
SOUTH AUSTRALIA COOPER BASIN JOINT VENTURE

STATEMENT OF ENVIRONMENTAL OBJECTIVES:

JENA WATERFLOOD PILOT PROJECT

1. INTRODUCTION

This Statement of Environmental Objectives (SEO) has been prepared to meet the requirements of Sections 99 and 100, of the South Australian *Petroleum Act 2000* (the Act) and Regulations 12 and 13 of the *Petroleum Regulations 2000*.

The SEO is specific to the environmental objectives associated with the Waterflood Trial proposed to be undertaken in the South Australian section of the Cooper Basin.

All other environmental objectives relating to Drilling & Well and Production & Processing Operations are covered under existing arrangements, including the SEO for Drilling and Well Operations (PIRSA, August 2000) and 'Alternate Arrangements' (2000). These existing arrangements are due to be reviewed by mid 2003.

Environmental objectives for the Waterflood Trial have been identified on the basis of information provided in the Environmental Impact Report (EIR), which, in brief, relate to the injection of produced formation water into the hydrocarbon bearing geological formation (Murta Formation) in order to enhance hydrocarbon recovery.

2. ENVIRONMENTAL OBJECTIVES

A number of environmental objectives identified in regards to the potential hazards associated with the proposed waterflood trial are listed below:

1. Minimise loss of aquifer pressure and avoid aquifer contamination.
2. Conserve soil resources by minimising disturbance and avoiding contamination.
3. Reduce disturbance to drainage patterns and avoid contamination of surface waters and shallow groundwater resources.

3. HAZARDS AND POTENTIAL CONSEQUENCES

The EIR prepared for the proposed waterflood trial outlined all perceivable hazards and potential consequences for the proposed trial. Each of these has the potential to impact on the achievement of the SEO.

A summary of environmental hazards and potential consequences identified in the EIR are provided in Table 1 below. Only hazards and consequences directly related to the waterflood injection portion of the waterflood are included here. Producing wells would be handled under existing arrangements.

Table 1. Summary of Environmental Hazards and Potential Consequences

Hazard	Potential Consequence(s)
Injection of contaminated water into the target or other aquifer zones	▪ Aquifer or reservoir contamination
Spill of waterflood tracer	▪ Localised contamination of soil.

4. ASSESSMENT CRITERIA

Criteria that will be adopted for measuring the achievement of the environmental objective are presented in Appendix A. These criteria may take any one of the following forms:

Defined conditions - the achievement of an objective assessed through ensuring defined conditions are met or carried out. Such conditions include prohibitions to undertake a specific action. For example, to achieve the objective ‘Conserve soil resources by minimising disturbance and avoiding contamination’, during construction of facilities adequate containment measures are put in place for potential spills.

Defined requirements - the achievement of an objective can be assessed against the implementation of specific procedures or actions required for an activity (e.g. to ensure aquifer cross flow is avoided by making sure casing is set in accordance with design parameters and company procedures.)

Goal Attainment Scaling (GAS) criteria - environmental objectives requiring visual assessment are likely to be prone to uncertainties of subjective judgement. To minimise this occurring, GAS is used to measure such objectives against a series of criteria described by a written description and/or photographs. No GAS is available for waterflood trial activities, however, these may be developed for future operations and may include issues such as assessment of injection water quality.

Where the environmental objective is identified as not being adhered to, variances will be recorded and reported as required.

5. REPORTING REQUIREMENTS

It is a requirement under Section 85 of the Petroleum Act 2000 that incidents which are determined to be 'serious' or 'reportable' incidents be reported to the Minister. Regulation 12 (2) of the Petroleum Regulations 2000 requires that a SEO identify events that could cause a 'serious' or 'reportable' incident to occur.

Serious Incidents must be reported to the PIRSA Minister as soon as practicable after the occurrence, as per Section 85 of the Petroleum Act 2000 and Section 32 of the Petroleum Regulations 2000.

Reportable Incidents must be reported to PIRSA on a quarterly basis within 1 month of the end of the quarter, as per Section 32 of the Petroleum Regulations 2000.

5.1 Serious Incidents

Pursuant to Section 85(1) of the Petroleum Act 2000, the following are considered to be serious incidents:

- A person is seriously injured or killed;
- An imminent risk to public health or safety arises; or
- Serious environmental damage occurs or an imminent risk of serious environmental damage arises; or
- Security of natural gas supply is prejudiced or an imminent risk of prejudice to security of natural gas supply arises.

Pursuant to Regulation 12(2) the incidents listed below are considered to be serious incidents that may arise from the waterflood trial covered under this SEO.

- Formation cross flow.
- Contamination of aquifer water.
- Any spill of hazardous material (i.e. tracer) which encroaches into land used for purposes other than petroleum production and processing or into groundwater supplies.

5.2 Reportable Incidents

Pursuant to Regulation 12(2) the incidents listed below are considered to be reportable incidents that may arise from Santos' activities associated with the proposed pipeline covered under this SEO.

- Any spills of hazardous material (i.e. waterflood tracer) outside of an area not specifically designed to contain such spills;
- Detected unauthorised third party access to facilities.
- Complaint from a landowner as a result of operations.

**APPENDIX A
ENVIRONMENTAL OBJECTIVES
& ASSESSMENT CRITERIA**

Environmental Objective	Comment	Assessment Criteria
<p>Objective 1 Minimise loss of aquifer pressure and avoid aquifer contamination.</p>	<p>This objective seeks to protect the water quality and water pressure of aquifers that may potentially be useful as water supplies, and to maintain pressure in sands that may host petroleum accumulations elsewhere.</p> <p>To address this objective, the risks of cross flow between aquifer cells known to be permeable and in natural hydraulic isolation from each other, or where there is insufficient information to determine that they are permeable or in hydraulic communication, must be assessed on a case by case basis and procedures implemented to minimize the fresh water aquifer cells from contamination and isolate potential and producing formations from formations that may deplete the reservoir pressure when not on production.</p> <p>The following geological formations comprising aquifer cells in the Cooper-Eromanga Basins. They may contain permeable sands which may be in natural hydraulic isolation from each other (from shallowest to deepest):</p> <ul style="list-style-type: none"> ▪ Eyre; ▪ Winton, Mackunda; ▪ Coorikiana; ▪ Cadna-owie; ▪ Murta, Namur, Adori, Birkhead, Hutton, Poolowanna, Cuddapan, Cuddapan; ▪ Nappamerri Group formations, Walkandi and Peera Peera formations (multiple sands); 	<p><u>Injection Wells</u></p> <ul style="list-style-type: none"> ▪ No change in expectant pressure or temperature (identified through monitoring programs eg: well logs, pressure measurements, casing integrity measurements and corrosion monitoring programs, which show adequate primary barrier casing condition and that cross flow is avoided; and contamination or pressure reduction is avoided). ▪ No significant change in water quality from the injection aquifer, identified by frequent water quality testing. ▪ For cases where isolation of these formations is not established, sufficient evidence is available to demonstrate that they are in natural hydraulic communication. <p><u>Well Abandonment Activities</u></p> <ul style="list-style-type: none"> ▪ Cement plugs are set to ensure that crossflow, contamination or pressure reduction will not occur.

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Environmental Objective	Comment	Assessment Criteria
<p>Objective 2 Conserve soil resources by minimising disturbance and avoiding contamination.</p>	<p>The main impact associated with this objective is the potential contamination from fuels, chemicals (including the waterflood tracer), and produced formation water during the waterflood operations.</p> <p>Measures implemented in order to minimise the potential for disturbance or contamination include:</p> <ul style="list-style-type: none"> ▪ All fuel, oil and chemical stored, handled and transported in accordance with industry standards eg. Australian Standard AS 1940 and Australian Dangerous Goods (ADG) Code. This is also reviewed and monitored in audit process. ▪ Records of spill events and corrective actions maintained in accordance with company procedures. ▪ Annual review of logged incidents to determine areas that may require corrective action in order to reduce spill volumes in subsequent years (to drive continual improvement). ▪ Results of emergency response procedures carried out in accord with Regulation 31 show that oil spill contingency plan in place in the event of a spill is adequate and any necessary remedial action needed to the plan is undertaken promptly. ▪ Spill response equipment audited annually. ▪ Annual spill response training exercise undertaken. 	<p><u>Fuel/Chemical Storage, Handling and Transportation</u></p> <ul style="list-style-type: none"> ▪ No spills outside of areas designed to contain them. ▪ Spills or leaks are immediately reported and clean up actions initiated. <p><u>Spill Response / Contingency Planning</u></p> <ul style="list-style-type: none"> ▪ Soils are remediation to a state consistent with the surrounding land use/environment. ▪ Up to date oil spill contingency plan (reviewed annually) with specific scenarios relating to spills to creeks and floodplain areas.
<p>Objective 3 Reduce disturbance to drainage patterns and avoid contamination of surface waters and shallow groundwater resources.</p>	<p>As per Objective 2, the main impact associated with this objective is the potential contamination.</p> <p>However, it has been found that in the Cooper Basin, that the threat of groundwater contamination is minimised as a result of:</p> <p>a) the depth of the underground aquifers and shallow ground waters; and</p> <p>b) the entrapment of contamination in the first 1 to 2 meters of soil.</p>	<p><u>Well Heads (Injection Systems)</u></p> <ul style="list-style-type: none"> ▪ Pumps and associated equipment installed within containment device with an adequately sized containment sump (at least 9m³). ▪ Well heads shut in and chemicals removed prior to flood events. <p><u>Fuel and Chemical Storage, Transport and Handling</u></p> <ul style="list-style-type: none"> ▪ As per objective 2, above. ▪ Refuelling occurs at least 50m from watercourses or sensitive ecological environments (wetlands). <p><u>Spill Response / Contingency Planning</u></p> <ul style="list-style-type: none"> ▪ As per objective 2.