

SUJELI PTY LTD trading as:

ACN 002 901 368
ABN 48 002 901 368

**ENVIRONMENT
SAFETY & RISK
CONSULTANTS**

McCRACKEN CONSULTING SERVICES

20 Christina Place KAREELA NSW 2232 AUSTRALIA

Telephone/Facsimile: (61-2) 9528-2870

Mobile: +61-418-442-340

E-mail: johnmccracken@optusnet.com.au

20 April 2007

Orica Australia Pty Ltd
16-20 Beauchamp Road
MATRAVILLE NSW 2036

Attention: Ms Lucy Archer, Communication Manager - Botany Transformation Projects

Dear Lucy,

**Re: BOTANY GROUNDWATER CLEAN-UP PROJECT
INDEPENDENT MONITORING COMMITTEE
TASKS 12 & 13 FOR MEETING WITH CLC ON 2 MAY 2007**

Further to your e-mail of 29 March 2007 and Paul Shepherd's subsequent formal request in his letter of 10 April 2007, I herewith provide my responses to the two tasks requested to be completed by IMC members as identified by the Community Liaison Committee at its meeting held on 20 March 2007. I understand the committee requested written responses be made for consideration at the next meeting to be held on 2nd May 2007. Unfortunately, as advised, I will be overseas and so not able to attend that meeting.

The two tasks were defined as follows:

- Task 12: Provide comment on the progress of the Botany Clean-Up Project to date;
- Task 13 Advise of specific questions that IMC member's think the CLC should be asking about the project.

As the nominated core member *Process Engineering Expert* of the IMC, my focus in responding to these tasks has been to consider only those issues relevant to the performance and other outcomes relating to the facilities provided by Orica for the collection and treatment of the ground water, and for disposal of the treated water and waste streams. As for progress and other relevant issues relating to the containment and cleanup of the contamination from the affected ground and surface waters, I leave for the other appropriately qualified IMC members to provide comment. This should avoid some unnecessary replication in responses.

My responses rely entirely on information that has been made available on Orica's website www.oricabotanygroundwater.com . I have drawn principally on information provided in the *Groundwater Cleanup Plan Progress Report No. 13* dated 28 February 2007 issued by Orica. I also refer to some comments made in Orica's *Community Newsletter* Issue 24, March 2007.

Task 12 - Progress of the Botany Clean-Up Project to date

Groundwater Treatment Plant (GTP) treatment rates. The increasing volume of groundwater being treated in the GTP undeniably supports the contention that progress is being made. In its March 2007 Community Newsletter, Orica claimed the GTP was then operating well. The average volume of groundwater treated daily is reported to have increased from about 1.6 megalitres in February 2006 to about 3.6 megalitres in February 2007, peaking at 4.1 megalitres in January 2007. Orica expects between 6 to 7 megalitres per day will be treated when all three groundwater containment lines are fully commissioned. Therefore, at least one half of the anticipated capacity requirement of the GTP has been achieved.

Ratcheting up of the treatment rate is normally required during the commissioning of any such complex facility to bring the various process units into successful operation and to resolve any problems that may be encountered. It is not unexpected that operational challenges should have presented and to have somewhat slowed progress of the commissioning of both the treatment plant and the facilities provided for the extraction of the ground water. It is however anticipated that resolutions will be found to each of the challenges presented with the foreseeable prospect that the treatment rate will continue to increase to the required capacity.

As the capacity of the GTP is gradually increased, the largest increase in the volume of groundwater presented for treatment is expected to come from the increased commissioning of extraction wells along the western boundary of the Botany Industrial Park (BIP) where extraction operations commenced during October 2006. All commissioning works associated with the extraction wells and pipelines at the Primary Containment Area (PCA) are said to be complete. Several commissioning problems have occurred with the extraction wells and pipelines at the Secondary Containment Area (SCA) and are receiving considerable attention. All three containment lines were expected to be fully operational by March 2007 with steady state level set points established over the following six months, i.e. by August 2007.

Plant shutdowns. Only two plant shutdowns were reported during the three months period December 2006 to February 2007. One involved a scheduled two-week shutdown in mid November for routine maintenance and improvement works, and the other was a temporary shutdown in late January when a steam leak occurred. Two sight glasses on the exterior of a steam drum failed and had to be replaced. An investigation showed slow chemical etching of the glass by the boiler chemicals. The standard boiler glass is to be replaced with mica glass.

Operating data summary. Aggregate data from the Stream Stripping Unit (SSU) and GTP for the period up until the end of February 2007, as provided on page 40 of the GCP Progress Report No. 13, can be summarised as follows:

Plant	Commencement date	Megalitres of ground water treated	Tonnes of CHCs* "recovered and/or destroyed"
SSU	28 October 2004	44	116
GTP	late January 2006	1,153	176
Totals	28 months	1,197	292

* CHCs = Chlorinated Hydrocarbons

Groundwater extraction commissioning. Good progress appears to have been made with resolving the problems of pumps failing and filters blocking, and in reducing the level of maintenance required on these facilities.

The problem of electrical cabling to pump motors failing as a result of leaking cable glands appears to have been resolved by replacement and those affected pumps along the SCA containment line on Foreshore Road have been put back into operation.

Many of the shallow wells along the SCA containment line went off-line because they required cleaning of a thick fungal sludge that developed within the sumps resulting in reduced performance or overheating of the motors rendering them inoperable. Orica has been trialling means to minimise the frequency of the cleaning of these pumps.

Filters installed between extraction pumps and header pipelines have also been fouling quickly. Orica has proposed to install a readily accessible common in-line filter to overcome this problem.

GTP commissioning. The GTP has been operating in the commissioning phase since January 2006, i.e. about 15 months to date. Challenges presented have included biofouling in the air strippers, reverse osmosis (RO) units and sand filters, and non-complying levels of dioxins in the stack gas emissions. Good progress appears to have been made in developing effective solutions to these problems although other problems requiring further resolution have arisen in some cases.

Biofouling in the air strippers was found to be due to the growth of filamentous fungi. This problem appears to have been resolved by operation without acidification of the contaminated groundwater. However, as was expected without acidification, slow inorganic fouling due to aluminium and iron deposition and some biofouling continues to occur requiring laborious maintenance of the air strippers. Methods to prevent this fouling are continuing to be explored to minimise the laborious maintenance program in the future.

Biofouling has also occurred in the RO units and particularly on the prefilter. The dosing of chloramine has proved to be an effective remedy in reducing this biofouling. As at the end of February 2007, further trials needed to be undertaken to optimise the operating parameters including pH adjustments of both feed and permeate.

The chloramine dosing compound has unexpectedly been found to pass through the RO units and present in the excess treated water which is currently being discharged to Botany Bay via a pipeline to Long Dam and to the stormwater canal at Perry Street which then flows into Bunnerong Canal and then into Brotherson Dock. Analysis of samples of the treated water taken along the whole of the discharge route on 12 January and 14 February 2007 indicated that the total residual chlorine levels (which includes for chloramines) substantially exceeded the ANZECC/ARMCANZ (2000) Indicative Interim Working Level (0.003 mg/L Cl). Nevertheless, the 0.09 mg/l Cl and 0.16 mg/L Cl concentrations measured in Bunnerong Canal (which is tidally influenced) at the point of discharge to the receiving system, Brotherson Dock, apparently lie within the background concentration range measured in the stormwater canal prior to the discharge from the GTP. As at the end of February 2007, Orica was continuing to seek technical solutions for removing the chloramine prior to discharge. It must be noted here, that in the longer term, any such chloramine discharge in treated water to the environment will effectively expire since the ultimate aim is to recycle all treated water.

Recycling of treated water. This has commenced only recently but progress in promoting this initiative seems to be satisfactory.

Orica's ChlorAlkali plant commenced using treated water from the GTP in December 2006 at a rate of 0.3 megalitres per day. Qenos, which also operates at BIP, has commenced trials using treated water from the GTP with the expectation that it could eventually use up to 5 megalitres per day. Solvay Interlox is also expected to begin taking this water at up to 0.5 megalitres per day in April 2007. Since a preliminary analysis undertaken by Orica indicated that 15 to 20 megalitres per day of treated water could be used in the Botany area, there should be no difficulty in disposing all of the anticipated 6 to 7 megalitres per day of treated water.

It is understood Orica intends to assist more than a dozen interested businesses in the preparation of a grant application to Department of Energy, Utilities and Sustainability (DEUS) for grants under their water recycling program.

Discharge of excess treated water. Since 9 October 2006 discharges averaging 2 megalitres per day to the Perry Street canal have occurred. This easily complies with the Environment Protection Licence Condition L4 which limits this discharge to 13.5 megalitres per day. An inspection of the Bunnerong Stormwater Channel up to December 2006 indicates no scouring of the channel – a brief report on such inspections/outcomes was to be provided to Sydney Ports.

Dioxins in GTP stack emissions. Significant progress has clearly been made in reducing dioxin levels with stack emissions now appearing to regularly comply with the strict licence limit.

In an attempt to determine optimum operating temperatures for dioxin control, trials were conducted during December 2006 and in January and February 2007 to determine if dioxin levels in the GTP stack emissions could be further reduced by lowering operating temperature (and gas throughput) of the thermal oxidiser. Six of the seven results from monitoring dioxins in the stack emissions during the trial period came in at less than the very strict licence limit of 0.1 ng/m³. Only one result just breached this licence limit at 0.115 ng/m³ but it has to be emphasised that this result occurred under trial conditions. Orica is continuing to explore the reasons for (i) consistently significant discrepancies between the lower results for the quencher outlet and the higher stack values, and (ii) apparent differences in results between testing laboratories.

Quarterly monitoring reports. All 13 of the required quarterly monitoring reports have been submitted by the schedule dates in accordance with the Notice of Clean Up Action (NCUA) issued to Orica by the EPA on 26 September 2003.

Regulatory compliance. Orica's obligations to comply with the requirements of the NCUA as far as is practicable has been achieved or is ongoing, according to relevant information provided in the GCP Progress Report No. 13.

Conclusion. Progress relating to the facilities provided by Orica for the collection and treatment of the ground water, and for disposal of the treated water and waste streams, appears to be at a satisfactory level. Installation of all required facilities is nearing completion and many of the commissioning challenges have been or are being successfully addressed. Orica has clearly demonstrated a commendable commitment both to get the GTP operating in the shortest time possible and to achieve acceptable treatment outcomes.

Task 13 – Some specific questions CLC should be asking about the project

- 1. Is the program still on schedule to have all three containment lines fully operational at their steady state level set points by August 2007?**
- 2.(a) Has the standard boiler glass used for the sight glasses at the boiler plant now been replaced with mica glass as a preventive measure against nuisance shutdown?**
- 2.(b) Why are the boiler chemicals used so aggressive and is it likely that other components of that plant might be similarly affected causing nuisance shutdowns or otherwise prejudicing operability of the GTP?**
- 3. What is the fate of all of the CHCs extracted with the groundwater?**

Although the quantities revealed in the summary of operating data for the SSU and GTP for the period up until the end of February 2007 (refer to the above tabulation of data provided on page 40 of the GCP Progress Report No. 13) may at first sight appear to be impressive, it is not clear from this information whether the quantities of CHCs referred to were actually “recovered and/or destroyed” or were simply the quantities extracted with the groundwater delivered to these plants. For example, if a total of 292 tonnes of CHCs was actually recovered and/or destroyed, what further quantity was lost to the various discharge streams from the plants? Alternatively, if a total of 292 tonnes of CHCs defines the quantity of these contaminants extracted with the groundwater delivered to the treatment plants, then what proportion was lost in the various discharge streams from the plants? This difficulty in interpretation arises because data does not appear to have been made available which provides efficiencies of treatment. The provision of a material balance for all inputs and outputs of CHCs would greatly assist in this regard as well as making the considerations given to the outcomes of the development more fully accountable.

A summary table of a material balance (and not just of those volatile CHC compounds that are stripped off to the TOU) is needed in order to readily comprehend the fate of all of the CHCs such that sensible questions can be put relating to potential impacts to the receiving biophysical environments where significant discharges of these compounds may be occurring. The following table provides a starting point for the presentation of such data. If there are other significant discharge points than those shown in this table, then these should also be included. Of course, the ability to carry out a material balance presumes sufficient analysis has been carried out and reported (as it should have been) on each of the discharge streams that provides the relevant combinations of concentration and flow rate data.

If the CLC considers that such a table produced in the form suggested, or as suitably modified, could provide both worthwhile insight to the effectiveness of the treatment process and a better comprehension of the outcomes of the project, then it should also consider requesting its inclusion in each quarterly progress report and with data in all relevant cells appropriately updated.

	Unit	SSU	GTP	Totals
Period of operation	months	?	11	28
Ground water treated	megalitres	44	1,153	1,197
Treated water recycled	megalitres			
CHCs extracted in groundwater	tonnes	116	176	292
Fate of CHCs				
Held in storage	tonnes		NA ¹	
Destroyed in TOU ^{2,3}	tonnes			
Discharged to atmosphere	tonnes			
Discharged to sewer	tonnes			
Discharged to Springvale Drain ⁴	tonnes		NA ¹	
Discharged to Perry Street Drain	tonnes			
Discharged in recycled water	tonnes	NA ¹		
Discharged in solid wastes	tonnes			
Totals	tonnes	116	176	292
Held in storage	%		NA ¹	
Destroyed in TOU ^{2,3}	%			
Discharged to atmosphere	%			
Discharged to sewer	%			
Discharged to Springvale drain ⁴	%		NA ¹	
Discharged to Perry Street drain	%			
Discharged in recycled water	%	NA ¹		
Discharged in solid wastes	%			
Totals	%	39.7	60.3	100.0

- Notes:
1. NA = not applicable to the specified treatment plant.
 2. TOU = Thermal Oxidation Unit in the GTP.
 3. It is understood Orica plans to progressively destroy the CHCs recovered with the SSU in the TOU, when feasible.
 4. According to information on page 28 of the GCP Progress Report No. 13, SSU permeate was only discharged to Springvale Drain for approximately one week in early December 2005.

4. **What impacts is the discharge of unacceptably high levels of chloramine in the excess treated water likely to be having on the affected biophysical environment?**
- 5.(a) **What progress has been achieved since February 2007 in increasing the quantity of recycled treated water from 0.3 megalitres per day?**
- 5.(b) **What is the proposed schedule for disposing all of the anticipated 6 to 7 megalitres per day of treated water by recycling?**
6. **What progress has been made to date in recycling/destroying the stored CHCs previously extracted with the SSU?**

- 7.(a) Are dioxins being regularly monitored in any of the discharges to sewer, on the waste filter carbon, and in the treated water?**
- 7.(b) Has consideration been given to the fate and environmental consequences of dioxins potentially discharged in the waste streams to sewer, on the spent filter carbon, and as solute in the treated water? If so, what are the outcomes?**

As I understand it dioxins are only required to be monitored in the gaseous stack discharge to atmosphere. The potential considered by the regulators for the presence of significant levels of dioxins in any other stream discharged from the plant would thus seem to have either been ignored or presumed to be negligible or else their environmental fate has been considered to be inconsequential.

It appears that an acceptably low level of dioxins is now being emitted the gaseous stack discharge to atmosphere. Residual dioxins not destroyed in the TOU, however, would ultimately be discharged;

- in the waste streams to sewer
- with the spent filter carbon
- as solute in the treated water (eg. the solubility of 2,3,7,8-TCDD in pure water is reported to be 0.2 mg/l @ 25°C).

Yours faithfully

Dr John McCracken
IMC Core Member – Process Engineering Expert
Managing Director
McCracken Consulting Services