

	REPORT No: EN.1591.61.PR032	Rev: 0
GROUNDWATER CLEANUP PLAN PROGRESS REPORT NO. 23		

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**GROUNDWATER CLEANUP PLAN PROGRESS REPORT No. 23**

**REPORT NO. EN.1591.61.PR032**

**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**

REV	STATUS	DATE	PREPARED	CHECKED	AUTHORISED
0	Issued to DECC	31/08/2009	S Corish 	J Stening 	G Richardson 

## DISTRIBUTION

1. Matthew Hart, Contaminated Sites Section, DECCW (hard copy with 2 copies of Attachments A).
2. Greg Russell, DWE (CD Version)
3. Santo Cannata, SESPHU (hard copy)
4. Geoff Richards, NSW Health (hard copy)
5. Paul Shepherd, CoBB (hard copy and CD version)
6. John Kent, CLC Chair (hard copy with CD for Attachment A)
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**LIST OF ACRONYMS**

<b>ACRONYM</b>	<b>DEFINITION</b>
ADWG	Australian Drinking Water Guidelines
AHD	Australian Height Datum
ANZECC	Australia and New Zealand Environment and Conservation Council
BAF	Biological Aerated Filter
BEW	Botany Environment Watch
BEREPA	Botany and Eastern Region Environment Protection Agency
BGC Project	Botany Groundwater Cleanup Project (hydraulic containment and treatment project as described in the EIS)
BGL	Below ground level
BGP	Botany Groundwater Project (entire set of activities pertaining to Orica's contamination of the BIP and environs)
BIP	Botany Industrial Park
BP	Bundle piezometer
CFM	Chloroform (trichloromethane)
CHC	Chlorinated hydrocarbon
cis-1,2-DCE	cis-1,2-dichloroethene
CoBB	City of Botany Bay
COPC	Chemical of potential concern
CPRC	Community Participation and Review Committee
CTC	Carbon tetrachloride (tetrachloromethane)
CLC	Community Liaison Committee
DEAC	Diethyl aluminium chloride
DEC	Department of Environment and Conservation, incorporates the EPA and is now DECCW
DECC	Department of Environment and Climate Change, formerly DEC
DECCW	Department of Environment, Climate Change and Water, formerly DECC
DIPNR	Department of Infrastructure, Planning and Natural Resources (former NSW Government department, separated into DoP and DNR)
DNAPL	Dense non-aqueous phase liquid
DNR	Department of Natural Resources (formerly part of DIPNR, now part of DWE)
DWE	Department of Water and Energy
DoD	Department of Defence
DoP	Department of Planning (formerly part of DIPNR)
EDC	Ethylene dichloride (1,2-dichloroethane)
EDO	Environmental Defender's Office
EIAD	Environmental Impact Assessment Document
EIS	Environmental Impact Statement
EPA	Environment Protection Authority
EPL	Environmental Protection Licence
EP&A Act	Environment Planning and Assessment Act
GAC	Granular activated carbon
GCP	Groundwater Cleanup Plan
GEEA	Groundwater Extraction Exclusion Area
GIR	Groundwater Injection and Recovery
GTA	General Terms of Approval

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<b>ACRONYM</b>	<b>DEFINITION</b>
GTP	Groundwater Treatment Plant
HCB	Hexachlorobenzene
HCBD	Hexachlorobutadiene
HHRA	Human Health Risk Assessment
IMC	Independent Monitoring Committee
ISCO	In Situ Chemical Oxidation
JBS	JBS Environmental Pty Ltd, an environmental consultancy
KBR	Kellogg, Brown and Root Pty Ltd, Engineering Contractor for many sub-projects of the BGP
KMH	KMH Consulting Pty Ltd, independent compliance auditor for the BGP
MoU	Memorandum of Understanding
NCUA	Notice of Clean Up Action
NHMRC	National Health and Medical Research Council
NSW	New South Wales
OEMP	Operational Environmental Management Plan
PCA	Primary Containment Area
PCE	Perchloroethylene (tetrachloroethene)
PFM	Planning Focus Meeting
PHA	Preliminary Hazard Analysis
PRP	Pollution Reduction Program
PVDF	Poly vinylidene fluoride
QRA	Qualitative Risk Assessment
RAP	Remedial Action Plan
REF	Review of Environmental Factors
RO	Reverse osmosis
RTA	Roads and Traffic Authority
RWG	Regulatory Working Group
SCA	Secondary Containment Area
SCW	Scheduled Chemical Waste
SEPP	State Environmental Planning Policy
SESPHU	South East Sydney Public Health Unit
SPC	Sydney Ports Corporation
SSU	Steam Stripping Unit
SWC	Sydney Water Corporation
TBA	To be advised
1,1,2,2-TeCA	1,1,2,2-Tetrachloroethane
1,1,2-TCA	1,1,2-Trichloroethane
1,2,4-TCB	1,2,4-Trichlorobenzene
1,2,4,5-TeCB	1,2,4,5-Tetrachlorobenzene
TCE	Trichloroethene
TO	Thermal Oxidiser
TOC	Total Organic Carbon
TWA TLV	Time Weighted Average Threshold Limit Value
TWSA	Trade Waste Service Agreement
URS	URS Australia Pty Ltd, Orica's principal environmental consultant on BGP
VC	Vinyl chloride (chloroethene)
VMP	Voluntary Management Plan
VOC	Volatile organic compound
VSD	Variable speed drive

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### **EXECUTIVE SUMMARY**

The NSW Environment Protection Authority (EPA), now part of the Department of Environment and Climate Change (DECC), issued Orica Australia Pty Ltd (Orica) with Notice of Clean Up Action (NCUA) No. 1030236 on 26 September 2003, under the Protection of the Environment Operations (POEO) Act 1997.

This document is the twenty-third report submitted in accordance to NCUA Condition 4G. The reporting interval for this report is 1 January to 31 March 2009, however if more recent and relevant information is available it is also included.

Orica engaged URS to complete a quarterly monitoring event in June 2009 in accordance with the agreed monitoring plan. Results and discussions were provided in the URS report *Groundwater Treatment Plant (GTP) Quarterly Groundwater and Surface Water Monitoring Report, August 2008*.

### **Hydraulic Containment**

- The inferred contours and patterns of shallow and deep groundwater flow indicate that hydraulic containment was achieved at the Secondary Containment Area (SCA) and Primary Containment Area (PCA) during the monitoring period;
- Elevated groundwater levels were observed at the SCA in intermediate monitoring wells east of MWF01. The increased levels have not resulted in a loss of hydraulic containment but corrective action is required to ensure that the water levels are lowered in the medium term. Orica has engaged URS to assist in determining the cause.
- Capacity constraints at the Groundwater Treatment Plant (GTP) do not always allow for full containment across the entire Botany Industrial Park (BIP) line. During the reporting period hydraulic containment was achieved at the central and southern portions of the BIP containment line in the shallow and deep aquifers as they are the prioritised areas. Containment was not consistently achieved at the northern portion of the BIP containment line as this is an area of relatively low contaminant concentrations. Containment will be effected here as GTP capacity increases. Regardless, groundwater flow from this area is towards the central portion of the line and will effectively be captured at the PCA; and
- Water levels at regional monitoring wells show no discernible water level impact due to hydraulic containment, thus indicating a limited potential to affect infrastructure and licensed groundwater users. A significant increase in regional water levels was observed in response to the significant rainfall events in April and May 2009.

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## **Chemical Monitoring Results**

### **General**

- Concentrations reported for offsite monitoring wells were similar to those previously reported;
- Minor increases in contaminant concentrations were observed at BP01 and BP115. These wells are located downgradient of the SCA and contaminants were present in this area prior to commencement of hydraulic containment at SCA in 2005. The observed increases are minor and reflect slow changes to the distribution of contaminants south of the SCA; and
- An historical maximum was observed at WG154D for ethylene dichloride (EDC) although the reported value was only slightly higher than historical concentrations. Importantly, WG154D is located upgradient of the SCA and groundwater from this location will be intercepted by the SCA.

### **Penrhyn Estuary**

- Volatile CHC concentrations in pore water within Penrhyn Estuary are similar to or lower than historical concentrations; and
- Vinyl chloride (VC) concentrations above the ANZECC (2000) Trigger Value for VC (0.1 mg/L) were observed at BP42 (0.1 m port) at both high and low tides. The concentrations are similar to those reported in September 2007 suggesting fluctuations at this location are seasonal in nature and not due to significant changes in contaminant distribution in Penrhyn Estuary.

### **Surface Water**

- The concentrations of volatile CHCs in surface water sampling locations were generally less than the respective ANZECC (2000) Trigger Values. This is consistent with the monitoring rounds performed since the GTP commenced steady operation indicating the remediation is having a significant effect on the surface water quality in the estuary; and
- The VC concentration at SW049 (in the Orica Southlands section of Springvale Drain close to McPherson Street) exceeded the ANZECC (2000) Trigger Value for VC (0.1 mg/L). However, the reported concentrations at nearby locations are similar to recent and historical values and as a result are not considered to change previous interpretations.

### **Implications for Human Health Risk Assessment**

- There are no additional data presented in the June 2009 round of sampling with respect to the western margin of the Northern Plumes that affect the conclusions of the Consolidated Human Health Risk Assessment (HHRA) (URS, 2005c) and Addendum (URS, 2006). That is, the groundwater contamination within the Northern Plumes near the western margin is not considered to pose an unacceptable risk to human health, assuming that groundwater is not extracted and used;

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- There are no additional data presented in the June 2009 round of sampling that alter the conclusions of the Consolidated HHRA (URS, 2005c) and Addendum (URS, 2006) with respect to existing commercial/industrial workers in the areas above the main plumes. That is, the groundwater contamination within the main plumes is not considered to pose an unacceptable risk to human health, assuming that groundwater is not extracted and used untreated; and
- With respect to Penrhyn Estuary, conclusions presented within the HHRA associated with exposures within the inner and outer estuary remain unchanged. That is, given the conservative nature of the range of assumptions and the safety factors applied to toxicity values, the risks to human health for all exposure scenarios are considered to be low. Some exceedances of target values occurred in the inner estuary, however the potential for exposure within the inner estuary is effectively eliminated by access restrictions associated with the Port Botany expansion works.

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## 1 INTRODUCTION

The NSW Environment Protection Authority (EPA), now part of the Department of Environment, Climate Change and Water (DECCW), issued Orica Australia Pty Ltd (Orica) with Notice of Clean Up Action (NCUA) No. 1030236 on 26 September 2003, under the Protection of the Environment Operations (POEO) Act 1997. Since then the DECCW has issued three variation notices as follows:

Notice under Protection of the Environment Act 1997	Date Issued
Notice of Cleanup Action (NCUA) No. 1030236	26 September 2003
<i>Variation NCUA No. 1033107</i>	17 February 2004
<i>Variation NCUA No. 1042957</i>	7 December 2004
<i>Variation NCUA No. 1052882</i>	2 February 2006

Condition 3 of the NCUA requires Orica to submit a Groundwater Cleanup Plan (GCP) by 31 October 2004 for consideration by the EPA. Condition 3 defines the issues to be addressed in the GCP within timeframes defined in Condition 4. Condition 3(e) defines requirements for a comprehensive monitoring plan, the results of which were to be reported to the EPA (under Condition 4G) on a quarterly basis.

This document is the twenty third report submitted in accordance to NCUA Condition 4G. The reporting interval for this report is 1 April to 30 June 2009, however if more recent and relevant information is available it is also included.

Progress Report No	Date	Comment
1	Wednesday 25 February 2004	Submitted on schedule
2	Monday 17 May 2004	Submitted on schedule
3	Friday 20 August, 2004	Submitted on schedule
4	Thursday 18 November 2004	Submitted on schedule
5	Wednesday 16 February 2005	Submitted on schedule
6	Tuesday 17 May 2005	Submitted on schedule
7	Monday 15 August 2005	Submitted on schedule
8	Wednesday 30 November 2005	Submitted on schedule
9	Tuesday 28 February 2006	Submitted on schedule
10	Wednesday 31 May 2006	Submitted on schedule
11	Thursday 31 August 2006	Submitted on schedule
12	Thursday 30 November 2006	Submitted on schedule
13	Wednesday 28 February 2007	Submitted on schedule
14	Thursday 31 May 2007	Submitted on schedule
15	Friday 31 August 2007	Submitted on schedule
16	Friday 30 November 2007	Submitted on schedule
17	Friday 29 February 2008	Submitted on schedule
18	Friday 30 May 2008	Submitted on schedule
19	Friday 29 August 2008	Submitted on schedule
20	Friday 28 November 2008	Submitted on schedule
21	Friday 27 February 2009	Submitted on schedule

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<b>Progress Report No</b>	<b>Date</b>	<b>Comment</b>
22	Friday 29 May 2009	Submitted on schedule
<b>23</b>	<b>Monday 31 August 2009</b>	<b>Current Report</b>

Previous reports are available at the relevant section of the website [www.orcabotanytransformation.com](http://www.orcabotanytransformation.com) and a distribution list is provided at the beginning of this document.

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## 2 COMPLIANCE SUMMARY

### 2.1 Notice of Clean Up Action (NCUA)

A summary of the compliance status against current NCUA (including variation notices) condition requirements is provided below. DECCW has advised that the regulation of the Botany Groundwater Cleanup (BGC) Project is currently being reviewed to take into account cleanup progress and recent developments. Orica made a submission to DECCW to outline a proposed way forward and DECCW has agreed that the NCUA can be replaced by a Voluntary Management Plan (VMP). Orica is preparing a draft VMP for review by DECCW (refer Section 2.4).

Cond.	Summary of Requirement	Status	Reference Documents / Comments
3A	Commence preparation of GCP by 30/09/2003	<b>Achieved</b>	Commenced on 26/09/2003
3B	Prepare and submit GCP by 31/10/2003 covering matters listed	<b>Achieved</b>	GCP submitted 31/10/2003. EPA authorisation of GCP on 17/02/2004 by Variation Notice No.1033107.
4A	Commence implementation of GCP by 16/03/2004	<b>Achieved</b>	Work commenced immediately after submission of GCP, in anticipation of its approval.
4B	Commence containment works within primary containment area within 14 days of receipt of all approvals and complete such work within 90 days.	<b>Achieved</b>	Extraction commenced 28/10/2004. Orica letter of 29/10/2004, DECCW letter 10/11/2004.
4BA	At least once every 3 months during GCP implementation report on effectiveness of hydraulic containment works.	<b>Ongoing compliance</b>	Most recent data provided in Section 3.1 of this report.
4C	Complete identification of the locations of the DNAPL sources by 31 May 2004.	<b>Ongoing compliance</b>	Significant DNAPL investigations completed to date and discussed in previous GCP Progress reports. No further work in this reporting period.
4D	Complete containment of DNAPL sources by 30/11/2004.	<b>Achieved</b>	Orica submission regarding compliance submitted 30/11/2004. DEC letter of 06/01/2005 has stated in-principle acceptance and requested further information. Orica submitted requested information on 27/01/2005. DEC provided letter of compliance on 07/09/2005.
4D	Remove DNAPL sources to the maximum extent practicable by 31 October 2005.	<b>Achieved</b>	Progress included in Section 0 of this report.
4E	Reduce the concentrations within the primary containment area to the maximum extent practicable by 31/10/2005, with an 80% target on July 2002 levels.	<b>Achieved</b>	Letter of compliance (to maximum extent practicable requirements of the Condition) received on 1 February 2006.
4F	Establish a secondary containment area by 31/10/2004.	<b>Achieved</b>	Commenced extraction 29/10/2004. Orica letter of 29/10/2004, DEC letter of 10/11/2004 (confirmed in DEC letter of 06/01/2005).
4G	Implement monitoring program and	<b>Ongoing</b>	Summary of monitoring program

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Cond.	Summary of Requirement	Status	Reference Documents / Comments
	report at the end of February, May, August and November of each year.	compliance	results for this reporting period provided in Section 3 of this report. Details are provided in Attachment A.
5	Remedial measures to ensure groundwater and surface water flows into Botany Bay and Penrhyn Estuary achieve ANZECC Guidelines for slightly to moderately disturbed ecosystems.	Work in progress	Discussion on latest findings provided in Section 3 and Attachment A of this report.
6	Emission controls from works and measures required by the NCUA strictly controlled through adoption of best practice. Works and operations to be carried out in a controlled and competent manner.	Ongoing monitoring being performed	A discussion on GTP emission compliance provided in Section 5.3 of this report.
7	Orica to make all reasonable attempts to obtain consent for work on premises not occupied by Orica and related companies. Notify EPA within 7 days if refusal to grant access.	<b>Ongoing compliance</b>	Ongoing access to third party premises sought as required.
7A	Updating of GCP to take account of developments.	<b>Ongoing compliance</b>	The GCP remains relevant in terms of the overall groundwater containment and remedial strategy. The strategy is currently under review (see comments on 7E). The Groundwater and Surface Water Monitoring Plan was agreed for 2006 and a revised Plan was submitted and agreed with former DEC (now DECCW) for 2007. In June 2008 Orica, in conjunction with its consultants, submitted a proposal for monitoring from late 2008 to 2010 (URS, 2008). DECCW has agreed to the revised program.
7B	Orica to monitor groundwater in any other area likely to have been, or to be, impacted by the contaminants.	<b>Ongoing compliance</b>	The most recent residential bore monitoring round took place in May 2009. The results are reported in Section 4.2.
7C	7B monitoring is to: a) Determine the spatial distribution of the contaminants; and b) Monitor changes in the spatial contamination and distribution of the contaminants.	<b>Ongoing compliance</b>	Refer to comments on 7B.
7D	Monitoring results to be provided to the EPA as soon as possible after results become available to Orica.	<b>Ongoing compliance</b>	Important results are provided to DECCW as soon as possible. The quarterly progress reports are the primary mode of reporting monitoring data.
7E	Orica must consider best practice technology in the remediation of DNAPL and groundwater containing dissolved phase contamination.	<b>Ongoing compliance</b>	DNAPL overseas mission completed in April 2005: Orica representatives have attended Battelle conference on "Remediation of Chlorinated and Recalcitrant

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Cond.	Summary of Requirement	Status	Reference Documents / Comments
			Compounds" in Monterey, California in May 2008. Orica held a workshop at Botany in December 2007 to discuss remediation strategy with a range of respected overseas and local experts. A submission and presentation was made to the DECCW and the Botany Groundwater Community Liaison Committee (CLC) in September 2008. A community workshop was held on 31 March 2009. Revised remediation strategy will be included in the documents arising from the review of the regulatory framework for the project.
7F	Orica must provide an annual written report to DECCW on actions required by 7E. First report to be provided no later than 28 February 2006.	<b>Ongoing compliance</b>	Annual detailed update provided in the February Progress Report each year.
7G	Orica must review the need to revise the HHRA in light of relevant monitoring data.	<b>Ongoing compliance</b>	See 7H
7H	All reports submitted to DECCW must include an assessment of the potential risk to human health.	<b>Ongoing compliance</b>	All reports now submitted to DECCW include relevant appraisal of potential risk to human health and hence identify any requirement to update the Consolidated HHRA.
7I	By 30 April 2006, Orica must prepare and submit to DEC, a monitoring plan for all necessary input parameters to the HHRA.	<b>Achieved</b>	Plan submitted on 30 April 2006.
7J	Orica must provide copies of reports issued under 7F and 7H to DWE, SESPHU, NSW Health, and City of Botany Bay (CoBB) Council within 7 days of submission to DECCW.	<b>Ongoing compliance</b>	Ongoing compliance
7K	Orica must inform the community of developments by: a) A community forum agreed to by the DECCW. b) Provision of a quarterly newsletter to people residing within a 1 km radius of BIP. c) Maintenance of a website in which copies of relevant reports are posted.	<b>Ongoing compliance</b>	a) The CLC meets quarterly b) See Section <b>Error! Reference source not found.</b> c) <a href="http://www.oricabotanytransformation.com">www.oricabotanytransformation.com</a>
8	Works and measures under voluntary agreement must not compromise the efficacy of measures under the notice.	<b>Ongoing compliance</b>	Orica has since discontinued bioremediation trials because sufficient data had been obtained to assess the efficacy of bioremediation, and the PCA interim hydraulic containment was interfering with the flow of groundwater through the trials area. Orica proposed and DECCW agreed to

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Cond.	Summary of Requirement	Status	Reference Documents / Comments
			defer installation of a zero valent iron permeable reactive barrier wall.
8A	Provide additional information as detailed to DEC by 16/03/2004.	<b>Achieved</b>	Issued by Orica 16/03/2004, received by DEC 17/03/2004 due to courier error. Additional information on PCA extraction design progressively provided in accordance with Orica's response of 16/03/2004.

## 2.2 Environmental Protection Licence No. 2148 (EPL2148)

Orica reports compliance against EPL2148 requirements via the submission of the annual return in September each year to DECCW. The following matters are noted in relation to the licence conditions and the Groundwater Treatment Plant (GTP) for the reporting period:

- Orica made an application to vary EPL2148 to amend the Load Limits for the GTP. Load limits have been set for discharges to air from the GTP for each of the following parameters: Arsenic, Benzene, Benzo(a)pyrene (equivalent), Fine Particulates, Lead, Mercury, Nitrogen Oxides, Nitrogen Oxides (summer) and Sulfur Oxides. On 10 July 2009 DECCW issued a licence variation incorporating the revised limits. Orica pays an annual fee based on the calculated emissions of each of these parameters emitted from the GTP stack.
- On 10 June 2009 DECCW issued a variation to the EPL as part of its regular licence review process. The following changes were included:
  - changes to the waste conditions to ensure consistency following the review of waste classifications under the *Protection of the Environment Operations Act, 1997*;
  - text confirming that Orica is permitted to process extracted groundwater, the substances therein, and associated free phase contaminants originating from Orica's (formerly ICI Australia) activities at the BIP and clarifying that this material originated from the premises and, for the purposes of licensing and the liquid waste levy, it is deemed to have been generated onsite and not received from offsite;
  - removal of remaining references to the Steam Stripping Unit (SSU) as it is no longer required for the project; and
  - text to the effect that an independent compliance audit is not required in 2009.
- On 26 June 2009 Orica submitted a progress report for the ammonia pollution reduction program. DECCW replied on 6 July 2009 requesting additional information to be included with the next report (to be submitted by 11 December 2009).
- As noted in Progress Report No. 21, Orica has identified an opportunity to treat contaminated stormwater, liquids and activated carbon from Stores G & H of the HCB Waste Repackaging operation at the GTP. These proposals were presented to the February 2009 Community Participation and Review Committee (CPRC) meeting and the March 2009 CLC meeting. Orica met with the

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Department of Planning (DoP) and DECCW to discuss the possible means for seeking approval for this proposal on 4 May 2009. Orica awaits the advice from those departments as to the appropriate approvals and assessment approach.

### 2.3 Other Licences and Statutory Approvals

A summary of recent compliance activity regarding other approvals relevant to the project is provided in the table below.

Licence / Statutory Approval	Comments
Conditions under Part V of the Water Act	<ul style="list-style-type: none"> <li>Groundwater and surface water monitoring conducted during this reporting period was undertaken in accordance with the program developed in response to condition E5.1.3 of EPL2148. A summary of the results is provided in Section 3 of this report.</li> <li>Orica submitted production bore applications to DWE in mid 2008 and awaits a response.</li> <li>Orica has obtained bore licences from DWE for the installation of the GIR injection and monitoring wells, and completion of the initial GIR trial.</li> </ul>
Conditions from Department of Planning	<ul style="list-style-type: none"> <li>These conditions require that Orica maintain a register of accidents, incidents and potential incidents with actual or potential significant off-site impacts on people, property, or the biophysical environment. Orica maintains an incident register for the GTP in the internal Safety Health and Environment Incident Management database.</li> <li>The DoP conditions require preparation of Hazard Audits. The first GTP hazard audit was conducted in November 2008 and the report submitted in December 2008. The results of this audit were presented to the CLC in June 2009.</li> </ul>
Network Operator and Retail Supplier licence under the Water Industry Competition Act, 2006.	<ul style="list-style-type: none"> <li>Orica is in the process of preparing an application for a combined Network Operator and Retail Supplier licence under the Water Industry Competition Act, 2006. Applications were initially due to be submitted to the Independent Pricing and Regulatory Tribunal of NSW by 8 August 2009, this date has now changed to 8 August 2010.</li> </ul>

### 2.4 Ongoing regulation

Since late 2008, Orica and DECCW have been reviewing the regulatory regime for the Botany Groundwater Cleanup Project. It was agreed that the NCUA issued in 2003 required revision or replacement with another regulatory instrument.

Following consultation with the Community Liaison Committee (CLC) and Orica, DECCW determined that the project is best managed under the Contaminated Land Management Act 1997. Orica will submit a formal VMP for review by DECCW in September 2009.

### 3 QUARTERLY MONITORING EVENT

NCUA Condition 3B(e) requires Orica to implement a comprehensive monitoring program within the defined area (formerly named as the Groundwater Protection Zone 1 by the then DIPNR (subsequently DNR and now part of DWE), and now referred to as the Groundwater Exclusion Extraction Area [GEEA]) to:

- monitor changes in concentrations of the substances in the contaminant plumes;
- monitor changes in the spatial distribution of contaminant plumes in the sub-surface;
- gauge groundwater levels to assess effectiveness of hydraulic containment; and
- monitor concentrations in groundwater and surface water discharges to Botany Bay and Penrhyn Estuary for comparison against the Australian and New Zealand Guidelines for Marine and Fresh Water (ANZECC, 2000) trigger values for protection of slightly to moderately disturbed ecosystems.

Orica and DEC (now DECCW) subsequently agreed the content and scope of the *GTP Groundwater and Surface Water Monitoring Plan* (URS, 2005b). On an annual basis DECCW and Orica meet to discuss the effectiveness of the monitoring program and revise monitoring requirements as appropriate. In June 2008 Orica submitted its proposal for monitoring from late 2008 to 2010 (URS, 2008).

Orica engaged URS to complete a quarterly monitoring event in June 2009 in accordance with the agreed monitoring plan. Results and discussions were provided in the URS report *Groundwater Treatment Plant (GTP) Quarterly Groundwater and Surface Water Monitoring Report, June 2009*. This report is bound separately as Attachment A. The remainder of this section has effectively been transcribed from the URS report to summarise the monitoring event.

#### 3.1 Hydraulic Monitoring

The inferred contours and patterns of shallow and deep groundwater flow indicate that hydraulic containment was achieved at SCA and PCA during the monitoring period;

- Elevated groundwater levels were observed at the SCA in intermediate monitoring wells east of MWF01. The increased levels have not resulted in a loss of hydraulic containment but corrective action is required to ensure that the water levels are lowered in the medium term. Orica has engaged URS to assist in determining the cause.
- Capacity constraints at the GTP do not always allow for full containment across the entire BIP line. During the reporting period hydraulic containment was achieved at the central and southern portions of the BIP containment line in the shallow and deep aquifers as they are the prioritised areas. Containment was not consistently achieved at the northern portion of the BIP containment line as this is an area of relatively low contaminant concentrations. Containment will be effected here as GTP capacity increases. Regardless, groundwater flow from this area is towards the central portion of the line and will effectively be captured at the PCA; and

- Water levels at regional monitoring wells show no discernible water level impact due to hydraulic containment, thus indicating a limited potential to affect infrastructure and licensed groundwater users. A significant increase in regional water levels was observed in response to the significant rainfall events in April and May 2009.

### 3.2 Chemical Monitoring

#### General

- Concentrations reported for offsite monitoring wells were similar to those previously reported;
- Minor increases in contaminant concentrations were observed at BP01 and BP115. These wells are located downgradient of the SCA and contaminants were present in this area prior to commencement of hydraulic containment at SCA in 2005. The observed increases are minor and reflect slow changes to the distribution of contaminants south of the SCA; and
- An historical maximum was observed at WG154D for ethylene dichloride (EDC) although the reported value was only slightly higher than historical concentrations. Importantly, WG154D is located upgradient of the SCA and groundwater from this location will be intercepted by the SCA.

#### Penrhyn Estuary

- Volatile CHC concentrations in pore water within Penrhyn Estuary are similar to or lower than historical concentrations; and
- Vinyl chloride (VC) concentrations above the ANZECC (2000) Trigger Value for VC (0.1 mg/L) were observed at BP42 (0.1 m port) at both high and low tides. The concentrations are similar to those reported in September 2007 suggesting fluctuations at this location are seasonal in nature and not due to significant changes in contaminant distribution in Penrhyn Estuary.

#### Surface Water

- The concentrations of volatile CHCs in surface water sampling locations were generally less than the respective ANZECC (2000) Trigger Values. This is consistent with the monitoring rounds performed since the GTP commenced steady operation indicating the remediation is having a significant effect on the surface water quality in the estuary; and
- The VC concentration at SW049 (in the Orica Southlands section of Springvale Drain close to McPherson Street) exceeded the ANZECC (2000) Trigger Value for VC (0.1 mg/L). However, the reported concentrations at nearby locations are similar to recent and historical values and as a result are not considered to change previous interpretations.

**Implications for Human Health Risk Assessment**

- There are no additional data presented in the June 2009 round of sampling with respect to the western margin of the Northern Plumes that affect the conclusions of the Consolidated Human Health Risk Assessment (HHRA) (URS, 2005c) and Addendum (URS, 2006). That is, the groundwater contamination within the Northern Plumes near the western margin is not considered to pose an unacceptable risk to human health, assuming that groundwater is not extracted and used;
- There are no additional data presented in the June 2009 round of sampling that alter the conclusions of the Consolidated HHRA (URS, 2005c) and Addendum (URS, 2006) with respect to existing commercial/industrial workers in the areas above the main plumes. That is, the groundwater contamination within the main plumes is not considered to pose an unacceptable risk to human health, assuming that groundwater is not extracted and used untreated; and
- With respect to Penrhyn Estuary, conclusions presented within the HHRA associated with exposures within the inner and outer estuary remain unchanged. That is, given the conservative nature of the range of assumptions and the safety factors applied to toxicity values, the risks to human health for all exposure scenarios are considered to be low. Some exceedances of target values occurred in the inner estuary, however the potential for exposure within the inner estuary is effectively eliminated by access restrictions associated with the Port Botany expansion works.

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#### **4 OTHER ENVIRONMENTAL ACTIVITIES**

Other groundwater and surface water monitoring and data acquisition activities that have been undertaken in this reporting period pursuant to, or that have relevance to, the agreed monitoring plan and conditions of the NCUA are detailed below.

##### **4.1 Air Monitoring and Human Health Risk Assessment**

It was reported in Progress Report No. 6 that the draft *Consolidated Human Health Risk Assessment 2005* (URS, 2005c) was prepared by URS and submitted to the DEC on 31 March 2005 with copies provided also to NSW Health and Prof. Brian Priestly (Monash University) from the Australian Centre for Human Health Risk Assessment for independent review. Following a request from the DEC, the draft report was released publicly.

Prof. Priestly completed the independent review and provided comments in a letter to the DEC on 11 May 2005. The comments were overwhelmingly positive and strongly supported the findings of the risk assessment.

Since 1995 air emission monitoring has conducted on a nominally 15-month cycle (targeting different seasons every year). Sampling locations are on and off the BIP and are usually adjacent to shallow groundwater-monitoring points. Some air monitoring locations – such as the Car Park Waste Encapsulation – are not directly relevant to the Botany Groundwater Project.

In this reporting period, sampling has been completed for the June / July 2009 monitoring event and the results will be reported by end September 2009 and summarised in the next Progress Report.

##### **4.2 Residential Monitoring**

In the first week of May 2009, Orica sampled 14 residential bores in the Groundwater Extraction Exclusion Area (GEEA) for volatile chlorinated hydrocarbons (vCHCs) associated with its past manufacturing operations. Results were provided to owners of the tested bores and to DECCW.

Results are compared to the National Health and Medical Research Council Australian Drinking Water Guidelines (2004) and the World Health Organisation Guidelines for Drinking Water Quality (2004 with rolling revisions). That is, a detection of vCHCs is described as being either below or above these guidelines. A reading above these guidelines means that a chemical is at a concentration that is unacceptable for drinking. A reading below these guidelines means a chemical is within the range that is acceptable in drinking water. Although it would not be common practice to drink the groundwater (and the use of bore water from domestic bores is prohibited in the GEEA), these guideline values are used as a reference to assess the results from the bore water sampling.

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Results for the May 2009 event are summarised in the following table.

	<b>May 2009</b>
Number of bores tested	14
Bores with no detection of vCHCs	3
Bores with detections of vCHCs below drinking water guideline values	4
Bores with detections of vCHCs above drinking water guideline values	7

Residents are provided with the results from their bore and a fact sheet with information on the testing process, risk assessments that have been conducted for Orica, contact details for relevant government agencies, and a non-Orica groundwater contamination source in Pagewood that is being investigated by DECCW. A report summarising the results is also provided to DECCW, the NSW Office of Water (previously Department of Water & Energy [DWE]) and NSW Health.

The next residential bore testing event is scheduled for the first week in November 2009.

#### **4.3 DNAPL Source Area Depletion Projects**

In accordance with Condition 7E of the NCUA, Orica is required to stay abreast of relevant DNAPL remedial technologies and apply them as practicable. Orica is required to submit an annual report pursuant to this condition at the end of February every year. The 2009 report was provided as an attachment in GCP Progress Report No. 21.

#### **4.4 Groundwater Injection and Recovery**

In January 2009, DECCW provided feedback on the proposed Groundwater Injection and Recovery (GIR) project. GIR proposes to reinject extracted groundwater into the aquifer upgradient of the containment lines on BIP if the GTP is unable to treat groundwater for an extended period of time.

Orica has received a variation to EPL2148 from DECCW, and a trial injection licence from DWE (now the NSW Office of Water).

At the time of writing works were well advanced. Several injection bores had been constructed and the civil and electrical engineering works for the trial were nearing completion. The trial injection of groundwater is planned for early September 2009.

#### **4.5 Springvale Drain Infilling**

Previous GTP reports have detailed the monitoring of chlorinated solvent vapours in air close to Springvale Drain caused by the influx on contaminated groundwater into the drain. Accordingly it was observed that reducing the groundwater level at Southlands (through pumping at the BIP and PCA containment lines) has decreased

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groundwater levels and hence decreased CHC concentrations in the surface water in Springvale Drain.

The monitoring also determined that the realignment channel located in Southlands contains concentrations of contaminants far greater than the main channel. Consequently, as a precautionary measure to protect against possible elevated concentrations of CHCs in air close to the realignment channel, it was determined to be prudent to infill this channel. The channel is not a natural feature, but was created by the sediment remediation works performed by Orica in the late 1990s.

Orica applied to the NSW Office of Water for a permit under Part 3 Chapter 3 of the *Water Management Act, 2000*. The NSW Office of Water has advised Orica that the works may proceed.

Environmental management plans have been prepared and a civil contractor will soon be engaged. It is expected that these works will be completed by the end of 2009.

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## 5 GROUNDWATER TREATMENT PLANT OPERATION

### 5.1 GTP Performance

A summary of the GTP operational performance for 1 April to 30 June 2009 is provided below:

Average volumetric rate of groundwater treated 1 April 2009 to 30 June 2009	4.66 ML/day
Total volume of groundwater treated since pump and treat activities commenced in 2005 (at 30 June 2009).	5 650 million litres
Total mass of CHCs destroyed in the thermal oxidiser (at 30 June 2009).	702 tonnes

### 5.2 Stripped Water Treatment Plant (SWTP)

Notable items in this reporting period include:

- Progress was made on the mechanical upgrades to the aeration sparger in the majority of Biological Aerated Filters (BAFs) that will result in greater run times and efficiency.
- The filter medium has been replaced with smaller grade zeolite in the majority of the BAFs. This will achieve higher Total Organic Carbon (TOC) removal in the treated water.
- Software modifications were made to Reverse Osmosis (RO) operating sequences to significantly reduce mechanical loads that adversely affect membrane performance.
- Replacement of filter media in the multimedia filters proved effective in removing short term flow restrictions, thus enabling higher groundwater treatment rates.

### 5.3 Thermal Oxidiser and Dioxin Air Emissions

All stack testing emission results were within licence limits.

### 5.4 Beneficial Reuse of Treated Water

Supply of treated water to Orica ChlorAlkali, Solvay and Qenos cooling towers has continued in this reporting period. Improvements to the Stripped Water Treatment Plant has increased the quality of the treated water and made the water more widely available for different end uses.

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### **5.5 Planned GTP Shutdown**

The annual shutdown of the GTP for repairs and preventative maintenance is scheduled for November 2009. A range of works are currently being planned, but the duration of this shutdown will be determined by the time taken to remove and replace the heat exchanger (which takes hot gas from the system and uses the heat produced from cooling that gas to heat the air feed to the thermal oxidiser - thus improving the efficiency of the heating process). Improvement works have been undertaken at the heat exchanger in previous years and a replacement is now required.

### **5.6 Containment Line Infrastructure**

Throughout the monitoring period it was observed that the performance of several pumps on Foreshore Road been in decline over time. As a result, in some areas, Orica was having difficulty pumping sufficient water to meet target levels required for containment.

Although there was no immediate risk to containment of the contaminant plumes, URS's hydrogeologists advised that the performance of these pumps would require rectification in the medium term.

Investigations revealed that pressure in the Foreshore Road pipeline had increased notably since the system was commissioned. The increase in pressure made it more difficult for the pumps to move water into the main header pipe, and was the most likely cause of the reduced pump performance. The smaller and less powerful sized pumps used in the shallow wells were most affected (i.e., the smaller pumps were least able to pump water into the main header against the back pressure in the pipeline).

The increased pressure was thought to be the result of a blockage somewhere in the pipeline between Foreshore Road and the GTP. Further investigations determined that the blockage was most likely occurring in the Southlands section of the pipeline.

In mid August 2009, the pipelines in Southlands were cleaned by forcing a plug through the pipelines with high pressure water. This plug is referred to as a "pig" and the process called "pigging".

Following the completion of the pigging process, the pressure in header decreased notably and the performance of the shallow pumps at Foreshore Road increased.

Plans are underway to "pig" the underbores (i.e., the underground pipelines) that a) run between Foreshore Road and Southlands and b) run under the railway corridor from Southlands to the BIP. These works will occur in early September.

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## 6 COMMUNITY CONSULTATION

This section provides a consolidated update in response to Condition 7K of the NCUA, which specifies how Orica must inform the community of developments in the remediation of groundwater, and provides information regarding the wider consultation activities that are undertaken by Orica to obtain community feedback regarding the BGC Project. Orica supports a two-way communication process with the local community and this section incorporates feedback received from the community during the reporting period.

### 6.1 Community Liaison Committee

The Community Liaison Committee (CLC) for the BGC Project was established in 1996 and meets the requirements for a community forum in accordance with Part A of Condition 7K of the NCUA. The CLC provides an opportunity for representatives of the local community to voice their concerns and questions, and provide feedback to Orica about the BGC Project.

#### **CLC Meetings**

A quarterly CLC meeting was held on 16 June 2009. Presentations were made by the DECCW and Orica on progress of the BGC Project, and by Karin Nilsson from Planager Pty Ltd on the results of the first hazard audit of the GTP. The following table summarises key matters raised by members of the CLC at the meeting, and actions taken or planned as a result (please note that this information has been summarised from draft minutes not yet endorsed by the CLC).

Matter Raised by CLC	Action Taken or Planned
Importance of informing and helping the wider community understand the scale and timeframe of the BGC Project.	Orica to include wording in future CLC newsletters, and other communication tools, such as 'cleanup will take a long time and Orica is in the early stages', 'cleanup of such scale has never been done before' and 'Orica will continue to look for ways to speed up the cleanup'.
Concerns with potential human health impacts from the destruction of DEAC waste at the GTP in November 2008 and the exceedance of the total solid particulate limit monitored at the GTP stack during the treatment	A new IMC task was issued to Prof Priestly (refer to next section).
Community members of the CLC wish to consider how it can pass on the committee's issues and goals to future generations independently from Orica	Further discussions to be held at the September CLC meeting
Concerns with how the community can be better engaged with Orica's multiple projects at Botany, members noted that it is difficult for the community to keep track of progress on all the projects and participate in consultation in a meaningful and efficient way.	Orica to prepare a table that summarises the status of all the Orica Botany Transformation Projects and relevant community consultative groups. Once a holistic plan is available, the CLC will discuss whether the current consultative framework is working and how it could be improved for the benefit of the community.

**CLC Newsletter**

Orica produces a quarterly CLC Newsletter distributed by letterbox drop to approximately 5,500 homes and businesses within the Botany, Banksmeadow, Hillsdale, Matraville and Pagewood areas. This distribution area encompasses the 1 km radius from the Orica premises at Botany as required under Part b of Condition 7K of the NCUA. Additional copies are also distributed to City of Botany Bay and Rockdale Councils, Botany and Rockdale Council Libraries and Bexley Community Centre.

CLC Newsletter No. 33 was distributed in June 2009 after being reviewed by the CLC. It included updates on groundwater treatment and containment, a summary of the March 2009 CLC meeting, and information on the Groundwater Remediation Strategy Review Community Workshop held in end of March 2009.

**6.2 Independent Monitoring Committee**

As detailed in previous reports, the IMC is a panel of experts, which has been established in consultation with the CLC to report to the CLC with appraisals of the operations of the GTP. As the IMC contracts with Orica will need to be renewed early next year, the CLC has agreed to review the IMC membership at the September CLC meeting. The table below lists recently completed and current IMC tasks.

Task #	IMC Task Description	Status
21	Orica to share the requirements of its Environment Protection Licence, Trade Waste Service Agreement and Ammonia Pollution Reduction Program for the GTP, along with recent results for each, with Dr John McCracken in order to better describe the inputs and outputs from the GTP treatment process. Dr John McCracken to provide feedback to the CLC following review of this information.	The CLC noted all works conducted for the task, including Orica's scan of semi-volatile organic compounds in groundwater feed and discharged groundwater, and agreed that no further action was required.
24	Prof Priestly to assess whether the treatment of diethyl aluminium chloride waste at the GTP in November 2008 is likely to have affected the health of the local community.	Prof Priestly will provide a response to the CLC before the upcoming September meeting.

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### 6.3 Communication Tools

#### **Community Workshops**

No community workshops on the BGC project were held during this reporting period. Orica plans to hold further community workshops on Water Recycling initiatives as those plans develop further over time.

#### **Newspaper Columns**

Three newspaper columns were published in the *Southern Courier* since the last quarterly Progress Report. A column was also published in the *St George and Sutherland Shire Leader* in June 2009. The columns incorporate information on a range of Orica projects. Reporting on the BGC Project was as follows:

- *Column 91: 30 June 2009:* Update on the review of the regulatory framework for the BGC project by the DECCW.
- *Column 92: 28 July 2009:* Update on CLC.
- *Column 93: 25 August 2009: Community Participation and Review Committee update* (no BGC Project matters mentioned).

#### **Website**

The website is an important tool which provides immediate access to information about the BGC Project and supports Orica's commitment to open and transparent communication. Maintenance of the website is now a requirement under Part c of Condition 7K.

The following material has been posted on the website during the reporting period:

- Groundwater Cleanup Plan Progress Report No.22;
- Recent newspaper columns;
- The June 2009 CLC newsletter;
- The Briefing Paper, and all presentations from the CLC June 2009 meeting; and
- Follow-up documents by DECCW and Orica related to Dr McCracken's feedback on IMC Task 21.

There were 2,200 visits to the Botany Transformation Projects website from 20 May to 20 August 2009, of which 1,029 visits were to BGC Project pages and 125 visits to Treated Water Recycling Program pages.

#### **1800 Number**

Orica continues to operate the free-call number – 1800 025 138. Calls during this reporting period, related to the BGC Project, included a query related to the use of bore water for gardening purposes within the GEEA. Enquiries placed through the 1800 line are generally responded to within 24 hours.

#### **e-mail Feedback**

Several e-mails were received in this reporting period from browsers of the Botany Transformation Projects website. Feedback related to the BGC Project included a request for the report from the Groundwater Remediation Strategy Review

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Community Workshop in March 2009 and the presentation made at that workshop by Prof Bernie Kueper. These documents are being prepared and will be uploaded as soon as they are available.

There were no emails received via the CLC feedback facility in this reporting period.

**Provision of Reports (Part d of Condition 7K)**

Part d of Condition 7K requires Orica to provide the community forum (i.e., the CLC) and the local libraries in the local government areas of Botany Bay and Randwick with copies of reports provided to DECCW under the NCUA. Quarterly reports are regularly provided to the CLC and these libraries.

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## 7 REFERENCES

ANZECC/ARMCANZ (2000). *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand.

Orica Australia Pty Ltd (Orica, 2003). *Groundwater Cleanup Plan*. EN1591-00-10-001, Rev 0. October 2003.

URS (2005a) Orica Botany Environmental Survey, Stage 4 – Remediation. *Groundwater Cleanup Plan (GCP) Quarterly Groundwater and Surface Water Monitoring Report - December 2004*. Doc. No. R021\_A, 15 February 2005.

URS (2005b) Orica Botany Environmental Survey, Stage 4 – Remediation. *Groundwater Treatment Plant – Groundwater and Surface Water Monitoring Plan*. Document Number R013\_A. 17 May 2005.

URS (2005c) Orica Botany Environmental Projects. *Consolidated Human Health Risk Assessment 2005*. Document Number R022\_D. August 2005.

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**ATTACHMENT A – QUARTERLY MONITORING REPORT – JUNE 2009.**

Groundwater Treatment Plant (GTP) Quarterly Groundwater and Surface Water Monitoring Report, June 2009, URS Australia Pty Ltd. *Separately bound report.*