

	REPORT No: EN.1591.61.PR-016	Rev: 0
Validation Audit and Environmental Review		

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VALIDATION AUDIT AND ENVIRONMENTAL REVIEW

REPORT NO. EN.1591.61.PR016

REVISION 0

This document is based upon material available at the time of preparation and is current and accurate only to that date. Material prepared by consultant third parties was prepared on instructions by Orica for specific purposes and should not be relied upon by other parties for any purposes.

REVISION HISTORY

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REV	STATUS	DATE	PREPARED	CHECKED	AUTHORISED
0	Final	18 September 2006	S Corish	S Jones	G Richardson

Handwritten signatures corresponding to the 'PREPARED', 'CHECKED', and 'AUTHORISED' columns of the revision history table.

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DISTRIBUTION

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INTRODUCTION

In accordance with Environmental Protection Licence (EPL) 2148, Orica engaged an independent compliance auditor (Ken Holmes of KMH Consulting) to perform a comprehensive validation audit and environmental review of the operation and associated environmental monitoring of the Groundwater Treatment Plant (GTP) located on the Botany Industrial Park (BIP), Botany.

The purpose of this report is to provide an overall summary of Orica's progress against the validation audit and environmental review requirements of EPL2148. Numerous supporting documents above and beyond the contents of this report was provided to the auditor to assist in investigation and determination of compliance.

This report is not a stand-alone document and should be read in conjunction with the *Independent Audit Report, Botany Groundwater Remediation Program*, (KMH Consulting, September 2006).

E12.1 VALIDATION AUDIT

Condition E12.1 stipulates that the licensee must engage the services of a suitable qualified auditor to perform comprehensive validation audits of the project (Ken Holmes – KMH Environmental). The following is an outline of the information provided to the auditor for the first of these audits performed in August 2006.

E12.1.1 Air Emission Validation Program

The licensee must conduct an Air Emissions Validation Program, which includes but is not be limited to the following:

(a) *Ensures the range of all air pollutants monitored are continually reviewed and modified where necessary to ensure the licensee is capable of detecting the presence of all significant air pollutants not already specified in the licence.*

A review of the range of air pollutants monitored was scheduled for 3, 6 and 12 monthly intervals in the first year of operation.

At 3 months and 6 months after operation of the GTP commenced, additional screening testing was undertaken on the emissions stack for the GTP and identified no additional volatile organics and recommends that the monitoring regime be maintained at that time.

(b) *Make recommendations about changes to existing monitoring, including substances monitored and frequency of monitoring.*

As described above, additional screening testing was undertaken on the emissions stack for the GTP and it identified no additional volatile organics. Subsequently, the monitoring regime remains unchanged.

(c) *Validate the conclusions of the human health risk assessment that was undertaken as part of the EIS using monitoring data collected under this licence;*

Pacific Air and Environment (PA&E) were commissioned to review GTP air emissions results for all measured analytes.

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Following the completion of the modelling, URS Australia Pty Limited (URS) were engaged to undertake a review of the Human Health Risk Assessment (HHRA) presented within the GTP EIS entitled *Groundwater Treatment Plant EIS, Human Health Risk Assessment* (URS, November 2004) with respect to emissions to air. The review of the HHRA was based on revised calculations air quality by PAE, and presented two scenarios:

1. Revised HHRA based on estimated emissions to air presented within the GTP EIS and revised air dispersion modelling (as detailed by PAE, 2006); and
2. Revised HHRA based on measured emissions to air from the GTP (as modelled by PAE also incorporating revised air dispersion modelling).

The review was undertaken adopting the assumptions and methodology associated with normal operations presented within the GTP EIS HHRA (URS, 2004) with respect to the quantification of exposure and risk associated with emissions to air from the GTP. The following was noted following review of the calculated risks to human health associated with potential exposures by workers, recreational users of the area and residents (including multiple pathway exposures) associated with the two scenarios:

1. Risks to human health are equal to or lower than risks presented within the EIS, based on the revised air dispersion modelling only; and
2. Risks to human health are lower based on measured emissions to air than presented within the EIS and calculated on the basis of the revised air dispersion modelling.

On this basis of the information provided above, the conclusions within the HHRA presented in the GTP EIS remain valid. That is "exposure by residents, recreational users of areas surrounding the BIP and workers are negligible and representative or acceptable risks to human health".

(d) Validate the conclusions of the air quality impact assessment that was undertaken as part of the EIS using monitoring data collected under this licence; and

URS reported to Orica on 14 June 2006 in a letter report titled *Review of Groundwater Treatment Plant EIS HHRA –Increased Dioxin Emissions – WCIE4298*. The report concludes that the design of the GTP has been improved since the EIS and that a 7 fold reduction in Ground Level Concentrations (GLC) has resulted. URS subsequently concluded that the human health risks associated with the reduction in GLC of Dioxin has resulted in a lower health risk than predicted in the EIS.

It should be noted, that at the time of the audit by KMH Consulting, the information provided here was not yet available.

The final reports from URS and PAE will be forwarded to both the auditor and DEC by the end of September 2006.

(e) Preparation and implementation of a comprehensive odour detection program. This must include but not be limited to:

(i) A Leak Detection and Repair (LDAR) Program to detect and minimise fugitive Volatile Organic Compounds (VOC) emissions from the groundwater treatment plant and associated plant and equipment in accordance with US EPA Method 21 – Determination of

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Volatile Organic Compound Leaks (40 CFR Part 60, Appendix A, Method 21) or such other method agreed in writing by the EPA.

ATMECO were commissioned to prepare and complete this program. The results are summarised in the report:

- *Orica Botany Groundwater Treatment Plant, Fugitive Emissions Management Program, Implementation and Monitoring for Year 2006 Final report on results of leak detection, ATMECO, August 2006.*

This report was provided to the auditor for review against this compliance point.

(ii) An overall odour detection program, including representative offsite observations by independent and suitably qualified persons to identify and prevent unanticipated odour sources.

EnvironOdour were engaged to design and perform an odour detection and monitoring program. The contents of the program and results of monitoring are provided in the report:

- *Ambient Odour Monitoring for Orica Botany Industrial Park, (Progress Report – 3rd assessment session), EnvironOdour, 20 July 2006.*

This report was provided to the auditor for review against this compliance point.

E12.1.2 Water Discharge Validation Program

The licensee must conduct a Water Discharge Validation Program, which must include but not be limited to the following:

- (a) Ensures the range of all water pollutants monitored is continually reviewed and modified where necessary to ensure the licensee is capable of detecting the presence of all significant water pollutants not already specified in the licence;*

Broad chemical scans were conducted at 3 and 6 month following commencement of operation (and eventually also at 12 months). Recommendations for changes would be made 3, 6, and 12 monthly.

- (b) Make recommendations about changes to existing monitoring, including substances monitored and frequency of monitoring.*

No additional analytes were added to the program following the monitoring performed under Condition (a).

E12.1.3 Noise Validation Program

The licensee must conduct a Noise Validation Program, which must include but not be limited to the following:

- (a) Identification and ranking by sound power level (in 1/3 octave bands for any source with potentially undesirable noise character) all significant noise sources on the Groundwater Treatment Plant site.*

The Acoustic Group was commissioned to undertake the noise validation testing. An initial report has been received from them:

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- *Preliminary Acoustic Compliance Testing, Ground Water Treatment Plant, Botany Industrial Park, The Acoustic Group, 5 May 2006.*

At the time of writing, another consultant, Stephenson's, had been commissioned to perform additional testing in accordance to the licence requirements.

- (b) *Identification of all noise sensitive receivers that may be affected by the operation of the Groundwater Treatment Plant, and select an appropriate number of representative receiver locations to represent all sensitive receivers.*

The Acoustic Groups report provides details of areas of the plant where excessive noise is being generated and provides data for the sound power levels generated from those areas.

- (c) *The results of all noise measurements undertaken to assess compliance with Condition L6.4 of the licence.*

The Acoustic Groups report states that at the time of testing the noise measurements performed demonstrated that the GTP noise emissions exceeded the limits established by the Environment Protection Licence.

- (d) *A statement of whether noise levels from all activities at the Groundwater Treatment Plant site comply with the specified noise limits at the representative receiver locations. The statement must take into account tonal, impulsive and short duration noises originating from the Groundwater Treatment Plant site.*

Stephensons' report, when completed, will provide additional information in relation to this licence requirement. This report will be provided to DEC on completion.

- (e) *Where noise levels have been assessed as exceeding allowable licence limits, a statement explaining the reason why this has taken place.*

Stephensons' report, when completed, will provide additional information in relation to this licence requirement. This report will be provided to DEC on completion.

- (f) *A statement of what feasible and reasonable additional measures may be implemented to further reduce noise levels below those specified in the Licence.*

The Acoustic Groups report provided recommendations for each area of the GTP where noise level exceedences were noted.

E12.1.4 Thermal Oxidation Unit Validation Program

The licensee must conduct a Thermal Oxidation Unit Validation Program, which includes but is not limited to the following:

- (a) *Ensures that all parameters monitored comply with the Thermal Oxidation Unit lower limits specified in Condition L3.6 in the licence.*

Thermal Oxidiser Temperature Point 10

The temperature fell below the licence limit on 28 occasions or events. For shutdown events the duration was calculated based on the time required for the oxidiser to cool from the operating set point to 200C, which is generally regarded as the lower temperature limit for de novo formation of dioxins.

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Many of these exceedences were caused by process trips, shutdown operations and general commissioning activities. A detailed description of the nature and duration of the exceedences was provided to the auditor.

Thermal Oxidiser Flow Residence Time Point 13

The residence time of off-gas / combustion gas in the thermal oxidiser was above the lower licence limit of 2 seconds, for the vast majority of the reporting period. A detailed description of the nature and duration of the exceedences was provided to the auditor.

Temperature of the Heat Exchanger, Bulk, Point 24

The temperature fell below the licence limit on 18 occasions or events. The duration and nature of events were provided to and discussed in detail with the auditor.

Temperature of the Heat Exchanger, Individual, Point 24

Five thermocouples were positioned across the outlet of the Heat Exchanger E6103 to provide a temperature profile across the outlet. The licence limit for an individual thermocouple is 420°C.

From 23 May to 22 Jun 2006 there were two events in which an individual temperature fell below 420°C during normal operation. The first event consisted of two measurements (416.9°C and 417.6°C). For the period 22 June to 31 July 2006 the operator logs do not contain instances in which the temperature of a thermocouple fell below 420C other than during process trips.

Full details of the nature and extent of these exceedences were provided to the auditor for review.

- (b) *Reports the fraction of time the lower temperature limit specified in Condition L3.6 is not achieved within ± 50 °C.*

Temperature of Thermal Oxidation Unit, Point 10

Approximately 85.9% of this time off-gas flowed to the thermal oxidiser and the unit was above the lower licence limit. For 14.1% of the operating period the temperature of the oxidiser was below the licence limit, however, no off-gas was supplied to the oxidiser during these times. Full details were provided to the auditor for review.

Temperature of Heat Exchanger (bulk), Point 24

In total, the temperature of the heat exchanger (bulk) was below the lower licence limit of 450°C for 10.4% of the operating interval. Full details were provided to the auditor for review.

Temperature of Heat Exchanger (individual), Point 24

The temperature of the heat exchanger (individual) was below the 420 °C licence limit for 10.8% of the operating interval. Full details were provided to the auditor for review.

- (c) *Correlates all dioxin air emissions data monitored at Point 9 in accordance with Condition M2.1 with temperature and flow rate data monitored at Point 10.*

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Dioxin Air Emissions Correlated with Oxidiser Temperature

For this reporting period, air emissions from Point 9 had been monitored for dioxins on 16 March, 11 April, 28 April, 29 May, 5 June, 1 July and 19 July 2006. Comparisons with oxidiser temperatures were difficult as there are a number of factors that influence accurate correlation. Current data did not indicate any significant correlations.

Dioxin Air Emissions Correlated with Residence Time

Dioxin emissions from Point 9 were also correlated with residence time in the thermal oxidiser. No relationship between residence time in the thermal oxidiser and dioxin levels was evident.

- (d) *Quantitatively assess dioxin air emissions at Point 9 with the thermal oxidiser operating at or near 850 °C / 950 °C.*

Dioxin emissions from Point 9 to date have not been assessed with the thermal oxidiser operating at the lower temperature limits specified by the EPL licence (850C pre-May 22 and 950C thereafter).

During start up on 20 May it was decided to operate the thermal oxidiser at 1000°C, allowing 50°C extra as a precautionary measure against dioxin formation via incomplete combustion.

When the results of the 29 May test were available it was evident that dioxin levels were still greater than the licence condition. On 6 June the plant was shutdown. Extra modifications were carried out to the oxidiser interior, packing in the absorber and scrubber were washed and the uppermost demister in the scrubber was replaced. At start up the oxidiser was once again run at 1000°C as a precautionary measure. It was decided by Orica management to continue to operate at 1000°C until such time that the process is stable and several consecutive tests register dioxin values below the licence limit. After such time the temperature can be lowered to the licence limit of 950°C and air emission monitoring conducted.

Use of incorrect thermocouples and high seal air flow to the thermocouples means that of the testing done to date, no tests have been carried out with the oxidiser at either 850°C or 950°C.

- (e) *Where there are increases in dioxin air emissions at the lower temperature limit set at Point 10 (as investigated in (d) above), make recommendations to change the lower temperature limit set at Point 10 and associated operational procedures to prevent dioxin concentration increases at the recommended lower temperature limit.*

For this to occur, a stable process with consecutive air emission tests registering dioxins below 0.1ng/m³ is first required; followed by lowering the oxidiser temperature to 950°C for a further air emission test. This will be performed as soon as practicable.

E12.2 ENVIRONMENTAL REVIEW

Condition E12.1 stipulates that the licensee must conduct an Environmental Review, which must include but not be limited to the following:

General Requirements

- (a) *A review of complaints received and action taken by the licensee.*

A summary of the complaints received and actions taken is provided in EPL2148 Annual Return 2006, provided to the DEC on or before 19 September 2006.

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- (b) *Summary of environmental monitoring required under the license and to the extent required by any other approval, compliance with those approval conditions relating to the project.*

A summary of the environmental monitoring required under the license and to the extent required by any other approval, compliance with those approval conditions relating to the project is provided in EPL2148 Annual Return 2006 provided to the DEC on or before 19 September 2006.

- (c) *Identification of trends in all monitoring data collected since the commencement of operation of the groundwater treatment plant.*

A discussion of the data collected at relevant EPA Monitoring Points has been provided with the annual return. Graphs displaying relevant monitoring data from EPA Monitoring Points 9, 10, 13 and 24 have been provided as an Appendix A to this report.

- (d) *A statement on the effectiveness of the overall environmental management and performance of the project.*

The purpose of the GTP construction was to effect hydraulic containment and remove chlorinated solvents from the extracted water and destroy them in the thermal oxidiser.

Overall, the containment works have been effective in mitigating the migration of contaminated groundwater towards Botany Bay. Over 150 tonnes of chlorinated solvents that were formerly migrating towards Botany Bay have been removed from the aquifer for destruction in the thermal oxidiser. With this in mind, it may be said that the project has met its primary environmental objectives.

However the GTP is still in the process of being commissioned and has had issues with dioxin emissions and bio-fouling that has limited its extraction capacity. Strict environmental standards have been placed on the GTP and Orica is committed to meeting these requirements.

E12.2.1 Dioxin Minimisation and Management Program

- (a) *Investigation into technical options and scientific developments which would allow continuous monitoring and or sampling of any dioxin emissions which may be emitted from the GTP.*

Chris Clunies-Ross is a recognised expert in the field of dioxin creation, testing and management in Australia. Mr Clunies-Ross is a member of the Botany Groundwater independent monitoring committee (IMC) and Orica has been fortunate to be able to seek Chris's advice through this project.

Bill Troxler from Focus Environmental is a recognised expert in the field of thermal treatment technologies. Orica has also consulted with Mr Troxler in regarding dioxin formation and measurement.

Current Approach

- Fourier Transform Infrared Spectrometry (FTIR) is currently used to monitor stack gas emissions. Compounds monitored are water, oxygen, carbon monoxide, hydrogen chloride, volatile organic compounds, ethylene dichloride, vinyl chloride monomer, tetrachloroethene, cis-1,2-dichloroethene, NO and NO₂, trichloromethane, 1,1,2,2-tetrachlorethane, 1,1,2-trichloroethane, benzene and sulphur dioxide.
- The FTIR cannot measure dioxin emissions and discreet samples are collected instead for analyses to determine compliance.

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Continuous monitoring

The following continuous monitoring technologies are being investigated:

- *Proton transfer reaction – mass spectrophotometer (PTR-MS)* - The use of a PTR-MS to monitor dioxin surrogates has been successfully demonstrated at incinerator plants in Japan. Chlorophenols and chlorobenzenes are common dioxin surrogates.
- *Time-of-flight mass spectrophotometer (TOF-MS)* provides monitoring at parts per trillion (ppt) levels in real time (minutes). However, it has several limitations including being unable to monitor all 17 toxic congeners simultaneously.
- A literature search (7 June 06) identified immunoassay technology for dioxin detection. Commercial kits produced by Cape Technologies LLC (Maine USA) are available in Australia through Leeder Consulting. Key features of the technology are: (i) cost-effective I-TEQ screening tool, (ii) speed, with turn-around times of 48hrs, (iii) simplicity, and (iv) parallel processing of multiple samples. A key limitation is it is necessary to validate immunoassay responses using conventional methods. The validation generates a calibration adjustment factor, and if used, provides quantitative results in ppt.

Discussions with the supplier have progressed to the point where Orica has purchased the immunoassay kits and associated hardware and the items have been delivered to Analytical Consulting Services (ACS) in Melbourne. A service agreement has been established whereby ACS will validate the kits. If the validation is successful the kits will be used for routine dioxin testing of aqueous samples of (a) groundwater, (b) HCl recirculating liquid, (c) caustic liquid.

Continuous Sampling

- Commercially available systems are available that can sample gas continuously for an extended period.
- The main disadvantage is that the result is an average over a week or fortnight and peak concentrations cannot be determined and as with discrete methods the results are not available for a month after sampling is complete.

Two continuous sampling systems – AMESA and DMS – are demonstrated and commercially available. A total turnaround time of 3 to 5 weeks could transpire between an emission event and receipt of data. The cost of these units is of the order of US\$110k – US\$130k. These units offer no further improvement on Orica's current practice of monthly monitoring of stack emissions for dioxins.

- Eight continuous monitoring systems are in development, however, Orica understands that as yet, they are not commercially available. Reporting sensitivities of the continuous monitors are in the range of several parts per trillion and may not be sufficiently low enough to measure Orica's required limits.
- The US EPA conducted evaluation tests for two continuous sampling and two continuous monitoring systems for dioxins. The final report for the study should be released in late 2006 and Orica will keep abreast of further developments.

b) Investigation of chemical and/or physical parameters that are likely to correlate with the actual or potential formation of dioxins and could be used as a surrogate indicator of dioxin formation in the GTP.

An independent expert, Dr Chris Clunies-Ross has been commissioned to advise on dioxin monitoring. In addition Orica are investigating a number of options and consulting with Nittetu (the TO manufacturer) and other authorities on the matter. A brief summary of

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findings to date is provided below. Full documentation was provided to the auditor for review and discussion.

Chemical Surrogates

Various chemical surrogates are being investigated as follows:

- Carbon monoxide is the simplest, however, this is not present at significant concentrations and so is not well suited to be a surrogate.
- Precursors, such as chlorobenzenes and chlorophenols are considered to be more reliable indicators of dioxin formation.
- Nittetsu have indicated that destruction efficiency of vinyl chloride monomer (chloroethene) has been used in Japan as a surrogate indicator for dioxins.
- A US EPA report ‘*The use of surrogate compounds as indicators of PCDD/Fs concentrations in combustor stack gases*’ (2004) showed a good correlation between PCDD/Fs and carbon monoxide at concentrations higher than 200ppm. GTP operates with CO levels typically less than 1 ppm.
- The US EPA reports significant relationships between PCDD/Fs and vinyl chloride, 1,2-dichloroethane, trichloroethylene or tetrachloroethylene.
- Mono-, di-, tri-chlorobenzenes were determined in some gas samples taken in parallel with dioxin monitoring and the results were negative.

E12.2.2 Groundwater Treatment Plant Water Re-use Strategy

The licensee must conduct a program that investigates opportunities to maximize the reuse of treated water from the groundwater treatment plant and reduce the amount of treated water discharged to waters provided the reuse or reduction can be achieved in a safe and practical manner and it will provide the best environmental outcome, in the circumstances. The program must include but need not necessarily be limited to the following:

- a) *Characterisation of the treated water in terms of quality and quantity;*

Quality

The GTP has not operated sufficiently consistently to reliably characterise the treated water based on large sample size. The quality has been assessed at various times most notably the period for a few days in May when discharge to the environment occurred. Using the licence values for the relevant parameters the treated water appeared to comply. The results are available at the GTP lab.

Quantity

The quantity of treated water has been limited to approximately 2.5 ML/d when the GTP has been operating because this flow is the commissioning flow. To date this has been discharged to sewer, except for a few periods of discharge to the environment.

According to the groundwater model, inflow to the GTP will be between 6.2 and 7.5 ML/d as this is the predicted required volume to effect containment across all three containment lines.

- b) *Identification of potential uses of this treated water, taking into account relevant and recognised environmental and human health guidelines or standards to ensure it is appropriate for this use;*

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Orica has identified numerous potential customers with a variety of uses for the water. Orica is only targeting non-potable uses for this water. Most of the use applications are industrial / commercial and include:

- Process water
- Cooling towers
- Demineralisation
- Washdown water;
- Lawn, garden watering; and
- Golf course watering.

Some other potential applications include:

- Laundry water; and
- Toilet water.

In determining the “Treated Water Specification” for Orica treated water, both human health and environmental concerns will be considered in light of the waters use and post use disposal.

c) Identification of options to beneficially reuse treated waters to minimise the amount of treated water being discharged;

A list of over a dozen potential customers has been compiled to date, many of which are located on the Botany Industrial Park (BIP).

d) Assessment of the feasibility and cost of these options;

In accounting for recycling of the 7ML/d of groundwater required to meet the cleanup obligations, three customers have already committed and are seeking government grants. The feasibility of each option will be assessed as required.

e) Selection of options for implementation;

These companies are the first of many that Orica is expecting to take Orica treated water.

f) Timetable for Implementation of the selected options;

Orica has developed a staging plan for the beneficial re-use of treated groundwater, incorporating primarily those identified customers on and close to the BIP.

g) Inclusion of any other relevant recommendations relating to treated water reuse.

At the moment a potential re-user is expecting that it will still require towns water for about 40% of its water flow to balance the alkalinity in the blended water to protect the equipment and hence the production. Orica believes that this 40% can also be substituted by recycled water providing we can meet the customers' requirements.

Recommendations will be made on a case-by-case basis.

h) The licensee must consult with the DEC, NSW Health Department, Sydney Water Corporation, Sydney Ports Corporation, Botany Bay Council, DIPNR and NSW Maritime on the development of the program.

Orica has consulted widely regarding preparation of the Water Reuse Strategy. This consultation has included government, potential customers, the Community Liaison Committee (CLC) and the local agencies community.

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Government Consultation

In April 2005 the State government announced that a working group chaired by DEUS, and made up of representatives from Orica, Sydney Water, DEC, (the then) DIPNR and NSW Health, was to be established to progress the review of the initiatives by Orica for the uptake of recycled water from Orica's major industrial reuse scheme as part of the Botany Groundwater Cleanup Project. This group met on 12 May and 13 June 2005 to discuss the water reuse opportunities and matters to be considered in the supply of treated water.

As the chair of this group, DEUS has presented as the key point of contact for government consultation regarding treated water reuse from the GTP. The working group has not continued in its original form, however, Orica continues to consult with representatives of the participating agencies on specific matters as required as the reuse project develops.

Further detail of consultation activity with state and local government and the feedback received is summarised in the table below.

	Consultation Activity	Feedback
Government		
<i>Sydney Water Corporation</i>	<p><i>Ian Hammerton, Sydney Water recycling manager has been contacted and we are awaiting his response to commence dialog.</i></p> <p><i>Richard Schuil, Sydney Water has been contacted to discuss taking recycled water at their Malabar sewage plant.</i></p> <p><i>Judy Hanson has received an invitation to participate in the October community session.</i></p> <p><i>Chris Guest has been approached regarding the principles of open access and using Sydney Water's sewers to transport our trade waste.</i></p>	<p><i>Still awaiting response.</i></p> <p><i>Still awaiting response.</i></p> <p><i>Still awaiting response.</i></p> <p><i>Still awaiting response.</i></p>
<i>Department of Energy Utilities and Sustainability (DEUS)</i>	<ul style="list-style-type: none"> - Working Group - Water Savings Plans 	<i>Keen to participate in planning for October community session as discussed below.</i>
<i>Department of Environment and Conservation</i>	<ul style="list-style-type: none"> - Working Group 	<i>Will discuss with DEC when the plant is operating more routinely and we have some regular and reliable analytical results to assess against proposed water quality specifications.</i>

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	Consultation Activity	Feedback
<i>NSW Health Department</i>	- <i>Working Group</i>	<i>Will discuss with NSW Health when the plant is operating more routinely and we have some regular and reliable analytical results to assess against proposed water quality specifications.</i>
<i>Sydney Ports Corporation (SPC)</i>	<i>Meeting held on 11 July 2006. Orica advised SPC (Colin Rudd, General Manager Projects; Marika Calfas, Manager, Planning & Environment; Christa Sams, Environment Operations Manager)</i>	<i>SPC have advised that they have no large water requirements and no specific interest in or contribution to Orica's water reuse plans.</i>
<i>Department of Natural Resources</i>	<i>Discussed plans for October session with Greg Dasey, Hydrogeologist and Brian Graham, A/Mgr Access and Compliance South Coast Region</i>	<i>Keen to participate in planning for October community session as discussed below.</i>
<i>Botany Bay City Council</i>	<i>Paul Shepherd, Director Technical Services</i> <i>Bronwyn Englaro, Environmental Scientist</i>	<i>Expressed interested in water for golf course, open space and road cleaning tankers.</i> <i>Keen to participate in planning for October community session as discussed below.</i>
<i>NSW Maritime Authority</i>	<i>Yet to contact</i>	-

Community Consultation

Orica provides regular updates to the CLC regarding all aspects of the Botany Groundwater Cleanup Project, including water reuse plans, at quarterly CLC meetings, in our quarterly progress reports and via the project website.

A detailed presentation was provided on the status of Orica's water reuse plans at a community workshop (addressing a number of Orica projects) held on Saturday 17 June 2006. This workshop was advertised in local press and in a leaflet delivered to 5,500 homes around the BIP. Orica was pleased that over 70 people attended the workshop.

Community members who attended this workshop have expressed keen interest in water reuse and requested the opportunity to discuss Orica's plans in an open forum with key government representatives. In response to this feedback Orica is planning a workshop to be held in October 2006 to discuss Orica's water reuse program. Orica has discussed this plan with the Department of Natural Resources, the City of Botany Bay Council and DEUS who have each expressed a keenness to be involved.

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Consultation with the CLC and broader community will continue as the reuse program develops.

E12.2.3 Groundwater Monitoring Program

The licensee must conduct a Groundwater Monitoring Program, which must include but not be limited to the following:

(a) *Monitoring of groundwater to assess whether the extraction of groundwater will result in any actual or potential impacts to surface waters or habitats in the locality;*

A groundwater-monitoring plan (*GTP Groundwater and Surface Water Monitoring Program*, URS, 15 July 2005) was prepared that satisfied both the requirements of the NCUA and the monitoring conditions outlined in EPL 2148. This plan was made available for review by relevant NSW authorities prior to implementation. In this reporting period a total of 4 quarterly monitoring events were performed under this plan:

- “*Orica Botany Environmental Survey Stage 4- Remediation – Groundwater Treatment Plant Quarterly Groundwater and Surface Water Monitoring Report – June 2005*” URS Australia Pty Ltd
- “*Orica Botany Environmental Survey Stage 4- Remediation – Groundwater Treatment Plant Quarterly Groundwater and Surface Water Monitoring Report – September 2005*” URS Australia Pty Ltd
- “*Orica Botany Environmental Survey Stage 4- Remediation – Groundwater Treatment Plant Quarterly Groundwater and Surface Water Monitoring Report – December 2005*” URS Australia Pty Ltd
- “*Orica Botany Environmental Survey Stage 4- Remediation – Groundwater Treatment Plant Quarterly Groundwater and Surface Water Monitoring Report – March 2006*” URS Australia Pty Ltd.

These reports were provided to DEC and other stakeholders. The quarterly monitoring reports referenced above includes an assessment of groundwater flow patterns and extraction within BIP, primary and secondary containment lines. In the conclusion section of each monitoring report, a description of the impacts of the groundwater extraction on the groundwater levels and flow patterns is provided.

Surface water monitoring was undertaken at Penrhyn Estuary, Floodvale and Springvale Drains. Trends in concentrations of contaminants in surface waters were discussed where relevant.

(b) *Review the conclusions of the groundwater assessments and modeling that was undertaken as part of the EIS, including using all monitoring data collected under this license or other approvals for this project;*

Orica commissioned Alan Laase (A.D. Laase Hydraulic Consulting) to revise and refine the groundwater modelling performed for the EIS and to evaluate the extraction requirements to ensure hydraulic containment. The results of this assessment were reported in November 2005 report titled “*Refinement of the Hydraulic Model for the Orica Extraction System. Botany NSW*”. The key conclusion of that report was that with the proposed 113 extraction wells that a pumping rate of between 6.2 and 7.5 ML/d (EIS modelling predicted 12 to 15 ML/d) would be sufficient to obtain hydraulic containment.

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(c) *Include a mechanism to regularly review the effectiveness of the monitoring program to ensure it is effective in detecting the presence of actual or potential impacts not already identified:*

It is difficult to review the effectiveness of the monitoring program on a quarterly basis, as chemical conditions do not dramatically alter over this period.

The GTP Monitoring program (URS 2005) recommended that the scope and effectiveness of the program be reviewed following 12 months of monitoring. This is likely to occur in late 2006.

(d) *Make recommendations about changes to existing monitoring and frequency of monitoring.*

The quarterly ground and surface water monitoring reports (referenced above) make specific recommendations regarding on going monitoring and testing.

(e) *The program must be prepared and implemented in consultation with the DEC, DIPNR, Department of Primary Industry (DPI), Sydney Ports, Sydney Water Corporation, NSW Maritime and City of Botany Council.*

All nominated groups were consulted in the development of this plan.

E12.2.4 Ambient Environmental Monitoring Program

The licensee must conduct an Ambient Environmental Monitoring Program, which must include but not be limited to the following:

a) *Develop and implement a program to monitor ecological health of habitats in the locality and water quality in the receiving environment, including specification of sampling locations, sampling frequencies and parameters to be tested.*

The following ecological monitoring plan was prepared in consultation with nominated NSW Authorities.

- *“Final Work plan – Ecological Monitoring for the Groundwater Treatment Plant and its Operations”*, URS, 13 October 2005.

At the time of writing, two reports had been prepared in accordance with this plan:

- *“Progress Report – Orica Botany GTP Operation Ecological Monitoring Program Report 1”*, URS, 15 December 2005.
- *“Progress Report – Orica Botany GTP Operation Ecological Monitoring Program Report 2”*, URS, 1 July 2006.

Copies of these reports were provided to various stakeholders and posted on the Orica Botany website.

b) *Include monitoring sites at Penrhyn Estuary, Botany Bay and Bunerong Canal as well as other rant off site locations.*

Monitoring Report 2 (URS July 2006) provides a detailed description of the monitoring undertaken and the general location of the habitats that are being monitored. Many of the

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specific locations were not provided in the initial monitoring plan as an initial survey was required to determine the most appropriate locations.

- c) *Assess whether the project will not result in any actual or potential impacts to surface waters or habitats in the locality from the operation of the groundwater treatment plant and associated plant and equipment.*

The monitoring reports provide a detailed description of the monitoring undertaken and presents conclusions relating to the impacts of the remedial works.

- d) *Review the conclusions of the ecological and ambient water quality assessments that were undertaken as part of the EIS, including using monitoring data collected under this license or other approvals for this project;*

These reports present the findings of the ecological monitoring undertaken and to date no measurable impacts have been identified. The GTP has been operating for a relatively short period of time and measurable impacts (if any) are not likely to be seen for some time.

- e) *Include a mechanism to regularly review the effectiveness of the monitoring program to ensure it is effective in detecting the presence of actual or potential impacts not already identified.*

The overall effectiveness of the program cannot be assessed from quarter to quarter. Each sampling event over a year targets a particular season. Hence, before the overall program can be reviewed, at least 2 sampling rounds from the same season will be required, this will occur in November 2006 (the sampling program commenced in November 2005). At this time of the effectiveness will be assessed and the changes may be made to the scope of monitoring.

- f) *Make recommendations about changes to existing monitoring, including substances monitored and frequency of monitoring.*

The monitoring reports provide detailed descriptions of the monitoring undertaken and presents recommendations for modifications to the monitoring program.

- g) *The program must be prepared and implemented in consultation with the DEC, DIPNR, DPI, Sydney Ports Corporation, Sydney Water Corporation NSW Maritime and City of Botany Council.*

All nominated groups were consulted in the development of this plan.

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Appendix A

Data Plots for EPA Monitoring Points 9, 10, 13 and 24.