



Orica Independent Monitoring Committee

**Report for Botany Groundwater Community Liaison Committee on Task 24
for the CLC meeting on 15 September 2009,**

Professor Brian Priestly, Director, Australian Centre for Human Health Risk Assessment

At the June 2009 meeting of the CLC, I was requested to provide comment on the following issue:

Task 24: To review the information surrounding the destruction of diethyl aluminium chloride (DEAC) contaminated waste by Orica at the Groundwater Treatment Plant (GTP) in November 2008 and advise the CLC if this was likely to affect the health of the local community and workers.

The available information on the toxicology of DEAC and the GTP emissions resulting from thermal destruction of the waste is relatively limited. Nevertheless, this report will attempt to provide some information, in lay rather than technical language, on any potential health risks associated with the thermal destruction of the waste, which was carried out in November 2008.

On the information provided to me, approximately 3.1 tonnes of stored waste containing on average 7.5% DEAC in heptane was transferred to the GTP for destruction over the period 3-12 November 2008, with a preliminary test run on <100kg on 31 October 2008. The information provided to me included:

- Some basic information summarising the origins of the waste and its storage history
- Technical details of the toxicity of the waste, in the form of a Material Safety Data Sheet (MSDS).
- Copies of correspondence between Orica and NSW DECC seeking approval for the processing of the waste and outlining the conditions under which approval was granted
- Details of continuous and non-continuous stack monitoring data for the period of the process
- A mass balance estimate for aluminium, focussing primarily on the amounts retained within the GTP and amounts recovered from the outlets.
- Advice that there were no aesthetic signs of emissions (haze or deposited coating on plant and equipment) during the course of the treatment.

This information is sufficient only to provide some general comments on likely health risks to local residents and workers at the plant. It is not possible to undertake a comprehensive health risk assessment on the basis of these reports. Furthermore, some consideration needs to be given to balancing any potential health risks associated with the GTP process (essentially quite slight) against the potentially larger risks associated with alternative waste management solutions, including perpetuation of on-site storage of the waste.

Toxicity of the primary waste material

Much of the risk associated with the DEAC/heptane waste relates to its flammability. Because of the high heptane content of the waste, the MSDS contains specific advice designed to minimise ignition risks. The principal toxic effects associated with acute exposures are likely to be severe skin/eye irritancy and depressant effects on the central nervous system, primarily associated with the volatile heptane component. However, it appears that the DEAC component would compound the strong irritancy to skin and all mucosal surfaces.

Occupational health standards relating to potential inhalation are not particularly stringent for the heptane component (8 hr TWA 1640 mg/m³; 15 min STEL 2050 mg/m³), reflecting the relatively low acute and chronic toxicity of this hydrocarbon solvent. The exposure limits for alkyl aluminium compounds are more stringent (2 mg/m³ as Al), reflecting the need to protect workers against metal fume irritancy effects on respiratory passages.

There is no indication that either component of the waste represents a cancer or reproductive toxicity hazard, nor are there any significant data on DEAC indicating long-term exposure toxicity.

Since there were no reports indicating loss of containment during the prior storage of the waste, or during transfer to the GTP, or during processing of the waste, it is likely that exposure of the local community to DEAC/heptane would have been essentially zero. Accordingly, there would be no consequent health risks. Acute health risks arising from direct contact with the waste material would theoretically be higher in on-site workers, but again there were no reports of spills or loss of containment that would suggest any such risks were realised. Workers handling these types of materials should be cognisant of the need to use personal protective equipment to minimise chemical exposures.

Toxicity of thermal decomposition products

I was unable to find any useful data on the toxicity of thermal decomposition products for either heptane or DEAC. However, the GTP operates at a temperature which is designed to break down organic materials to small molecular weight fragments, and most of these would be captured by scrubbers and quenching materials. Therefore, emission of any toxic materials from the stack would be expected to be small and stack emission monitoring data tends to confirm this.

Data were provided on: carbon monoxide, hydrogen chloride, 1,2-dichloroethane, volatile organic carbon compounds (VOCs), vinyl chloride, oxides of nitrogen, sulphur dioxide, chlorine, hydrogen sulphide, total solid particulate matter (TSP) and dioxins/furans.

Some of these measurements may have been redundant because they would have been based on licence conditions for expected GTP emissions relating to handling of EDC stripped from groundwater plumes. The conditions for conversion of DEAC to some of these degradation products may not have been present. However, it appears prudent that the monitoring schedule applicable to thermal destruction of EDC was followed in this case.

None of the stack monitoring measurements exceeded DECC regulatory limits (except for TSPs on one out of two monitoring dates). The apparent exceedence of the TSP limit (42.2 mg/m^3 vs licence limit of 20 mg/m^3) on one of the two measurements was not accompanied by any visual discharge (haze or depositions on plant or equipment). Since the compliant and non-compliant readings were obtained from different analytical laboratories and there remains some doubt about the calibration of the measuring equipment at the time of the test, no health significance should be attributed to this one-off result.

Metallic aluminium (Al) and/or aluminium oxides would be expected to be a significant residual products arising from thermal decomposition of the DEAC component of the waste. While Al is a common element of the earth's crust and exposure from dietary and other non-industrial sources is quite common, it is also not particularly toxic and chronic exposure limits are relatively high. However, monitoring Al emissions from the GTP stack during processing of the DEAC waste was considered important, and was mandated by DECC.

Mass balance calculations showed that the majority of the 52.1 kg of aluminium fed into the GTP was recovered from the GTP surfaces, quenching fluids and scrubbers. The estimated total aluminium emission in particulate matter carried in stack gases was 5.2 kg (approx. 10%), spread over 13 days.

There has been no modelling of the potential dispersion of this amount of aluminium into the region surrounding the GTP, but it is my opinion that such a small emission is unlikely to result in any significant increase in total aluminium exposure in local residents or to represent a health risk. To put this into perspective, estimates of aluminium emissions to air arising from heavy industrial sources and soil tend to be of the order of thousand of tonnes per annum (EHC 194, WHO 1997). Total intake for non-occupationally exposed humans is estimated to be in the range 2.5 – 13 mg/day (EHC 194, WHO 1997), mainly from food sources, and this is well within the health-based tolerable limit for chronic (lifetime) exposure of 1 mg/kg body weight/day (WHO 1993).

Issues of liaison between Orica, DECC and the CLC

While the CLC Task 24 specifically requests my advice on issues relating to possible health risks, I feel I should also comment on matters relating to community risk perception. It is well known that, even when a comprehensive and scientifically-founded health risk assessment indicates little or no risk of there being any adverse health outcomes, a well-managed program will fail to assuage the concerns of an enlightened community unless mutual trust has been earned through effective consultation.

It appears that trust may have broken down, at least to some extent, in the matters relating to Task 24. Despite Orica having informed DECC of its proposal to manage DEAC waste using the existing GTP, and received DECC approval to proceed with the project, subject to stringent reporting conditions, it appears that time-constraints prevented an effective prior consultation with the CLC. Subsequent

attempts were made to redress this communication breakdown through a formal communication with the CLC Chair and at later meetings with the CLC.

I hope that the comments I have made in this report, while falling short of being a comprehensive quantitative risk assessment of the outcomes, will at least go some way towards reassuring the community, through the CLC, that the thermal destruction of the DEAC/heptane waste actually provided an effective solution to ongoing storage of the waste, with minimal attendant risk to the local community or to the on-site workers.

A handwritten signature in black ink, appearing to read 'B. Priestly', with a long horizontal flourish extending to the right.

Brian G. Priestly PhD

7 September 2009