

	REPORT No: EN.1591.61.PR036	Rev: 0
GROUNDWATER CLEANUP PLAN PROGRESS REPORT NO. 25		

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REVISION 0

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LIST OF ACRONYMS

ACRONYM	DEFINITION
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
DEC	Department of Environment and Conservation, incorporates the EPA and is now DECCW
DECC	Department of Environment and Climate Change, formerly DEC, incorporates the EPA and is now DECCW
DECCW	Department of Environment, Climate Change and Water, formerly DECC, incorporates the EPA and NSW Office of Water (whose function was formerly part of DNR)
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 and DWE, now the relevant section is incorporated in the NSW Office of Water, which is part of DECCW)
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

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ACRONYM	DEFINITION
GEEA	Groundwater Extraction Exclusion Area
GIR	Groundwater Injection and Recovery
GTA	General Terms of Approval
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 Proposal

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ACRONYM	DEFINITION
VOC	Volatile organic compound
VSD	Variable speed drive

EXECUTIVE SUMMARY

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. This document is the twenty fifth report submitted in accordance with NCUA Condition 4G. The following is a summary of activities in the period 1 October 2009 to 31 December 2010.

NCUA Condition 3B(e) requires Orica to implement a comprehensive monitoring program. Results in this quarter indicated the following:

- The inferred contours and patterns of shallow and deep groundwater flow infer that hydraulic containment was achieved at Secondary Containment Area (SCA and primary containment area (PCA) during the monitoring period;
- Hydraulic containment was achieved at the northern, central and southern portions of the Botany Industrial Park (BIP) containment line in the shallow and deep aquifers. The focus on containment at BIP remains at sections of the line where contaminant concentrations are highest;
- Concentrations of chlorinated solvents reported for offsite monitoring wells were generally similar to those previously reported;
- In general, volatile chlorinated hydrocarbons (CHC) concentrations in pore water within Penrhyn Estuary were similar to or lower than historical concentrations.
- The concentrations of volatile CHCs in surface water sampling locations were generally less than the respective ANZECC (2000) Trigger Values; and
- The conclusions presented within the Consolidated Human Health Risk Assessment (CHHRA) remain unchanged.

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 conditions of the NCUA are detailed below:

- The 15-monthly air emission report was finalised and forwarded to DECCW for review.
- A time weighted exposure assessment requested by DECCW for Springvale Drain air emissions was completed. The additional work (requested by DECCW) showed that the exposure scenarios were consistent with those presented previously.
- Monitoring of requested eligible residential bores in the Groundwater Extraction Exclusion Area (GEEA) for volatile chlorinated hydrocarbons (vCHCs) occurred again in early November 2009.
 - Volatile CHCs were detected in groundwater collected from 10 of the 13 residential bores sampled;

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- Of the 10 detections, 7 were located in either Collins or Spring Street, Pagewood. The source of contamination under the Collins and Spring Streets area is considered to be unrelated to historic activities conducted by Orica at BIP.
- In accordance with Condition 7E of the NCUA, Orica is required to stay abreast of relevant DNAPL remedial technologies and apply them as practicable. The 2009 annual report is provided as an attachment in GCP Progress Report No. 21.
- The Groundwater Injection and Recovery (GIR) System is designed 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 submitted a Stage 2 trial plan to DECCW in November 2009 for discussion.
- The annual GTP shutdown for preventative maintenance works and repairs commenced on 6 November 2009 and was completed in the first week of December. All works were completed successfully and without any environmental or safety incidents.

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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 fifth report submitted in accordance with NCUA Condition 4G. The reporting interval for this report is 1 October to 31 December 2009, however if more recent and relevant information is available it is also included.

Previous reports are available at the relevant section of the website www.oricabotanytransformation.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. As noted in the last report, the regulation of the Botany Groundwater Cleanup (BGC) has been reviewed to take into account cleanup progress and recent developments and the NCUA is to be replaced with a Voluntary Management Plan (VMP). Orica has prepared 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	Achieved	Commenced on 26/09/2003
3B	Prepare and submit GCP by 31/10/2003 covering matters listed	Achieved	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	Achieved	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.	Achieved	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.	Ongoing compliance	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.	Ongoing compliance	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.	Achieved	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.	Achieved	Progress included in Section 4.3 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.	Achieved	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.	Achieved	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 report at the end of February, May, August and November of each year.	Ongoing compliance	Summary of monitoring program results for this reporting period provided in Section 3 of this report.

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Cond.	Summary of Requirement	Status	Reference Documents / Comments
			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 5.2 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.	Ongoing compliance	Access to third party premises sought as required.
7A	Updating of GCP to take account of developments.	Ongoing compliance	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. A revised Groundwater Remediation and Management Plan (GRAMP) has been submitted for review by DECCW as part of the draft VMP (see Section 2.4). When finalised, the GRAMP will replace the current GCP.
7B	Orica to monitor groundwater in any other area likely to have been, or to be, impacted by the contaminants.	Ongoing compliance	The most recent residential bore monitoring round took place in early November 2009, a summary is provided 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.	Ongoing compliance	Refer to comments on 7B.
7D	Monitoring results to be provided to the EPA as soon as possible after results become available to Orica.	Ongoing compliance	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	Ongoing	DNAPL overseas mission completed in

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Cond.	Summary of Requirement	Status	Reference Documents / Comments
	technology in the remediation of DNAPL and groundwater containing dissolved phase contamination.	compliance	April 2005. Orica representatives attended the Battelle conference on "Remediation of Chlorinated and Recalcitrant 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. The revised remediation strategy has been included in the draft VMP and supporting documents.
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.	Ongoing compliance	Annual Report provided in Appendix B of this document.
7G	Orica must review the need to revise the HHRA in light of relevant monitoring data.	Ongoing compliance	See 7H
7H	All reports submitted to DECCW must include an assessment of the potential risk to human health.	Ongoing compliance	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.	Achieved	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.	Ongoing compliance	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.	Ongoing compliance	a) The CLC meets quarterly b) See Section 6.1. c) www.oricabotanytransformation.com
8	Works and measures under voluntary agreement must not compromise the efficacy of measures under the notice.	Ongoing compliance	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.

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Cond.	Summary of Requirement	Status	Reference Documents / Comments
			Orica proposed and DECCW agreed to defer installation of a zero valent iron permeable reactive barrier wall.
8A	Provide additional information as detailed to DEC by 16/03/2004.	Achieved	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 for the GTP for the reporting period:

- Orica advised DECCW that the pipe shroud for Condition U3, the treated water discharge temperature reduction strategy, was installed in November 2009.
- A progress report for the ammonia pollution reduction program (Condition U2.2) was submitted on 9 December 2009.
- Orica provided the following documents, as a follow up to last year's Annual Return for EPL2148, to demonstrate compliance with Condition E5.1:
 - Dioxin Minimisation Program and attachments (E5.1.1)
 - GTP Water Reuse Strategy (E5.1.2)
 - Demonstration of compliance with the Groundwater Monitoring Program (E5.1.3).
- Orica provided further information in relation to the Deed of Cross Guarantee, as required by Condition E7.7.1. This advice confirmed that there had been no change to the financial capacity of Orica to fulfil its obligations under the Licence.
- Orica provided a review of outstanding capital and operating costs for the GTP as required by Condition E7.6.1.
- In January 2010 a licence variation was processed to:
 - reduce the monitoring frequencies for some parameters at Point 9 (discharge to air from the GTP stack) and Point 11/14 (excess treated water discharge to waters) in light of consistently demonstrable compliance;
 - permit bioaugmentation trials at Southlands; and
 - confirm that no independent validation audit is required in 2010.
- In January 2010, Orica wrote to advise DECCW of plans to conduct a trial of membrane bio-reactor (MBR) technology at the GTP, with the aim of reducing maintenance requirements. Orica has noted that if MBR technology is found to be beneficial, and full-scale implementation is pursued, the licensed nitrate concentration of treated water will need to be reviewed.

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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"> 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. Orica submitted production bore applications to DWE (now the NSW Office of Water, part of DECCW) in mid 2008 and awaits a response.
Conditions from Department of Planning	<ul style="list-style-type: none"> 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.
Network Operator and Retail Supplier licence under the Water Industry Competition Act, 2006.	<ul style="list-style-type: none"> An application for a combined Network Operator and Retail Supplier licence under the Water Industry Competition Act, 2006 is to be submitted to the Independent Pricing and Regulatory Tribunal of NSW by 8 August 2010.

Other matters of note in the reporting period include:

- 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 Department of Planning (DoP) and DECCW to discuss the possible means for seeking approval for this proposal on 4 May 2009. Orica has since discussed the possible approvals and assessment approach with DoP (which has also consulted with DECCW) and is waiting for written advice from DoP regarding the way forward.

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 by a Voluntary Management Proposal under the Contaminated Land Management Act 1997.

Orica submitted a draft VMP to DECCW in late October 2009. The purpose of the VMP is to establish a clear set of undertakings relating to each part of the project including:

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- Maintenance and optimisation of hydraulic containment;
- Chemical and hydraulic monitoring programs for groundwater, surface water, air and other relevant environmental media;
- Assessment of risk to human health and the environment;
- Source area management;
- Contingencies for the GTP; and
- Community consultation.

At the time of writing, Orica was in the process of finalising these documents for execution.

Orica notes that the existing NCUA is referenced in Schedule 1 to State Environmental Planning Policy (SEPP) 55 – Remediation of Land, and that DoP and DECCW have discussed the need for an amendment to this SEPP following implementation of the approved VMP to provide the ongoing statutory approvals framework under SEPP55 for work conducted in accordance with the approved VMP.

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 (now the NSW Office of Water), 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 December 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, December 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 infer 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. A program of maintenance of SCA extraction wells is underway.
- Hydraulic containment was achieved at the central and southern portions of the Botany Industrial Park (BIP) containment line in the shallow and deep aquifers. The focus on containment at BIP remains at these sections of the line where contaminant concentrations are highest;
- Containment was also regularly achieved at the northern portion of the BIP containment line during the monitoring period;

- 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.

3.2 Chemical Monitoring

General

- Concentrations of volatile chlorinated hydrocarbons (CHC) reported for offsite monitoring wells were generally similar to those previously reported;
- Increases in contaminant concentrations greater than 1.0 mg/L and historical maximum concentrations were observed in the Northern Plumes offsite area at BP41. It is considered very unlikely that the changes in contaminant concentrations at this location are a result of horizontal plume migration. It is more likely that vertical hydraulic gradients generated due to hydraulic containment are resulting in vertical mixing in the borehole annulus;
- Increases in contaminant concentrations greater than 1.0 mg/L and historical maximum concentrations were observed in the Central Plume offsite area at WG154. The increase at this location is likely to be a function of hydraulic containment and associated changes to the distribution of the Central Plume. Importantly, WG154 is located upgradient of the SCA and groundwater from this location will be contained.

Penrhyn Estuary

- In general, volatile CHC concentrations in pore water within Penrhyn Estuary were similar to or lower than historical concentrations.
- 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 June 2009 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 and indicate that remediation has significantly improved surface water quality in the estuary; and
- The VC concentration at SW062 (mid way along the Realignment Channel within Southlands) exceeded the ANZECC (2000) Trigger Value for VC (0.1 mg/L). It is not considered to be significant since it is not connected to the main channel, and there are currently no long-term workers on Southlands and the maximum

concentrations reported down-stream where long-term workers are present were below the adopted risk based criteria.

Implications for Human Health Risk Assessment

- 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;
- 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 is effectively eliminated by access restrictions.

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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.

In this reporting period the following has occurred:

- The 15-monthly air emission report was finalised and forwarded to DECCW for review. A copy will be placed on oricabotanytransformation.com shortly. The results were discussed in Progress Report No. 24.
- A time weighted exposure assessment requested by DECCW for Springvale Drain air emissions was completed. The assessment used long term recorded water levels and previous air emission results to model actual potential exposure resulting from groundwater entering the Springvale Drain. The additional work (requested by DECCW) showed that the exposure scenarios were consistent with those presented previously.

4.2 Residential Monitoring

Monitoring of requested eligible residential bores in the Groundwater Extraction Exclusion Area (GEEA) for volatile chlorinated hydrocarbons (vCHCs) occurred again in early November 2009. On the basis of the results from the November 2009 bore sampling program, the following was observed:

- Volatile CHCs were detected in groundwater collected from 10 of the 13 residential bores sampled;
- Of the 10 detections, 7 were located in either Collins or Spring Street, Pagewood;
- Trends in concentrations of TCE and PCE in bores sampled along Collins and Spring Streets, Pagewood indicate that the contaminants appear to be migrating to the south (following the general groundwater flow direction) based on the generally decreasing concentrations measured in bores in the properties on these streets and the detection of TCE and PCE in 2009 at Swinbourne Street located south of Collins and Spring Streets;

- The source of contamination under the Collins and Spring Streets area is considered to be unrelated to historic activities conducted by Orica at BIP, based on:
 - The location of Collins, Queen, Swinbourne and Spring Streets relative to BIP and the known groundwater flow direction;
 - Differences in the contaminant characteristics.
- The potential long term health risks presented by the presence of these compounds have not been quantified. It is the role of the responsible polluter to perform this work.

It is Orica's opinion that other responsible polluters should contribute to the residential bore monitoring program. This will be the subject of discussion with DECCW and DWE in early 2010.

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. Report No. 4, due at the end of February 2010, is attached to this report as Attachment B.

4.4 Groundwater Injection and Recovery

The Groundwater Injection and Recovery (GIR) System is designed 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.

As reported in Progress Report No. 24, in order to maximise effectiveness Orica will need to minimise clogging in the injection wells (which has been observed during the injection field trials conducted in November 2009) so as to extend the rates and duration of the injection. Orica has proposed an extension of the trial prior to the implementation of the full-scale system. The trial will focus on the use of anti-fouling agents and injection well maintenance techniques.

Orica submitted a Stage 2 trial plan to DECCW in November 2009 for discussion. At the time of writing, DECCW had requested some clarifications which Orica was in the process of responding to.

4.5 Springvale Drain Infilling

Monitoring has shown that, generally, the realignment channel located in Southlands contains concentrations of contaminants 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 considered

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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.

Following submission of the Environmental Assessment for the Southlands Remediation development proposal, the Department of Planning has required Orica to revise the flood modelling (Connell Wagner, 2008) to ensure it is performed to the latest standards. This work commenced in February 2010 and will be completed by April 2010.

The final configuration of Springvale Drain cannot be finalised until this work is completed. As a result, the proposed infilling of the realignment channel has been deferred pending completion of these works.

5 GROUNDWATER TREATMENT PLANT OPERATION

5.1 GTP Performance

A summary of indicative GTP operational performance figures for 1 October to 31 December 2009 is provided below:

Average volumetric rate of groundwater treated 1 October 2009 to 31 December 2009	4.24 ML/d
Total volume of groundwater treated since pump and treat activities commenced in 2005 (at 31 December 2009).	6,400 ML
Total mass of CHCs destroyed in the thermal oxidiser (at 31 December 2009).	750 tonnes

Since commencement of operations in 2006, there have been significant improvements to the treatment process resulting in gradual increases in the daily treatment volumes. In this reporting period, the average daily treated volume is lower than previous quarters due to the annual shutdown in November 2009.

5.2 Thermal Oxidiser and Dioxin Air Emissions

All stack testing emission results were within licence limits.

5.3 Beneficial Reuse of Treated Water

Orica continues to provide treated water from the GTP for industrial reuse at the BIP and adjacent industry.

5.4 Annual GTP Shutdown

The annual GTP shutdown for preventative maintenance works and repairs commenced on 6 November 2009 and was completed in the first week of December. The shutdown included the replacement of some major components including the heat exchanger. All works were completed successfully and without any environmental or safety incidents.

5.5 Containment Line Infrastructure

Ongoing maintenance works are occurring on the SCA, PCA and BIP containment lines. The works consist primarily of cleaning and minor inspection and repair works. In the short term this will require the barricades on Foreshore Road to remain in place. In early 2010, the barricades were moved to the western end of the line to facilitate the regular cleaning and maintenance associated with a pump and treat

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system. These works will continue until approximately April 2010. Orica is reviewing long term options for the barriers at the SCA.

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. It provides information regarding the consultation activities undertaken by Orica to obtain community feedback regarding the BGC Project.

6.1 Community Liaison Committee

A quarterly Community Liaison Committee (CLC) meeting was held on 15 December 2009. The following table summarises key matters raised at the meeting, and actions taken or planned as a result (N.B. this information has been summarised from draft minutes not yet endorsed by the CLC).

Matter Raised by CLC	Action Taken or Planned
SCA temporary barrier management, including options to improve visual impact and signage.	Orica is reviewing long-term options for improving access to the SCA for the safety and protection of Orica's workers, contractors, and road users. Aesthetics will be considered.
Potential to review the current communication approach and identify ways that the CLC can generate interest in the project in the wider community, especially among younger generations.	Further discussions to be held at the next CLC meeting (likely March 2010), following presentation from Jason Prior (Institute of Sustainable Futures, UTS) on the outcomes of research into community perceptions of the BGC Project.
Potential for residential concern that Orica's groundwater extraction may present a subsidence risk.	Next CLC newsletter to include information confirming that Orica's hydraulic containment has not caused subsidence.

CLC Newsletter

CLC Newsletter No. 35 was distributed to approximately 5,500 homes and businesses within the Botany, Banksmeadow, Hillsdale, Matrville and Pagewood areas in December 2009, after being reviewed by the CLC. Additional copies are distributed to City of Botany Bay and Rockdale Councils, Botany and Rockdale Council Libraries and Bexley Community Centre.

CLC Newsletter No. 35 included updates on groundwater containment and treatment, and progress of the GIR trial.

6.2 Communication Tools

Website

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

- Groundwater Cleanup Plan Progress Report No. 24;
- CLC newsletter No. 35;
- The Briefing Paper and presentations from the December 2009 CLC meeting; and,
- Recent newspaper columns.

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Of the 2,237 visits to the Botany Transformation Projects website from 13 November 2009 to 18 February 2010, 964 visits were to BGC Project pages.

E-mail Enquiry

There was one website email enquiry related to the BGC Project in this reporting period concerning the now complete Rainwater Tank Rebate Program. No emails were received via the CLC feedback facility.

Newspaper Columns

Three newspaper columns have been 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 December 2009.

1800 Number

The Botany Industrial Park operates a free-call number – 1800 025 138. Calls relating to Orica’s remediation projects are directed to the Community Relations Team. Of the calls received during this reporting period, two related to the BGC Project and these were from new residents to the area seeking information about the groundwater contamination.

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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.

Connell Wagner (2008) *Hydrological Flood Study, Southlands*

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.

URS (2006) Orica Botany Environmental Projects. *Addendum to Consolidated Human Health Risk*. Doc. No. R022_D, August 2005.

URS (2008) *Proposed Amendment to the GTP Groundwater and Surface Water Monitoring Program, 2008-2010*. WCIE 4396. 6 June 2008.

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ATTACHMENT A – QUARTERLY MONITORING REPORT – DECEMBER 2009.

Groundwater Treatment Plant (GTP) Quarterly Groundwater and Surface Water Monitoring Report, December 2009. URS Australia Pty Ltd. February 2010.
Separately bound report.

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ATTACHMENT B – ANNUAL TECHNOLOGY REVIEW

DNAPL and Groundwater Remediation Technology
Annual Review No. 4, Orica Australia Pty Ltd, February 2010.