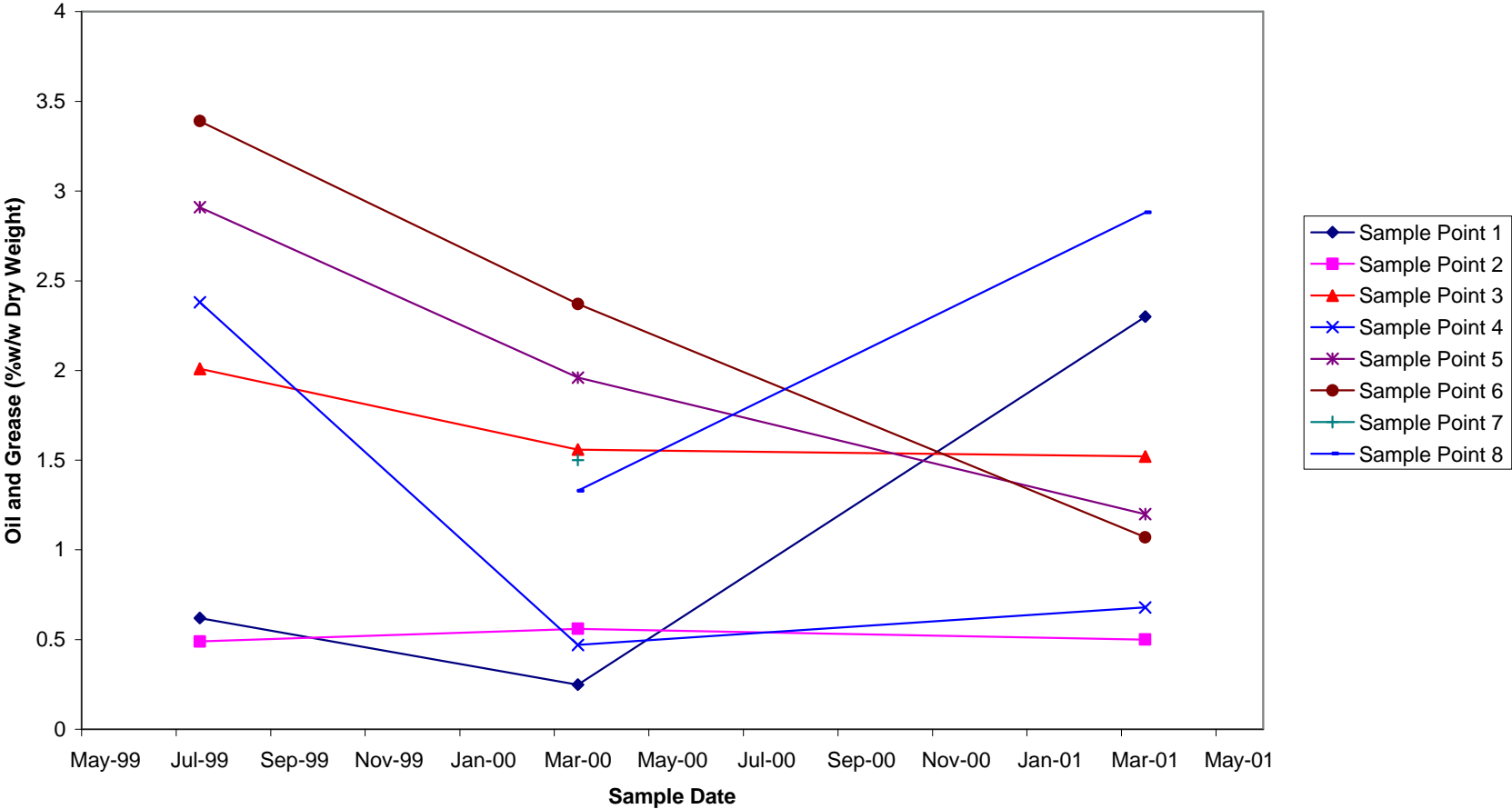
Limestone Creek - Strzelecki Trunkline Oil Spill (15 km from LSC)



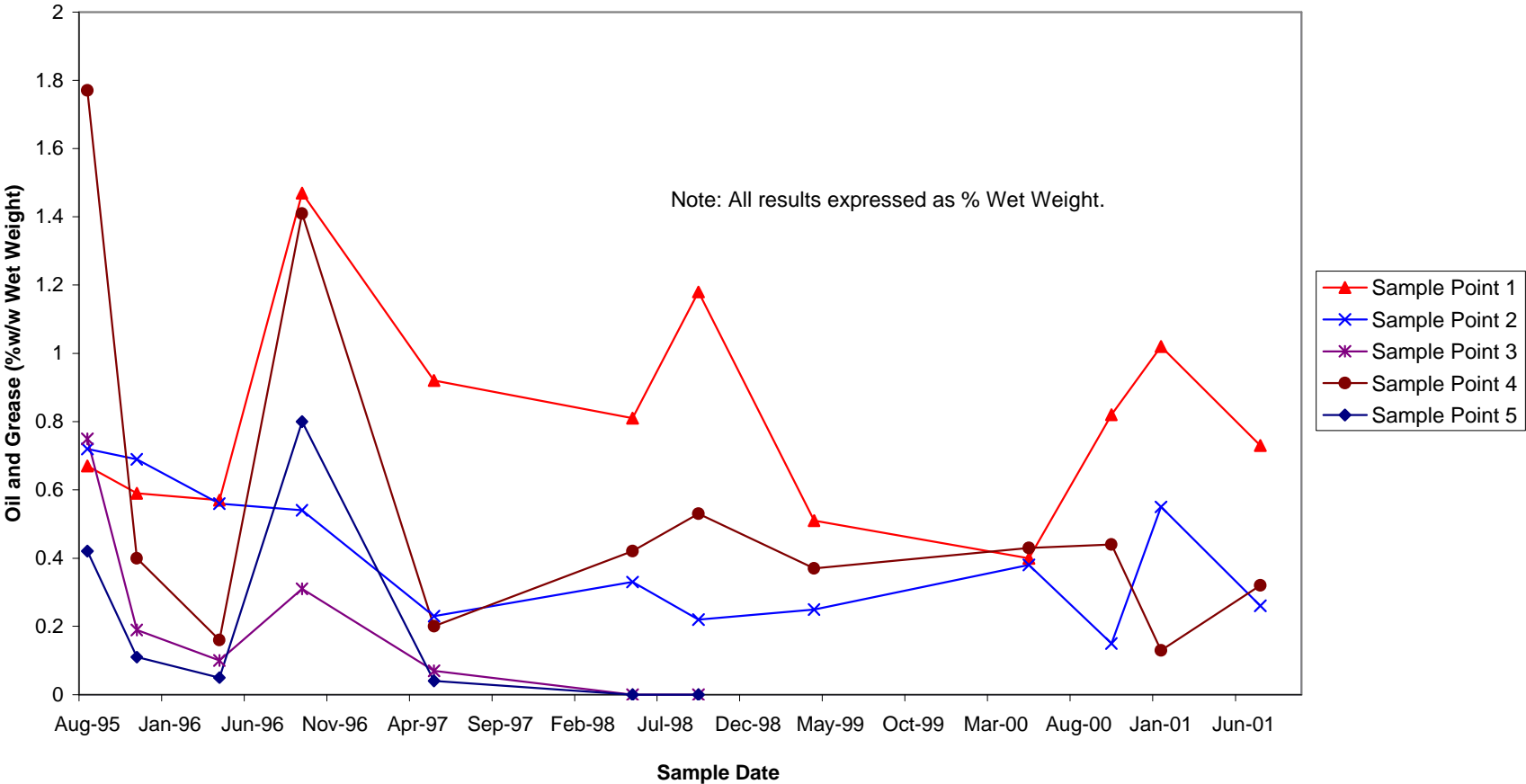
* Note: Sampling dates identified with a "W" indicate results presented as % Wet Weight. All other results expressed as % Dry Weight.



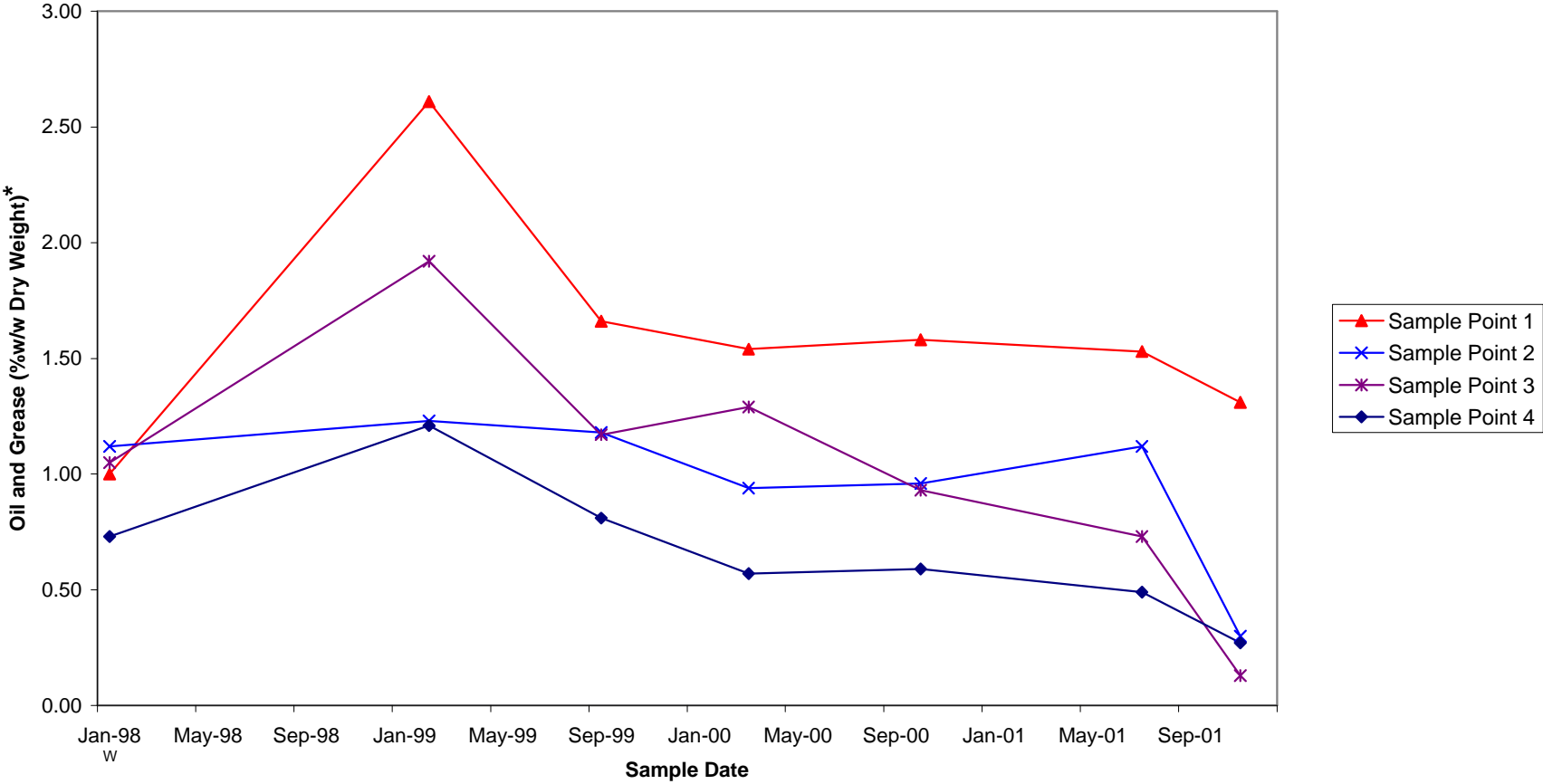
Strzelecki Oil Satellite Oil Spill



Tirrawarra Trunkline Oil Spill

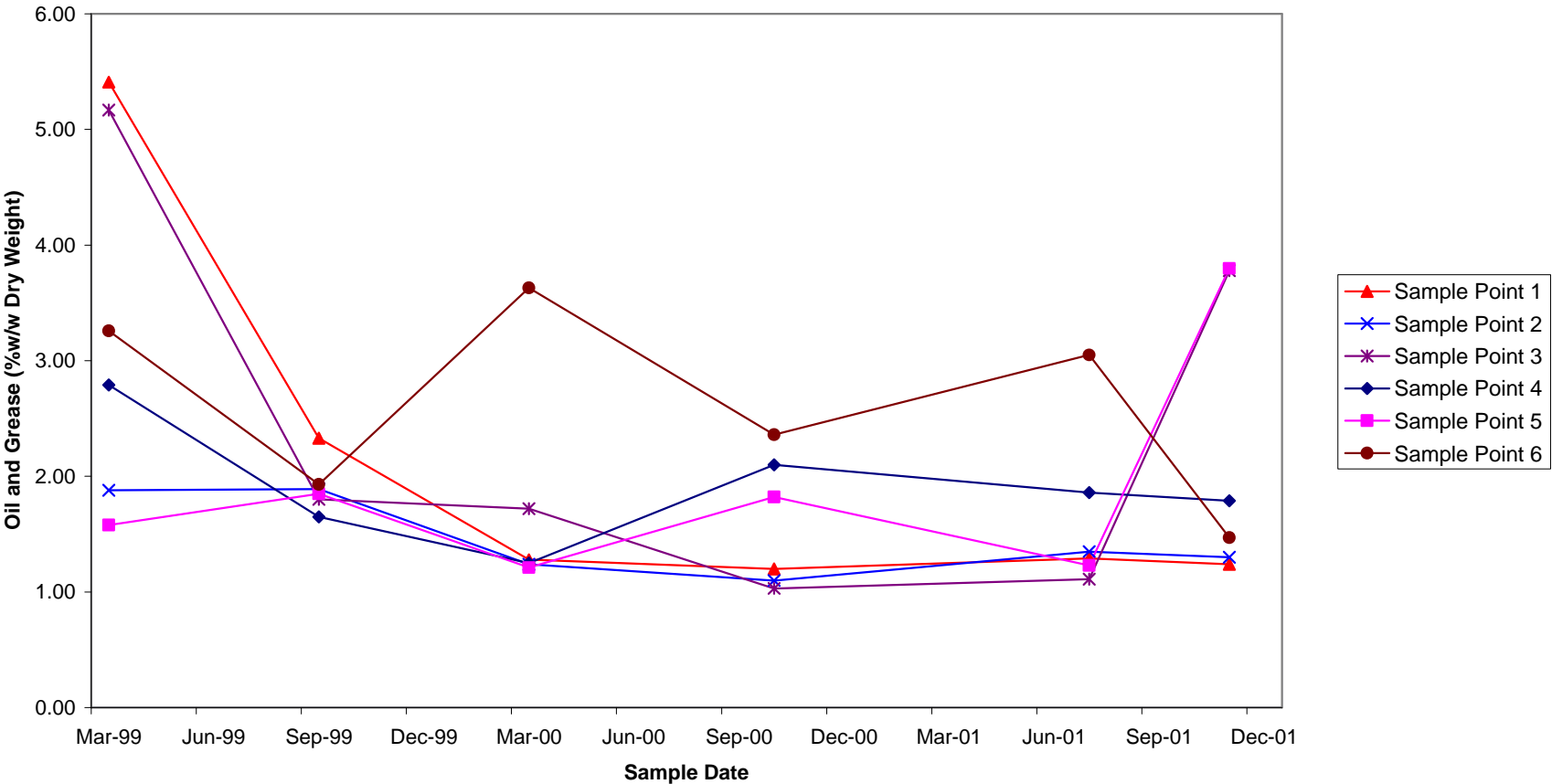


Ulandi 1 (1-98) Trunkline Oil Spill



*Note: Sampling dates identified with a "W" indicate results presented as % Wet Weight. All other results expressed as % Dry Weight.

Ulandi 1 (2-99) Trunkline Oil Spill



Appendix 16: Production Facility Projects

Project	Project Number	Description	Start Date	Completion Date
Moomba DPCU Compressor Motor Upgrade	811228	The replacement of explosion-protected electric motors and starters, cabling and switchboards at DPCU units 6,7,8 & 9 and associated auxiliary drives .	18 OCT 2001	18 OCT 2002
Moomba Northern Evaporation Pond	811220	The construction of a lined 40 000m2 evaporation pond adjacent to the existing Moomba North Evap Pond, to cater for production and stormwater disposal requirements from Moomba Main Plant .	15 OCT 2001	15 APRIL 2002
Moomba KP 29 Microwave Tower back up power supply	811256	The installation of a small (7KVA) generator to provide backup power for up to in order to prevent communications loss to Moomba when SWR line drops out .	11 JAN 2002	30 JUN 2002
Epsilon Compression	815033	Remove one nodal compressor from the Mawson Compression facility and install at Epsilon. Complete with gas/liquid separation facilities, interceptor pit and evaporation pond.	11 OCT 2000	JULY 2001
Brumby Compression	815031	Remove one nodal compressor from Toolachee East and install at Brumby. Complete with gas/liquid separation facilities, interceptor pit and evaporation pond.	11 OCT 2000	JULY2001
Re-cylindering of the Munkarie and Toolachee South nodal compressors	815036	Install new cylinders on the compressors, upgrade E.S.D. system and modify field manifold.	7 MAR 2001	AUGUST 2001
Moomba Instrument Air Upgrade	811131	Install three new instrument air compressors, complete with drier/ refrigeration treatment facilities	1 SEP 2000	18 DEC 2001
Moomba South Oil facilities upgrade	811579 811584	.Install new dewatering and production tanks complete with associated piping and instrumentation.	1 AUG 2001	NOV 2001
Mawson-Karunda Compression facilities	811218	.Installation of new lined evaporation pond and oily/water collection and disposal facilities	1 AUG 2001	OCT 2002
Replacement of P.S.V.s on Nodal compressors and on several production facilities	811101 811555 811556	Replacement of P.S.V.s on Nodal compressors, Merrimelia and Strzelecki oil satellite stations.	OCT 1999	NOV 2001

Appendix 17: Annual Formation Water Monitoring

ANALYTICAL REPORT

Date of Report:	20 November 2000
Job No:	2000410
Client:	Santos Ltd
Address:	GPO Box 2319, Adelaide SA 5001
Contact:	Catriona McTaggart
Dates of Sampling:	25/9/00-1/10/00
Dates of Receipt:	28-9-00 – 3-10-00
Analytical Request:	Wildlife and stock watering parameters
Description of Samples:	Water samples collected from oil and gas well evaporation ponds - Cooper Basin

2000 Process Formation Water Monitoring: Sampling Program Summary

Site No.	Sample Description	Sampling Date
1	Moomba South Central	25-9-00
2	Lake Brooks	25-9-00
3	North Evaporation Pond	25-9-00
4	Murta South	26-9-00
5	Daralingie	26-9-00
6	Tantanna	26-9-00
7	Spencer	26-9-00
8	Gidgealpa Oil Satellite	26-9-00
9	Gidgealpa Gas Satellite	26-9-00
10	Narcoonowie	27-9-00
11	Toolachee South	27-9-00
12	Toolachee East	27-9-00
13	Munkarrie	27-9-00
14	Amyema-Brumby	27-9-00
15	Toolachee Satellite 1 st Evaporation Pond	27-9-00
16	Toolachee Satellite 2nd Evaporation Pond	27-9-00
17	Toolachee North	27-9-00
18	Big Lake Gas Satellite	28-9-00
19	Big Lake 17	28-9-00
20	Moomba South East	28-9-00
21	Big Lake Oil Satellite	28-9-00
22	Limestone Creek	28-9-00
23	Della	28-9-00
24	Dullingari	29-9-00
25	Kidman	29-9-00
26	Lepena	29-9-00
27	Strzelecki 15	29-9-00
28	Strzelecki Oil	29-9-00
29	Moomba Oil	29-9-00
30	Meranji	30-9-00
31	Merrimelia Gas Satellite	30-9-00
32	Tirrawarra Gas Facility	30-9-00
33	Merrimelia Oil	30-9-00
34	Bookabourdie	1-10-00
35	Keleary	1-10-00
36	Lake Brooks Sewerage	1-10-00

2000 Process Formation Water Monitoring: Sample Collection & Preservation*

Laboratory Registration #	Sample Type	Preservation	Sample Container
2000410-1.1 To 2000410-36.11	water	4°C	1L G(S)
		4°C sulphuric acid	1L P(D)
		4°C HCl	1L P(D)
		4°C nitric acid	250ml P(A)
		4°C Zn Ac/caustic	250mL P
		freeze	500mL P(D)
		Lugols soln	250mL S

* Example only. Complete sample collection and preservation details available if required.

2000 Process Formation Water Monitoring: 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	Graphite 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 ₄ E	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 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)

2000 Process Formation Water Monitoring: Results for Oil Satellite Facilities

<i>Parameter</i>	<i>Units</i>	<i>Keleary</i>	<i>Narcoonowie</i>	<i>Strzelecki</i>	<i>Limestone Creek</i>	<i>Moomba Oil</i>	<i>Merrimelia Oil</i>	<i>Meranji Oil</i>	<i>Tantanna Oil</i>	<i>Spencer</i>	<i>Wildlife Guideline Level¹</i>	<i>Stock Guideline Level¹</i>
Site No.		35	10	28	22	29	33	30	6	7		
Biological												
Faecal Coliforms	cfu/100mL	1	0	0	5	1	0	0	0	0	N/A	1000
Blue-Green Algae (total)	cells/mL	500	900	350	250	200	450	250	4000	1857	N/A	10000
Chlorophyll-a	µg/L	<1	<1	4	2	6	36	<1	5	6	2.0-10.0	N/A
Physico-Chemical												
Water Temperature	°C	N/A	21.4	na	24.1	24.4	22.9	21.5	21.7	24.2	N/A	N/A
Dissolved Oxygen	mg/L	8.4	10.1	5.9	8.8	7.9	7.4	9.9	11.4	6.3	>6	N/A
pH	Stand.	9.5	9.3	8.8	9.5	8.7	9.1	10.1	9.3	8.4	6.5-9.0	N/A
Conductivity	µS/cm	6770	5640	7090	12240	2032	4030	3920	3190	3320	<1500 (freshwaters)	N/A
Salinity	mg/L	4231	3525	4431	7650	1270	2519	2450	1994	2075	<1000 (freshwaters)	N/A
TDS	mg/L	4500	3940	3940	3440	4260	4020	7020	1740	1420	N/A	10000 ³
Inorganic												
Aluminium	µg/L	351	1645	322	362	356	257	478	180	245	100	5000
Antimony	µg/L	46	58	57	67	70	34	83	30	30	30	N/A
Arsenic	µg/L	95	111	114	126	120	97	111	75	60	50	500
Beryllium	µg/L	4	4	5	4	5	4	7	3	2	4	100
Boron	µg/L	6380	6740	6490	4850	6300	4030	8850	1890	2100	N/A	5000
Cadmium	µg/L	<1	<1	<1	<1	<1	<1	<1	<1	<1	0.2-2.0	10
Chromium	µg/L	10	14	11	10	11	6	25	6	8	10	1000
Copper	µg/L	10	10	10	9	9	8	<1	6	7	2.0-5.0	500
Iron	µg/L	300	980	180	370	110	220	50	30	210	1000	N/A
Lead	µg/L	<1	13	<1	<1	20	<1	<1	12	17	1.0-5.0	100
Mercury	µg/L	1	0.2	0.3	0.3	2.3	1.4	0.9	0.1	0.1	0.1	2
Molybdenum	µg/L	26	20	13	20	20	24	<1	21	24	N/A	10
Nickel	µg/L	<1	10	8	9	8	<1	<1	<1	7	15.0-150.0	1000
Selenium	µg/L	97	55	65	69	69	59	110	53	51	5	20

[illegible]

<i>Parameter</i>	<i>Units</i>	<i>Gidgealpa Oil</i>	<i>Big Lake Oil Satellite</i>	<i>Wildlife Guideline Level¹</i>	<i>Stock Guideline Level¹</i>
Site No.		8	21		
Biological					
Faecal Coliforms	cfu/100mL	0	0	N/A	1000
Blue-Green Algae (total)	cells/mL	3667	1900	N/A	10000
Chlorophyll-a	µg/L	7	363	2.0-10.0	N/A
Physico-Chemical					
Water Temperature	°C	27.6	22.2	N/A	N/A
Dissolved Oxygen	mg/L	2.4	2.5	>6	N/A
pH	Stand.	8.5	9.8	6.5-9.0	N/A
Conductivity	µS/cm	6520	6930	<1500 (freshwaters)	N/A
Salinity	mg/L	4075	4331	<1000 (freshwaters)	N/A
TDS	mg/L	3700	5960	N/A	10000 ³
Inorganic					
Aluminium	µg/L	328	292	100	5000
Antimony	µg/L	47	91	30	N/A
Arsenic	µg/L	112	148	50	500
Beryllium	µg/L	4	6	4	100
Boron	µg/L	5320	11650	N/A	5000
Cadmium	µg/L	<1	<1	0.2-2.0	10
Chromium	µg/L	12	9	10	1000
Copper	µg/L	10	8	2.0-5.0	500
Iron	µg/L	150	310	1000	N/A
Lead	µg/L	19	24	1.0-5.0	100
Mercury	µg/L	0.2	0.9	0.1	2
Molybdenum	µg/L	24	32	N/A	10
Nickel	µg/L	<1	13	15.0-150.0	1000
Selenium	µg/L	90	86	5	20
Silver	µg/L	2	<0.1	0.1	N/A
Vanadium	µg/L	60	134	N/A	100
Zinc	µg/L	57	42	5.0-50.0	20000
Fluoride	mg/L	2	2	N/A	2

<i>Parameter</i>	<i>Units</i>	<i>Gidgealpa Oil</i>	<i>Big Lake Oil Satellite</i>	<i>Wildlife Guideline Level¹</i>	<i>Stock Guideline Level¹</i>
Sulphate	mg/L	23	20	N/A	1000
Sulphide	mg/L	0.02	0.4	0.002	N/A
Nutrients					
Ammonia-Nitrogen	µg/L	1360	4900	20.0-30.0	N/A
Nitrate-Nitrogen	µg/L	33	20	N/A	40000
Nitrite-Nitrogen	µg/L	3	9	N/A	10000
Total Nitrogen	µg/L	3680	14440	100-500	N/A
Total Phosphorus	µg/L	52	432	5.0-50	N/A
Organics					
Benzene	µg/L	242	1084	300	10*
Benzo(a)pyrene	µg/L	<0.01	<0.01	N/A	0.01*
Oil and Grease	mg/L	5	9	30 ²	N/A
Pentachlorophenol	µg/L	<0.05	<0.05	0.05	10*
Phenol	µg/L	180	<1	50	N/A
Phenolics (total)	µg/L	510	1	N/A	2*
Phthalate esters	µg/L	<0.2	<0.2	0.2	N/A
Polycyclic aromatic hydrocarbons (total)	µg/L	<0.1	<0.1	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	410	461	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*

¹: ANZECC (1992)²: SANTOS guidelines³: maximum concentration for limited periods

N/A = not available

* = drinking water guidelines

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

2000 Process Formation Water Monitoring: Results for Gas Satellite Facilities

<i>Parameter</i>	<i>Units</i>	<i>Moomba South Central</i>	<i>Bookabourdie</i>	<i>Dullingari Gas</i>	<i>Toolachee South Nodal</i>	<i>Toolachee Satellite 1st</i>	<i>Toolachee Satellite 2nd</i>	<i>Toolachee East Nodal</i>	<i>Munkarrie Nodal</i>	<i>Wildlife Guideline Level¹</i>	<i>Stock Guideline Level¹</i>
Site No.		1	34	24	11	15	16	12	13		
Biological											
Faecal Coliforms	cfu/100mL	0	0	0	0	0	0	0	0	N/A	1000
Blue-Green Algae (total)	cells/mL	3450	3050	148500	1400	13000	1000	1100	9800	N/A	10000
Chlorophyll-a	µg/L	15	3	89	15	<1	<1	<1	<1	2.0-10.0	N/A
Physico-Chemical											
Water Temperature	°C	23.4	N/A	20.6	23	24.4	N/A	20.7	37.5	N/A	N/A
Dissolved Oxygen	mg/L	<1	1.5	7.3	3.7	<1	8	<1	1.9	>6	N/A
pH	Stand.	7.5	8.7	8.4	6.9	6.9	8.8	6.4	7.2	6.5-9.0	N/A
Conductivity	µS/cm	11500	13980	22580	5640	16740	25270	9550	3450	<1500 (freshwaters)	N/A
Salinity	mg/L	7188	8738	14113	3525	10463	15794	5969	2156	<1000 (freshwaters)	N/A
TDS	mg/L	8580	9160	14580	8740	8940	20380	4920	4640	N/A	10000 ³
Inorganic											
Aluminium	µg/L	182	472	451	336	381	702	150	397	100	5000
Antimony	µg/L	88	110	204	108	116	246	50	70	30	N/A
Arsenic	µg/L	190	185	333	252	217	437	138	154	50	500
Beryllium	µg/L	8	14	14	10	10	19	5	8	4	100
Boron	µg/L	16760	29400	29330	14100	16200	43990	8550	10980	N/A	5000
Cadmium	µg/L	<1	<1	<1	<1	<1	<1	<1	<1	0.2-2.0	10
Chromium	µg/L	12	14	19	14	15	25	9	11	10	1000
Copper	µg/L	85	22	130	68	9	19	6	9	2.0-5.0	500
Iron	µg/L	3340	3950	1060	6440	2830	590	9780	1060	1000	N/A
Lead	µg/L	<1	<1	<1	<1	<1	<1	14	16	1.0-5.0	100
Mercury	µg/L	0.4	0.8	1.3	1.6	0.9	0.5	1.2	0.6	0.1	2
Molybdenum	µg/L	48	49	59	43	37	83	<1	26	N/A	10
Nickel	µg/L	52	20	42	43	37	28	17	15	15.0-150.0	1000
Selenium	µg/L	168	168	205	140	135	315	75	77	5	20

[illegible]

<i>Parameter</i>	<i>Units</i>	<i>Della Gas</i>	<i>Amyema/ Brumby Nodal</i>	<i>Toolachee North Nodal</i>	<i>Kidman</i>	<i>Moomba South East</i>	<i>Strzelecki #15 Nodal</i>	<i>Murta South Nodal</i>	<i>Daralingie Gas</i>	<i>Wildlife Guideline Level¹</i>	<i>Stock Guideline Level¹</i>
Site No.		23	14	17	25	20	27	4	5		
Biological											
Faecal Coliforms	cfu/100mL	2	0	0	0	0	0	0	0	N/A	1000
Blue-Green Algae (total)	cells/mL	3950	15333	5067	1150	40000	1200	19600	111500	N/A	10000
Chlorophyll-a	µg/L	<1	3	3	<1	<1	12	<1	14	2.0-10.0	N/A
Physico-Chemical											
Water Temperature	°C	N/A	29	27.1	24	N/A	24.8	24.4	20.6	N/A	N/A
Dissolved Oxygen	mg/L	6.2	2	3	2	<1	<1	4.3	<1	>6	N/A
pH	Stand.	9.1	5.5	6.3	8.6	7.6	8.7	6.9	7.2	6.5-9.0	N/A
Conductivity	µS/cm	35100	15290	14110	11230	1801	18420	13620	16070	<1500 (freshwaters)	N/A
Salinity	mg/L	21938	9556	8819	7019	1126	11513	8513	10044	<1000 (freshwaters)	N/A
TDS	mg/L	22000	14420	11100	6500	1040	11020	8560	9020	N/A	10000 ³
Inorganic											
Aluminium	µg/L	652	420	388	347	65	613	294	310	100	5000
Antimony	µg/L	300	164	116	93	19	129	95	78	30	N/A
Arsenic	µg/L	442	305	319	198	65	231	211	196	50	500
Beryllium	µg/L	24	14	13	9	2	13	8	9	4	100
Boron	µg/L	59050	23700	22520	15550	1880	23140	10350	16620	N/A	5000
Cadmium	µg/L	<1	<1	<1	<1	<0.2	<1	<1	<1	0.2-2.0	10
Chromium	µg/L	31	17	17	13	5	21	20	20	10	1000
Copper	µg/L	73	15	81	8	4	37	64	93	2.0-5.0	500
Iron	µg/L	470	4030	5180	600	28620	1430	3290	8640	1000	N/A
Lead	µg/L	<1	43	<1	<1	6	43	41	40	1.0-5.0	100
Mercury	µg/L	0.6	3.2	0.5	0.3	0.4	0.4	0.5	0.7	0.1	2
Molybdenum	µg/L	87	53	43	30	16	52	45	47	N/A	10
Nickel	µg/L	<1	81	52	17	<1	18	34	41	15.0-150.0	1000
Selenium	µg/L	346	205	161	95	34	186	159	179	5	20
Silver	µg/L	5	4	4	1	<0.1	3	0.2	3	0.1	N/A

[illegible]

<i>Parameter</i>	<i>Units</i>	<i>Big Lake Gas</i>	<i>Big Lake 17</i>	<i>Tirrawarra Gas</i>	<i>Merrimelia Gas</i>	<i>Lepena</i>	<i>Gidgealpa Gas</i>	<i>Wildlife Guideline Level¹</i>	<i>Stock Guideline Level¹</i>
Site No.		18	19	32	31	26	9		
Biological									
Faecal Coliforms	cfu/100mL	66	2	0	0	0	0	N/A	1000
Blue-Green Algae (total)	cells/mL	2600	45500	100	1050	2100	2350	N/A	10000
Chlorophyll-a	µg/L	<1	<1	260	<1	104	<1	2.0-10.0	N/A
Physico-Chemical									
Water Temperature	°C	24.5	N/A	22.7	20.1	26.3	23.9	N/A	N/A
Dissolved Oxygen	mg/L	<1	1.2	2.9	<1	3.4	<1	>6	N/A
pH	Stand.	7.6	6.8	7.9	8.2	8.1	6.9	6.5-9.0	N/A
Conductivity	µS/cm	5130	26020	18040	16330	10220	25720	<1500 (freshwaters)	N/A
Salinity	mg/L	3206	16263	11275	10206	6388	16075	<1000 (freshwaters)	N/A
TDS	mg/L	4420	18960	10140	9240	7040	15460	N/A	10000 ³
Inorganic									
Aluminium	µg/L	203	1244	243	313	347	448	100	5000
Antimony	µg/L	67	223	104	107	87	146	30	N/A
Arsenic	µg/L	150	455	197	200	129	306	50	500
Beryllium	µg/L	6	19	10	10	10	14	4	100
Boron	µg/L	8700	37150	15600	14220	12770	26190	N/A	5000
Cadmium	µg/L	<1	<1	<1	<1	<1	<1	0.2-2.0	10
Chromium	µg/L	10	21	14	16	11	25	10	1000
Copper	µg/L	16	70	111	66	26	169	2.0-5.0	500
Iron	µg/L	10910	3820	3270	6510	440	5750	1000	N/A
Lead	µg/L	19	61	46	43	<1	65	1.0-5.0	100
Mercury	µg/L	2	49	1	1.1	1.5	0.6	0.1	2
Molybdenum	µg/L	30	77	47	47	33	83	N/A	10
Nickel	µg/L	21	83	32	29	14	60	15.0-150.0	1000
Selenium	µg/L	95	312	169	195	114	271	5	20
Silver	µg/L	0.9	<0.1	<0.1	<0.1	1	1	0.1	N/A
Vanadium	µg/L	195	495	243	234	124	389	N/A	100
Zinc	µg/L	66	84	84	94	50	133	5.0-50.0	20000

<i>Parameter</i>	<i>Units</i>	<i>Big Lake Gas</i>	<i>Big Lake 17</i>	<i>Tirrawarra Gas</i>	<i>Merrimelia Gas</i>	<i>Lepena</i>	<i>Gidgealpa Gas</i>	<i>Wildlife Guideline Level¹</i>	<i>Stock Guideline Level¹</i>
Fluoride	mg/L	2	2	1	1	6	2	N/A	2
Sulphate	mg/L	15	12	11	25	16	10	N/A	1000
Sulphide	mg/L	0.008	0.02	0.04	0.02	0.009	0.007	0.002	N/A
Nutrients									
Ammonia-Nitrogen	µg/L	22030	51710	45720	28700	6570	42450	20.0-30.0	N/A
Nitrate-Nitrogen	µg/L	27	10	12	38	<1	25	N/A	40000
Nitrite-Nitrogen	µg/L	8	<1	3	3	11	1	N/A	10000
Total Nitrogen	µg/L	23100	50270	45710	32130	15300	48990	100-500	N/A
Total Phosphorus	µg/L	83	59	246	171	219	49	5.0-50	N/A
Organics									
Benzene	µg/L	2849	8426	<10	205	775	6211	300	10*
Benzo(a)pyrene	µg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	N/A	0.01*
Oil and Grease	mg/L	7	3	17	23	1	1	30 ²	N/A
Pentachlorophenol	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.05	10*
Phenol	µg/L	2	<1	<1	160	<1	1730	50	N/A
Phenolics (total)	µg/L	190	4	<1	900	2	7040	N/A	2*
Phthalate esters	µg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	N/A
Polycyclic aromatic hydrocarbons (total)	µg/L	57	134	<0.1	<0.1	<0.1	6.6	3	N/A
Polychlorinated biphenyls	µg/L	<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	1	N/A
Toluene	µg/L	16770	15540	32	39	733	10680	300	N/A
2,4-dichlorophenol	µg/L	<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	0.9	N/A
1,2,4-trichlorobenzene	µg/L	<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	0.7	N/A
2,4,5-trichlorophenol	µg/L	32	64	<0.05	<0.05	<0.05	<0.05	N/A	1*

¹: ANZECC (1992)²: SANTOS guidelines³: maximum concentration for limited periods

N/A = not available

* = drinking water guidelines

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

2000 Process Formation Water Monitoring: Results for Moomba Plant Facilities

<i>Parameter</i>	<i>Units</i>	<i>Lake Brooks</i>	<i>Lake Brooks Sewage</i>	<i>Northern Evaporation Pond</i>	<i>Wildlife Guideline Level¹</i>	<i>Stock Guideline Level¹</i>
Site No.		2	36	3		
Biological						
Faecal Coliforms	cfu/100mL	0	0	0	N/A	1000
Blue-Green Algae (total)	cells/mL	8450	200	1300	N/A	10000
Chlorophyll-a	µg/L	<1	26	<1	2.0-10.0	N/A
Physico-Chemical						
Water Temperature	°C	44.5	N/A	22.4	N/A	N/A
Dissolved Oxygen	mg/L	<1	5.4	<1	>6	N/A
pH	Stand.	9.3	9	8.8	6.5-9.0	N/A
Conductivity	µS/cm	9560	446	13290	<1500 (freshwaters)	N/A
Salinity	mg/L	5975	279	8306	<1000 (freshwaters)	N/A
TDS	mg/L	6540	625	9540	N/A	10000 ³
Inorganic						
Aluminium	µg/L	487	58	258	100	5000
Antimony	µg/L	85	19	76	30	N/A
Arsenic	µg/L	152	23	162	50	500
Beryllium	µg/L	7	2	6	4	100
Boron	µg/L	9090	1910	5960	N/A	5000
Cadmium	µg/L	<1	<0.2	<1	0.2-2.0	10
Chromium	µg/L	32	<1	44	10	1000
Copper	µg/L	79	25	28	2.0-5.0	500
Iron	µg/L	250	350	1420	1000	N/A
Lead	µg/L	41	9	39	1.0-5.0	100
Mercury	µg/L	0.6	1.1	0.2	0.1	2
Molybdenum	µg/L	49	15	53	N/A	10
Nickel	µg/L	15	9	29	15.0-150.0	1000
Selenium	µg/L	144	20	181	5	20
Silver	µg/L	0.1	<0.1	0.1	0.1	N/A
Vanadium	µg/L	57	63	38230	N/A	100

<i>Parameter</i>	<i>Units</i>	<i>Lake Brooks</i>	<i>Lake Brooks Sewage</i>	<i>Northern Evaporation Pond</i>	<i>Wildlife Guideline Level¹</i>	<i>Stock Guideline Level¹</i>
Zinc	µg/L	80	82	64	5.0-50.0	20000
Fluoride	mg/L	9	<1	<1	N/A	2
Sulphate	mg/L	9	11	157	N/A	1000
Sulphide	mg/L	0.06	0.007	5.3	0.002	N/A
Nutrients						
Ammonia-Nitrogen	µg/L	870	3290	3030	20.0-30.0	N/A
Nitrate-Nitrogen	µg/L	36	13000	37	N/A	40000
Nitrite-Nitrogen	µg/L	4	180	16	N/A	10000
Total Nitrogen	µg/L	3830	22440	23030	100-500	N/A
Total Phosphorus	µg/L	1196	8491	204	5.0-50	N/A
Organics						
Benzene	µg/L	<10	<10	96	300	10*
Benzo(a)pyrene	µg/L	<0.01	<0.01	<0.01	N/A	0.01*
Oil and Grease	mg/L	1	19	2	30 ²	N/A
Pentachlorophenol	µg/L	<0.05	<0.05	<0.05	0.05	10*
Phenol	µg/L	2	<1	3550	50	N/A
Phenolics (total)	µg/L	21	<1	9920	N/A	2*
Phthalate esters	µg/L	<0.2	0.2	<0.2	0.2	N/A
Polycyclic aromatic hydrocarbons (total)	µg/L	1.8	0.2	0.5	3	N/A
Polychlorinated biphenyls	µg/L	<0.001	<0.001	<0.001	0.001	0.1*
Tetrachlorophenol	µg/L	<0.05	<0.05	<0.05	1	N/A
Toluene	µg/L	47	15	2280	300	N/A
2,4-dichlorophenol	µg/L	<0.05	<0.05	<0.05	0.2	N/A
1,2,3-trichlorobenzene	µg/L	<0.1	<0.1	<0.1	0.9	N/A
1,2,4-trichlorobenzene	µg/L	<0.1	<0.1	<0.1	0.5	N/A
1,3,5-trichlorobenzene	µg/L	<0.1	<0.1	<0.1	0.7	N/A
2,4,5-trichlorophenol	µg/L	<0.05	<0.05	<0.05	N/A	1*

¹: ANZECC (1992)²: SANTOS guidelines³: maximum concentration for limited periods

N/A = not available

* = drinking water guidelines

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

2000 Process Formation Water Monitoring: Quality Control

Parameter	Method	Type of QC	Units	Laboratory Control Standards			Acceptance Units for Precision (%)
				Measured	Nominal	% Recovery of Known Additions	
<i>Physico-chemical</i>							
Total Dissolved Solids	APHA 2540C	APHA Control Solution	mg/L	285	293		±10
<i>Inorganic</i>							
<i>Trace Elements</i>	APHA 3120B	Certified Wastewater	µg/L				±10
Antimony				12	10		
Arsenic				13	10		
Beryllium				8	10		
Chromium				39	50		
Copper				47	50		
Lead				45	50		
Molybdenum				36	50		
Nickel				42	50		
Selenium				11	10		
Vanadium				39	50		
Zinc				51	50		
Cadmium	APHA 3111	Certified Wastewater	µg/L	11	10		
Mercury	APHA 3112	Known addition method	µg/L	10.5	10	109	80-120
Silver	APHA 3111	Certified Wastewater	µg/L	10.2	10		
Fluoride	APHA 4500-F ⁻	APHA Control Solution	mg/L	1.12	1.2		±10
Sulphate	APHA 4500-SO ₄ ²⁻ E	APHA Control Solution	mg/L	20.5	20		±10
Sulphide	APHA 4500-S ₂ -C,D	APHA Recovery	µg/L	794	910	87	80-120
<i>Nutrients</i>							
Ammonia-Nitrogen	Rayment & Higginson (1992-7A2)	Certified Wastewater	µg/L	1000	1000		±10
Nitrate+Nitrite-Nitrogen	APHA 4500-E	Certified Wastewater	µg/L	908	1000		±10
Nitrite-Nitrogen	APHA-4500-NO ₂ -B	Certified Wastewater	µg/L	101	100		±10
Total Kjeldahl Nitrogen [†]	Rayment & Higginson (1992-7A2)	Certified Wastewater	µg/L	3220	2000		±10
Total Phosphorus	APHA 4500-P B,E	Certified Wastewater	µg/L	992	1000		±10
<i>Organics</i>							
Oil and Grease	APHA5520B	Duplicate analysis	mg/L	6.0 & 8.7			

[†] Reason for poor precision for Laboratory Control Standard TKN result not identified. Repeat analysis of random samples achieved results within acceptable limits.

Parameter	Method	Type of QC	Units	Laboratory Control Standards			Acceptance Units for Precision (%)
				Measured	Nominal	% Recovery of Known Additions	
<u>Volatile Organics</u>							
Benzene Recovery	SPME GC-MS	Known addition method	µg/L	10.1	10	101	80-120
Toluene Recovery	SPME GC-MS	Known addition method	µg/L	9.7	10	97	80-120
<u>Polynuclear Aromatic Hydrocarbons</u>	APHA 6440 GC-MS						
<u>Organics</u>							
Oil and Grease	APHA5520B	Duplicate analysis	mg/L	6.0 & 8.7			
<u>Volatile Organics</u>							
Benzene Recovery	SPME GC-MS	Known addition method	µg/L	10.1	10	101	80-120
Toluene Recovery	SPME GC-MS	Known addition method	µg/L	9.7	10	97	80-120
<u>Polynuclear Aromatic Hydrocarbons</u>	APHA 6440 GC-MS						
Total Polynuclear Aromatic Hydrocarbons		Known addition method	µg/L	10.4	10	104	80-120
Benzo(a)pyrene		Known addition method	µg/L	10.04	10	100	80-120
<u>Phenols</u>	APHA-6410						
Total Phenols		Spike recovery	µg/L	109	100	109	80-120
Phthalate Esters	APHA 6630	Known addition method	µg/L		10	86	80-120
Polychlorinated Biphenyls	APHA 6630	Known addition method	µg/L	0.232	0.278	83	80-120
<u>Trichlorobenzenes</u>	APHA 6630						
1,2,3-trichlorobenzene		Known addition method	µg/L	1.6	2.0	80	70-100
1,2,4-trichlorobenzene		Known addition method	µg/L	1.5	2.0	75	70-100
1,3,5-trichlorobenzene		Known addition method	µg/L	1.4	2.0	70	70-100

Appendix 18: Register of Oil Spills and Site Remediation

Date	Location	Area (m2)	Action Taken
25/07/2000	Narcoonowie 1000 bbl tanks.	100	On site remediation
02/07/2000	Moomba 94 oil spill	480	On site remediation
15/07/2000	83.4Km from Keleary Satellite	4	Relocated to Moomba LTU
08/08/2000	Meranji Oil Receiver	20	On site remediation
28/08/2000	1.3 Km from Keleary Satellite	1000	On site remediation
23/09/2000	Merrimelia Oil Lact	10	On site remediation
26/09/2000	LSC oil line leak	85	Relocated to Moomba LTU
22/09/2000	Meranji #3 jet	200	On site remediation
04/10/2000	Moomba North Compressor Facility	1	Relocated to Moomba LTU
29/10/2000	Merremelia 39	1900	Relocated to Moomba LTU
20/11/2000	LRP Pipeline booster pumps	5	Relocated to Moomba LTU
16/11/2000	Merrimelia Oil inlet manifold area.	100	Relocated to Moomba LTU
27/12/2000	Narcoonowie 4 Stuffing box leak.	150	Relocated to Moomba LTU
28/12/2000	Strzelecki Satellite Oil spill	70	Relocated to Moomba LTU
02/12/2000	Jena #4 flow line failure	10	Relocated to Moomba LTU
04/12/2000	Alwyn #1 manifold	30	Relocated to Moomba LTU
05/12/2000	Merrimelia #19 Jet Pp.	20	Relocated to Moomba LTU
11/12/2000	Big Lake Condensate Recovery Tanks.	5	Relocated to Moomba LTU
25/12/2000	Carmina #1 flow lin	20	Relocated to Moomba LTU
29/01/2001	Dullingari bund walled diesel	35	Relocated to Moomba LTU
16/01/2001	processing plant interceptor ponds	60	Relocated to Moomba LTU
20/01/2001	Moomba 104 tank farm	6	Relocated to Moomba LTU
19/01/2001	Tirrawarra Road	10	On site remediation
30/01/2001	TK 1000 water drain spill	90	Relocated to Moomba LTU
03/01/2001	Tirrawarra - Mooba Oil Trunkline Leak	60	Relocated to Moomba LTU
28/01/2001	Merri #19 jet pump sensing line	8	Relocated to Moomba LTU
14/02/2001	Dullingari LA 40 bulk	5	On site remediation
14/02/2001	Narcoonowie # 2 jet pump	5	On site remediation
07/02/2001	Moomba 102 sump spill	100	On site remediation
10/02/2001	Mawson Kurunda compressor station	80	On site remediation
12/02/2001	tank TK 2000	200	Relocated to Moomba LTU
15/02/2001	Oil Spill at Sturt #6	8	Relocated to Moomba LTU
25/02/2001	TK.- 1000 - 104 Overflow.	10	Relocated to Moomba LTU
05/02/2001	Tirrawarra / Plant /	100	Relocated to Moomba LTU
15/02/2001	Tirrawarra # 42	70	On site remediation
23/02/2001	Meranji # 6	24	On site remediation
05/02/2001	Tirrawarra satellite open drain sump.	100	Relocated to Moomba LTU
15/02/2001	Tirrawarra # 42	70	On site remediation
23/02/2001	Meranji # 6	24	On site remediation
14/03/2001	Dullingari Oil Meter Proving Skid	30	On site remediation
17/03/2001	Strzelecki 15 nodal compressor	70	On site remediation
22/03/2001	Strzelecki oil facility LACT unit	5	On site remediation
09/03/2001	Tantanna #5 line failure	15	Relocated to Moomba LTU
20/03/2001	Sturt 7 beam pump leaking stuffing box.	300	On site remediation
20/03/2001	Sturt 4 beam pump leaking stuffing box.	400	On site remediation
26/03/2001	Limestone creek sump overflow	5	On site remediation
09/03/2001	Meranji 3 Jet Pump Hose Failure	600	Relocated to Moomba LTU
14/04/2001	Tantanna shipping facility	10	On site remediation
22/04/2001	Tantanna 8 jet pump	70	On site remediation
22/04/2001	Toolachee satellite	12	On site remediation
03/04/2001	Meranji #9 jet pump sump overflow	30	On site remediation
20/05/2001	Limestone creek shipping pump'B'.	5	On site remediation
30/05/2001	Recovered oil tank sump	30	On site remediation
29/05/2001	Lime Stone Creek to Strz Oil Pipeline	10	On site remediation

Date	Location	Area (m2)	Action Taken
07/06/2001	Toolachee satellite road sump	50	On site remediation
10/06/2001	Narcoonowie 4	10	On site remediation
12/06/2001	Strzelecki satellite	50	Relocated to Moomba LTU
14/06/2001	Strzelecki 15 evaporation pond	10	Relocated to Moomba LTU
06/06/2001	Plant Stormwater Tank (TK-1000-104)	100	Relocated to Moomba LTU
03/06/2001	Murta South Nodal	200	Relocated to Moomba LTU
24/06/2001	Pinhole on Gidgealpa 27 flow	300	Relocated to Moomba LTU
27/06/2001	PS1 sump moomba plant	6	On site remediation
25/06/2001	Tirrawarra #49 flowline	100	Relocated to Moomba LTU
03/07/2001	Tantanna #9	20	Relocated to Moomba LTU
09/07/2001	Moomba south oil.	20	Relocated to Moomba LTU
25/07/2001	At Big Lake 58 Jet Pump Lease	20	On site remediation
27/07/2001	Merrimelia oil # 19	45	On site remediation
21/07/2001	Merrimelia interceptor pit overflow	85	Relocated to Moomba LTU
22/07/2001	Tirrawarra 71	1000	Relocated to Moomba LTU
04/08/2001	Oil in Moomba Creek Process	100	Relocated to Moomba LTU
14/08/2001	Taloola # 2 & 4 flow line	100	Relocated to Moomba LTU
20/08/2001	Early Patchawarra facilities Process	20	Relocated to Moomba LTU
07/08/2001	Tirra Sat cond pum	20	On site remediation
05/09/2001	Dullingari well head #30	100	On site remediation
12/09/2001	Jena # 11 Flow line failure	16560	Relocated to Goyder & Milluna
01/10/2001	Dullingari / Plant	10	On site remediation
08/10/2001	Moomba south oil interceptor pond	100	Relocated to Moomba LTU
09/10/2001	Early Patch sump Process	20	Relocated to Moomba LTU
27/10/2001	Jena 5 manifold	5	Relocated to Moomba LTU
29/10/2001	Jena #2 manifold	3	On site remediation
31/10/2001	Tirrawarra Satt	4	On site remediation
20/11/2001	Toolachee North	10	On site remediation
20/11/2001	Strzelecki Satellite Interceptor Pond	750	Relocated to Moomba LTU
26/11/2001	Dullingari #23	2.5	Relocated to Moomba LTU
09/11/2001	Ulandi # 3 gathering line	25	Relocated to Moomba LTU
18/11/2001	Moomba Oil Satellite truck loading area	2	Relocated to Moomba LTU
20/12/2001	Dullingari Gas satellite LA 40 bulky tank	5	Relocated to Moomba LTU
08/12/2001	Sump overflow at Early Patch	20	Relocated to Moomba LTU
16/12/2001	Gidgealpa #44 test seperator.	300	Relocated to Moomba LTU
05/12/2001	Meranji #14	50	Relocated to Moomba LTU
17/12/2001	8 km upstream Merrimelia Oil Satellite	40	Relocated to Moomba LTU
20/12/2001	Bookabourdie #4	4	Relocated to Moomba LTU
28/12/2001	Tirrawarra Oil 'C' Manifold Tie In	10	Relocated to Moomba LTU

Appendix 19: Jena #11 Flowline Oil Spill Report

Central Australia Business Unit

Jena #11 Flowline

12 September 2001.

Jena #11 Flowline – Oil Spill Report

JENA #2 oil spill

On 12th September 2001, an oil spill was identified from a flow-line in the Jena field. The total volume of the spill, which consisted of formation water and crude oil, was estimated at 480 - 500 m³.

Field Location / History / Design

The Jena field, located approx 65 kilometres (by road) south-east of Moomba, was initially developed in 1990. The Jena field is one of several oil fields in the area. Other fields include Alwyn, Biala, Ulandi, Carmina and Limestone Creek.

The Jena field is situated in the floodplain of the Strzelecki Creek. The creek is generally a dry water course. Occasional local area rains cause small flows to occur. The Creek only flows to any significant degree during a major flood event in the Cooper Creek.

The Strzelecki Creek is only identifiable by the number of trees along the normally dry water-course rather than by any other distinguishable “creek” features.

The flowline network in these fields consist mainly of surface laid lines of various dimensions. The initial lines constructed in 1991 consisted of X52 line pipe joined using “ZAPLOCK” interference fit jointing techniques. Bacterial corrosion in this pipeline system resulted in the majority of the pipeline network being replaced with surface laid J55 EUE tubing in 1995.

Sections of line that cross the Strzelecki creek are coated X52 linepipe which are buried to prevent damage from any flood carried debris. To avoid excessive disturbance to the creek channel, these sections of line were not replaced during the pipeline upgrade.

When designed, no provision was made for flowline or trunkline pigging facilities. The major trunklines have since been retro-fitted to include pigging facilities. Flow loss or leak/line break detection facilities were not installed in the flowline network. Individual well capacity is generally measured using test tanks.

The two mechanisms of corrosion that have been identified in this pipeline network are

- External corrosion in the pipe/soil interface
- Internal corrosion by bacterial which appear to have contaminated this reservoir.

Periodic pressure tests are conducted on the major trunklines to assess the line integrity. These tests are also occasionally adopted for flowlines.

Merty Merty Station

The Jena oil field is located on Merty Merty Station. This station is a beef production pastoral lease. The station water supply is taken from a shallow soak (perched aquifer) in the Strzelecki Creek approx 5 km downstream from the referenced leak site. The operators of Merty Merty Station are in the final stages of accreditation with the National Association for Sustainable Agriculture, Australia as “*Organic Beef*” producers.

Considerable consultation has been held with Merty Merty Station since the leak to develop a clean-up response that is appropriate to the needs and concerns of all stakeholders.

Identification of Leak

The leak was identified when Santos personnel reported a significant reduction in flowing tubing head pressure while testing the Jena wells. Subsequent checks of the field flowlines revealed an oil leak on the test line between the Jena #4 and Jena #2 manifolds.

It was determined that the oil / water mixture had been leaking for 3 – 5 days. The leak volume was calculated to have been some 480 – 500 m³ of fluid. The leak occurred in a buried section of coated X52 line pipe at a point where the line crosses the dry Strzelecki Creek bed.

Because of the waxy nature of Jena crude oil, testing is not normally done in the colder winter months. With the seasonal increase in ambient temperature, the well test program had recently recommenced.

A considerable quantity of the escaped fluid was contained within the immediate vicinity of the creek owing to the undulating creek bed. The remainder of the escaped fluid was contained a small distance downstream within a borrow-pit that had previously been constructed in the Strzelecki Creek.

Jena Field Production

The last production testing from the Jena field is as follows,

Jena #11	8.2 m ³ oil	11.7 m ³ Total Fluid (S/D 21 August)
	(Well on free flow at 3 m ³ oil/day, no water)	
Jena #7	18 m ³ oil	57 m ³ Total Fluid
Jena #5U	2.7 m ³ oil	24 m ³ Total Fluid
Jena #8L	5.8 m ³ oil	22 m ³ Total Fluid
Jena #2	15 m ³ oil	109 m ³ Total Fluid

The Jena #11 well was the only well with recent production history. Other flowlines to the Jena #4 manifold were previously disconnected and filled with inhibitor fluid. The Jena #11 beam pump was shutdown on 21/8/01 with a downhole problem and had been on free flow at 3 m³ oil per day prior to the leak.

Mechanism and Impact

The leak occurred on the Jena #2 manifold test line from a location at the 5 o'clock position (cross section) on the pipe, in an area where the pipe coating was in good condition. This pipe was at a buried depth of around 2m. Subsequent investigation found that the leak was as a result of internal bacterial corrosion.

Recovery of oil was commenced soon after the leak was identified using vacuum trucks. Approximately 170 m³ of oil was recovered (measured from vacuum truck contents).

Because there were a number of cattle in the vicinity, the spill area was immediately fenced.

Several Pied Cormorants were found severely oiled at the leak site. Attempts to capture all birds were unsuccessful and assistance was obtained from the National Parks Ranger stationed at Innamincka. Whilst a few birds died as a result of oiling, several others birds were cleaned using procedures recommended by Taronga Park Zoo. These birds were then released back to the wild.

Reporting

As required by legislation the spill was reported to the EPA and PIRSA on the 13th September 2001.

The spill was formally reported to PIRSA at the Quarterly Compliance Meeting in November 2001.

Clean-up Action

The spill clean-up commenced as soon as the spill was identified. Approximately 170 m³ of oil was recovered to the production system. The oil was recovered from the spill site using vacuum trucks and the remaining water was pumped to a lined interceptor pit at Jena 2. This method of recovery reduced the extent of oil contamination to an “oil ring” around the spill area except for the area where the oil flowed to the borrow pit.

The spill site was fenced as soon as possible to exclude cattle from the spill site. The fence shall remain in place until the residual hydrocarbon levels do not present any risk to stock.

A sampling program commenced to identify the extent of contamination and assist in identifying remediation options. The depth of oil contamination through the soil profile was found to range from 25 mm to over 3 metres in the heavily contaminated areas.

Due to Organic Beef Accreditation being sought by Merty Merty Station, it was deemed necessary to excavate as much hydrocarbon contaminated soil as possible and to transport this soil off of the Merty Merty Pastoral Lease. The contaminated soil from the downstream borrow pit and braided channel of the Creek was excavated and removed from Merty Merty Station for remediation at temporary landfarm sites established at Goyder and Miluna.

In an effort to minimise impact during the cleanup operation, contaminated soils were left in place wherever mature riparian vegetation occurred. However, subsequent discussions with the National Association for Sustainable Agriculture in relation to the impact upon Organic Beef accreditation, drove the need to pursue the excavation and removal of all contaminated soil from Merty Merty Station. This would necessitate the removal of several mature riparian trees.

An application for Native Vegetation Clearance to remove several mature native trees from the spill site was submitted to the Native Vegetation Council – SA Department of Environment and Heritage for approval. This application was submitted to enable the removal of hydrocarbon contaminated soils from beneath where the mature trees occur. At the time of reporting a decision on this application had not been made.

Chemical monitoring of this spill site will continue to enable an assessment of the rehabilitation success, and assist in identifying any further follow-up actions.