Regulatory Compliance Discussion Report

2 Christina Road, Villawood

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Note: Attachments and relevant calculations can be found in the Environmental Assessment for the Orica Car Park Wase Encapsulation (July 2007).

1 Introduction

The proposed remediation project is governed by a number of environmental conventions, protocols, guidelines, regulations and acts including state, national and international instruments. These and the associated New South Wales (NSW) planning instruments are outlined in Chapter 2 (Statutory Planning) of the Environmental Assessment (EA). NSW and national regulations relevant to impact assessment are also discussed in the PAE Pty Ltd (2010) *Air Quality Impact Assessment* (Appendix H) of the EA.

The following discussion provides further details on regulatory requirements, specifically with respect to the proposed directly-heated thermal desorption (DTD) treatment technology including compliance of the plant design and operation with:

- the Stockholm Convention;
- the national OCP Management Plan;
- the national ambient air quality measure;
- NSW stack emission criteria; and
- NSW chemical control orders.

A description of the DTD Plant and process is contained in Section 5.4.2 of the EA.

2 Regulatory Requirements

2.1 Stockholm Convention

The Stockholm Convention[1] requires (under Article 3 and Annex A) that parties to the covenant eliminate from use and dispose in an environmentally sound manner nominated chemicals including some organochlorine pesticides (OCPs), hexachlorobenzene (HCB) and polychlorinated biphenyls (PCBs). Compounds of concern for the Villawood site include OCPs and HCB but not PCBs. The discussion below would also be applicable to PCBs if they were present on the site. The Stockholm Convention also requires (Article 5 and Annex C) that the parties to the convention reduce or eliminate releases from unintentional production of dioxins and furans, HCB and PCBs, by adopting Best Available Techniques and best environmental practices.

The treatment technology (DTD) proposed for the Villawood remediation conforms with the principles of the convention in that it removes and destroys the OCPs and HCB present in the site soil to the maximum extent practicable (i.e. near to or at their limit of detection in soil), while minimising emissions of dioxins and furans, OCPs and HCB by the use of best available techniques and best environmental practices. In this case Best Available Techniques are mainly applicable to the DTD Plant, while best environmental practices are relevant to the associated site works, including dewatering, excavation, transportation, and pre-treatment of soil for the DTD Plant. The latter activities are outlined in the EA and not discussed further here.

Guidelines for best available techniques were issued in 2004 under the Stockholm Convention for various processes and plants[2]. The guidelines focus in particular on minimising or eliminating to the maximum extent possible emissions of dioxins and furans during the destruction of the above chemicals. In the absence of Australian guidance, these guidelines and associated directives of the European Parliament[3] take precedence over other jurisdictions in terms of international regulatory principles applied in Australia. Although none of the above sources deals directly with DTD as a technology, they do deal with the use of thermal oxidisers to destroy chlorinated wastes, and it is this aspect that is relevant to the proposed remediation technology.

Features of the best practice guidelines relevant to the DTD process are:

- good combustion practice, which involves optimising turbulence, temperature and residence time in the DTD Plant thermal oxidiser (TO);
- rapid quenching (or fast gas cooling) to minimise the reformation (or de-novo formation) of dioxins in the TO off-gas, which is achieved in the DTD quench (or evaporative cooler);
- dust separation using cloth filters to remove particulates that may contain adsorbed dioxins in the DTD Plant baghouse;
- cyclones (or multi-clones) to further remove dust from the off-gas; and
- wet scrubbing to remove acid gases from the off-gas in the DTD Plant acid gas scrubber.

Thermal Oxidiser Design: considering good combustion practice it should be noted that the Stockholm guidance is for incinerator thermal oxidisers. There are some design and operational differences between an incinerator TO and a DTD Plant TO, mainly due to the nature of the waste treated. Specifically DTD plants treat soil with low organic content and high mineral content relative to incinerator wastes which typically have high organic contents and low mineral contents and may include liquid feeds. This means that the details of the Best Available Techniques of the Stockholm Convention have to be interpreted when applying the principles of

[1] Stockholm Convention on Persistent Organic Pollutants, Stockholm, 22-23 May 2001

[2] Guidance on Best Available Techniques and Provisional Guidelines on Best Environmental Practices Relevant to Article 5 and Annex C of the Stockholm Convention on Persistent Organic Pollutants, December 2004

[3] Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the Incineration of Waste (EU Waste Incineration Directive)

the convention to the design and operation of a DTD Plant treating soil.

Thermal Oxidiser Turbulence: the Stockholm Convention does not specifically reference design parameters for turbulence but notes that turbulent mixing is required for complete incineration. The DTD Plant TO would be designed to ensure turbulent mixing by the use of turbulent mixing vanes about the oxidisers flame.

Thermal Oxidiser Temperature: The Stockholm Convention Best Available Techniques recommends a minimum thermal oxidiser temperature of 900°C, and states that ash fusion can become a problem in incinerators operated at 980°C or above. The European Union (EU) Waste Incineration Directive specifies a minimum temperature of 850°C for any incinerator, and a minimum of 1,100°C when burning wastes containing more than 1% organic chlorine. The chlorine content of the Villawood soil would be <1%, and the DTD Plant TO would be operated above the minimum temperature of 900 ^{o}C, providing that slagging of the TO due to melting of entrained dust was not an issue. Slagging is more likely to be a significant problem in a DTD Plant TO than a high temperature incinerator due to the relatively high dust load passing through it. Slagging would result in an undesirable stop start operation as well as prolonging the duration of the work and creating safety risks due to the requirement to deslag the TO (which would require entry by personnel).

Thermal Oxidiser Residence Time: Residence time is the time that contaminants take to pass through the TO where they are destroyed. It is a function of gas velocity and TO length. Many guidance documents for hazardous waste incineration design recommend a minimum gas residence time of 2 seconds. The Stockholm Convention Best Available Techniques document (Section 12.1.1) references "sufficient residence time (for example 2 seconds)" to complete incineration. The recommendation for a 2 second residence time originates with the requirement to treat liquid wastes so that adequate time is provided first for the liquid droplet to evaporate and then for the resulting organic vapour to be oxidised. The rate-limiting step in the process is the evaporation of the liquid droplet. Conversely, fume incinerators treating vapour are typically designed with a minimum gas residence time in the range of 0.5 to 1.0 seconds, with a typical value being 0.75 seconds. In a DTD Plant equipped with a TO, the organics entering the TO are already in the vapour phase and therefore a relatively short gas residence time is capable of achieving adequate organic destruction efficiency.

It is also relevant that TO residence time cannot be directly measured since it is determined by a number of continuously varying inputs when treating contaminated soil (such as the moisture content of the soil). In the US, residence time is not a regulated operating parameter for thermal plants, except for high temperature incinerators treating liquid PCB waste.

Quench: The DTD Plant proposed for the Villawood project would be equipped with a quench (or an evaporative cooler) after the TO to quench the TO off-gas from 1,000 ^{o}C to around 200 ^{o}C, and thus minimise the potential for reformation of dioxins. The lower temperature limit would be optimised to prevent the condensation of acid in the downstream baghouse.

Dioxin Emissions: The Stockholm Convention Best Available Techniques document considers that dioxin and furan emissions of 0.1 to 0.01 ng TEQ / Nm3 are achievable for incinerators configured as above. DTD plants similar to the plant proposed for the Villawood project have achieved a standard of < 0.1 ng TEQ / Nm3. The plant proposed for the Villawood project would be designed and operated to meet this standard.

Dust Removal. The DTD Plant proposed for the Villawood project would be equipped with a cyclone or multi-clones before the TO and a baghouse after the TO to remove dust from off-gas. The baghouse would be fitted with fabric or cloth filters to remove fine dust. It should be noted that while fabric filters represent Best Available Techniques for the Plant, that absolute dust emissions from DTD plants are typically higher than dust emission from incinerators (although removal efficiencies are similar), because they treat soil and not concentrated organic waste.

Acid Gas Removal: The DTD Plant would be equipped with a wet scrubber to remove hydrochloric acid from the off-gas stream. The off-gas entering the scrubber from the baghouse passes through a pipe quench to protect the fibreglass reinforced plastic vessel from high temperature. Hydrochloric acid, which is the main acid gas present, would be removed with a high efficiency by the wet scrubber.

2.2 National Guidelines

Australia has well developed national guidelines for the management of persistent organic compounds nominated in the Stockholm Convention, which are referred to as Schedule X Wastes in the National Strategy for the Management of Scheduled Waste[4]. The national guideline relevant to the Villawood project is the national Organochlorine Pesticides (OCP) Waste Management Plan[5](WMP). It should be noted that the OCP WMP specifically excludes OCP contaminated soil. However the parallel instrument in NSW (the SCW CCO) captures both waste and soil, so the principles of the OCP WMP apply.

The national PCB Management Plan [6](MP) is not applicable because PCBs are not known to be present on the site. The HCB WMP applies only to the Orica Botany site and therefore is not applicable. HCB is also an OCP and is therefore captured in the OCP WMP.

The national framework of guidelines also includes National Protocols for Approval/Licensing of Trials of Technologies for the Treatment/Disposal of Schedule X Wastes [7]and/or the National Protocols for Approval/Licensing of Commercial-Scale Facilities for the Treatment/Disposal of Schedule X Wastes. These are implemented in NSW through Environmentally Hazardous Chemicals Act 1985 (EHC Act), which calls up a "Technology Application" conforming to the protocols. This application would be submitted when the detailed design of the DTD Plant is developed or available.

Another national instrument relevant to the proposed remediation is the National Environment Protection Measure (NEPM) for Ambient Air Quality[8], setting out national standards and goals for six common ambient air pollutants (known as the "criteria" air pollutants). The Ambient Air Quality NEPM, was varied in 2003 to expand its scope. The application of the NEPM to the proposal is discussed in Appendix H of the EA and is summarised below.

The material contained on the Villawood site is notionally scheduled OCP Waste because it contains a mean concentration of > 50 mg/kg of OCPs.

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[4] Australian and New Zealand Environment and Conservation Council, 1992. National Strategy for the Management of Scheduled Waste

[5] Australia and New Zealand Environment and Conservation Council, November 1996. Hexachlorobenzene Waste Management Plan

[6] Australia and New Zealand Environment and Conservation Council, July 1999. Polychlorinated Biphenyls Management Plan

[7] Australia and New Zealand Environment and Conservation Council Waste Management Secretariat, 1994. National Protocols for Approval/Licensing of Trials of Technologies for the Treatment/Disposal of Schedule X Wastes

[8] National Environment Protection Council (NEPC), 1998. National Environment Protection Measure (NEPM) for Ambient Air Quality

OCP Waste Management Plan: The OCP WMP set out a number of provisions for OCP waste relevant to design and operation of the DTD plant including:

- 8. Destruction of Scheduled OCP Waste
- 9. Disposal of Scheduled OCP Waste

Provision 8 deals with emissions and residues from destruction of OCP waste. It requires that treated solids must contain < 2 mg/kg in aggregate of chlorinated compounds produced in the destruction process. It is likely that the treated waste would contain < 2 mg/kg of OCP, subject to optimising the soil treatment temperature to minimise emissions of mercury to air. If the aggregate is taken to include all other chlorinated compounds in the waste, then the sum of non-detects could be as high as 4 mg/kg using routine commercially available laboratory techniques.

The remediation proposal does not include the production of non-aqueous liquid wastes. It does include the treatment of free water from the site, surface runoff from the treatment facility and scrubber water (if required) from the thermal treatment plant. Provision 8 of the OCP WMP sets a limit of 0.001 mg/L for an aggregate of all chlorinated compounds produced in the destruction process for discharge to sewer. The detection limit for chlorinated compounds in water using routine commercially available laboratory techniques ranges from 0.001 to 0.00001 mg/L. A limit of 0.001 mg/L can be demonstrated for OCPs. However, the aggregate of all chlorinated compounds in the waste at the limit of detection in water may be > 0.001 mg/L.

Provision 8 calls up a limit of 0.1 ng/m^3 of dioxins and furans in emissions to air from any treatment process. The proposed process meets this limit and the limit can be measured using routine commercially available laboratory techniques. Emissions from largely undiluted sources (eg excavation works) must be less than a time weighted exposure average (TWA) of 0.001 mg/m^3 for OCP. Emission from point sources must be treated using best practice control technology, such that the 3 minute design level concentration at the site boundary is less than 1/30th of the above TWAs. The thermal plant would use best practice technology to treat emission to air as described the above. Emissions to air from the thermal plant and buildings under normal operating conditions are predicted to meet the above standards.

Provision 9 allows for the disposal of non-scheduled OCP waste to landfill (i.e. <50mg/kg).

2.2.1 NEPM for Ambient Air Quality

The NEPM sets ambient air standards over various averaging periods for a range of priority pollutants. The assessment of these and other toxic pollutants is discussed in the section below on dispersion modelling and ambient air concentrations under NSW acts and regulations. All emissions are predicted to comply with the relevant ground level concentrations set out in the NEPM. The predictions are based on the proposed design of the plant and its historical performance.

2.2.2 NSW Legislation and Regulations

NSW has well developed acts and regulations for the management of persistent organic compounds nominated in the Stockholm Convention and Schedule X Wastes in the National Strategy for the Management of Scheduled Waste.

They include principally the Protection of the Environment Operations Act 1997 (POEO Act) and the EHC Act and their subordinate regulations (principally the POEO (Clean Air) Regulation (2002)) and other instruments. The proposed Villawood remediation project would require an Environment Protection Licence (EPL) under the POEO Act. The project would also require to be licensed under the EHC Act, which includes provision for submission of a Technology Application in conformance with the National Protocols for Approval/Licensing of Commercial-Scale Facilities for the Treatment/Disposal of Schedule X Wastes. The Technology Application would be submitted once the detailed design for the project has been developed and a Plant selected.

Further a number of chemicals present on the Villawood site are declared chemical wastes under the EHC Act and are subject to Chemical Control Orders (CCOs). The CCOs contain environmental performance standards for emissions and residues from treatment of declared chemical wastes, which are discussed below.

Clean Air Regulation: The Clean Air Regulation (CAR), which came into force in September 2005, specifies stack emission concentration limits for a range of industries and processes, as well as operational parameters for some thermal operations. It classifies plant in terms of Groups 1 to 6, with Group 6 being plant approved after September 2005. Although Group 1 to 5 plant may be is subject to less stringent emission limits than Group 6 plant, they are subject to periodic reclassification and thus progressively more stringent limits. The thermal plant proposed for the Villawood remediation would be classified and regulated as Group 6 plant.

CAR Stack Concentrations: Table 1 below shows a comparison of stack emission concentration limits for Group 6 thermal plants under the CAR (Schedules 2 and 4). The CAR applies the stack emission concentration limits at the native oxygen content for a particular process. Historical stack oxygen data for DTD plants used on the Allied Feeds and Lednez projects ranged from 8.2 to 10.1% with means of 8.7 % (Allied Feeds) and 9.8% (Lednez) (Table 1). For the proposed technology a stack oxygen concentration of 10% has been assumed, which is higher than the default oxygen concentration of 3% in the CAR. It should be noted that if the 3% oxygen correction was applied it would effectively halve the maximum allowable concentrations (compared with a 10% oxygen correction).

The two right hand columns of Table 1 show historical results (corrected to 11% oxygen and standard conditions) for the DTD plants from the Allied Feeds and Lednez sites in Sydney treating soil contaminated by chlorinated compounds. Looking at the results it can be seen that the stack concentration limits have generally been achieved by the technology, although there have been a few exceptions.

For the Villawood remediation project, mercury emission in the stack have been estimated assuming:

- A high average soil mercury concentration of 0.43 mg/kg;
- A high soil feed rate of 35 t/h; and
- A stack gas flow of 35,500 Nm^3/h (dry) corrected to 10% O2.

For the assumptions above the stack concentration assuming 0% mercury Removal Efficiency (RE) in the plant would be 0.42 mg/Nm^3 at 10% O2, compared with a standard in the CAR of 0.2 mg/Nm^3. If an RE of 50% is assumed then the stack concentration would be 0.21 mg/Nm^3 at 10% O2. Historical mercury data for the Allied Feeds project show a mercury RE of 73.4% to 99.8% with an average of 91.6%.

The intrinsic controls on mercury removal efficiency in DTD plants are poorly understood. They probably include adsorption onto carbon produced during treatment and interaction with chlorine in the gas phase in the baghouse and liquid phase in the scrubber. The Villawood soil contains about 3000 mg/kg of chlorinated compounds on a mass weighted average basis, but as little as a few hundred mg/kg in several of the ISZs. The concentrations are similar to the Allied Feeds project soil so a similar RE could be anticipated in which case the CAR mercury criterion would be met. If this was not the case carbon injection could be considered to achieve compliance.

In addition, a small (about 50 m^3) mercury hotspot may exist in the north west part of the site. Treatment of soil from this hotspot without dilution could result in exceedence of the stack concentration criterion for mercury. Therefore it is proposed to further delineate the hotspot and then consider the appropriate treatment method to meet the stack concentration standard, such as blending of the feed soil, injection of Powdered Activated Carbon (PAC) into the baghouse, or scrubber chemistry manipulation. The results of mercury control trials from the Orica Car Park project would be relevant.

CAR Operating Parameters: The CAR specified operational parameters for some thermal plants. For the purpose the CAR divides Group 6 plant into two classes depending on whether it is treating Principal Toxic Air Pollutants (PTAPs) or not. PTAPs are a list of nominated organic compounds and inorganic species. Because the CPWE contains several listed PTAPs more stringent operational parameters apply. The operational requirements of the CAR are:

- a gas residence time of > 2 seconds in any afterburner (i.e. TO);
- a combustion temperature of > 980 ^{o}C in any afterburner; and
- a destruction efficiency of > 99.9999%.

Gas residence time and combustion temperature have been discussed under the Stockholm Convention above. The Stockholm Convention has identified 980 ^{o}C as the temperature above which slagging may occur in a TO. Treatability testing has not been undertaken for the Villawood project, to predict if slagging may be an issue.

The DTD Plant TO would be treating vaporised contaminants, so a shorter gas residence time would be required to achieve the same destruction efficiency as a high temperature incinerator with a gas residence time of 2 seconds. The gas residence time for the DTD Plant used for the Villawood project would likely be 2 seconds or more.

Destruction Efficiency (DE) requirement is a performance based requirement modelled on the US Environmental Protection Agency (USEPA) Destruction and Removal Efficiency (DRE) requirement for treatment of PCBs and dioxin wastes, under the USEPA Resource Conservation and Recovery Act Regulations for hazardous waste incinerators, 40 Code of Federal Regulations, Part 60, Subpart O, Section 264.343. As such it reflects a different approach to regulation than that under the Stockholm Convention (which focuses on operation parameters including residence time, temperature and turbulence).

The DE requirement is measured across the plant and compares the mass of a selected contaminant emitted to air with the mass of the same contaminant introduced in the feed soil, to determine the mass of contaminant removed and destroyed in the process. It is not a direct measure of the destruction efficiency of the TO.

It is unlikely that the DE specified in the CAR will be demonstrable using the contaminants on the Villawood site because the mass of contaminant in the feed soil is too small compared with the mass in the stack gas and the commercially feasible detection limits for both media to allow the calculation to be made to the required number of decimal points.

Environmentally Hazardous Chemicals Act: The Scheduled Chemical Waste (SCW) CCO of the NSW EHC Act is relevant to the Villawood remediation proposal.

The SCW CCO nominates a list of 24 scheduled compounds including HCB and DDT. Several other SCW compounds are also present on the Villawood site at concentrations above the limit defining SCW (2 mg/kg aggregate). The SCW CCO specified a maximum aggregate level of SCW compounds in treated material of < 2 mg/kg unless it is not practicable (technically and economically) to do so. It may not be possible to comply with this level for aggregate SCW compounds given potentially high concentrations of DDX compounds in the feed soil.

Table 1 Stack Emission Standards from Recent Hazardous Waste Treatment Consents

Pollutant	Units of measure	Stack emission concentration		
		CAR[2] @ 11% O_2	Allied Feeds DTD @ 11% O_2, Pre-tests 1, 2, PoP Tests 1, 2, 3	Lednez DTD @ 11% O_2 Pre-tests 1, 2, PoP Tests 1, 2, 3
Oxygen	% v/v dry		9.5, 8.4, 8.3, 8.2, 9.0	9.6, na, 9.7, 10.0, 10.1
Sulphuric acid mist (H_2SO_4)	mg/m^3	100	8.8, 26.1, 22.8, 50.1, 88.5	4.7, na, 3.4, 2.4, <2
Chlorine	mg/m^3	200	0.4, <0.4, 1.27, 0.29, 0.89	0.1, na, 0.64, 24, 7.5
Hydrogen chloride (HCl)	mg/m^3	100	0.08, <0.08, <0.09, <0.06, <0.1	2.5, na, 6.4, 0.4, 0.5
Any fluorine compound (HF)	mg/m^3	50	2.1, 1.4, 0.99, 0.18, 2.9	<0.5, na, <0.1, <0.1, <0.1
Nitrogen dioxide (NO_2)	µg/m^3	350	120, 174, 142, 142, 144	270, na, **680**[4] 220, 180,
Hazardous subs. Types 1 and 2	µg/m^3	1000	0.07, 0.04, 0.016, 0.054, 0.023	0.074, na, 0.075, 0.057, 0.12
Cadmium	µg/m^3	200	0.0054, 0.0003, 0.0003, <0.0004, 0.0008	<0.00005, na, <0.0006, <0.0006, <0.0007
Mercury	µg/m^3	200	0.012, 0.029, 0.007, 0.0076, 0.0029	<0.0005, na, 0.0019, 0.00045, 0.020
Solid particles	mg/m^3	50	11.6, 21.3, 2.1, 28.3, 9.2	5.3, 0.71, 1.8, 1.3, 1.2
Dioxins and furans @ 11% O2	µg/m^3	0.1	0.0379, 0.060, 0.010, 0.023, **0.190**	0.095, 0.068, 0.058, 0.0098, 0.012
Carbon monoxide	mg/m^3	125	4.3, 7.1, 7.9, 9.7, 3.7	<1, na, <1, 1.2, 2.2
VOCs	mg/m^3	100	0.80, 0.63, 0.78, 2.36, 2.08	1.0, na, <0.003, 0.24, 0.11

Notes: All results rounded for convenience, **bold** = exceeds limit

[1] CAPER = Clean Air (Plant & Equipment) Regulation 1997.

[2] CAR = POEO (Clean Air) Regulation 2002 (released Sept 2005)

[3] Allied Feeds Plant Pre-test and Pop Tests

[4] Erroneous result from field instrument

[5] Inadequate waste characterisation data to estimate a concentration

[6] Concentrations would exceed maximum allowable based on worst case interpretations or treatability study

Dispersion Modelling and Ambient Air Concentrations: The NEPM for Ambient Air Quality and sets ambient air standards over various averaging periods (10 minute average to annual average) for a range of priority pollutants including sulphur dioxide (SO_2), particulate matter (PM10), carbon monoxide (CO), lead (Pb), ozone (O_3) and nitrogen dioxide (NO_2).

PAEHolmes (2010) has estimated GLCs for compounds emitted from the site works and the thermal treatment plant, at identified sensitive receptors in the area. The latter is discussed here. The estimates are based on modelled dispersion of predicted mass emissions for the DTD Plant stack. Because the remediation project has not yet been tendered, a conservative approach was taken in the modelling that would allow either of two locally available DTD plants to be used for the project. Thus the modelling applied the lower stack height in combination with the larger gas flow and lower gas temperature to ensure the maximum glcs are presented in the analysis.

Initial modelling was performed with a 14.9m DTD stack height (to provide the most conservative assessment of air quality impacts). This is the lowest stack height of locally available DTD plants. Predictions for some pollutants (HF, TSP, PM10) in this study showed exceedance of the air quality criteria for a 14.9m high DTD stack. Where this occurred the stack was remodelled at 30m height above ground level and the glcs then met the relevant criteria. Therefore a 30m height would be required for the thermal plant, unless the values for emissions of those exceeding pollutants can be proven to be lower/less conservative than the values used in this assessment.

In addition, a small (about 50 m^3) mercury hotspot may exist in the north west part of the site. Excavation of the mercury hotspot in the open could lead to unacceptable short term (1 hr) ambient impacts. Therefore it is proposed to further delineate the hotspot and then consider the appropriate excavation method to meet the applicable standards. These could include excavation at a reduced rate or in small increments or use of an enclosure.

Table 1 shows maximum stack concentration limits under the CAR which were used for the ambient air modelling to provide a conservative assessment of impacts. Actual concentrations measured in stack tests are generally less than the CAR limits by varying safety factors depending on the particular pollutant, the stringency of the limits and the control afforded by the plant.

The impacts of minor compounds that do not have stack concentration limits in the CAR, were assessed using an assumed Destruction and Removal Efficiency (DRE) of 0.0001% of the mass feed rate. This assessment is also conservative because the DRE is one order of magnitude less than the design DRE of the plant.

Hazardous substances were not modelled because they comprise an aggregate of concentrations for several metals.

Table 2 Stack Emission Standards and Historical Concentrations

Pollutant	Units of measure	Stack emission concentration	
		CAR[1] and EA input @ 11% O_2	Historical Ranges[2] in DTD plant @ 11% O_2
Sulphuric acid mist (H_2SO_4), sulphur trioxide (SO_3), or both (as SO_3)	mg/Nm³	100	<2 – 88.5
Chlorine	mg/Nm³	200	0.1 – 24
Hydrogen chloride (HCl)	mg/Nm³	100	<0.06 – 6.4
Any fluorine compound (HF)	mg/Nm³	50	<.5 – 2.9
Nitrogen dioxide (NO_2) or nitric oxide (NO), or both AS NO2	mg/Nm³	350	120 - 270
Hazardous subs. Types 1 and 2	µg/Nm³	1000	0.016 – 0.12
Cadmium	µg/Nm³	200	<0.00005 – 0.0003
Mercury	µg/Nm³	200	<0.0005 – 0.029
Solid particles	mg/Nm³	50	0.71 – 28.3
Dioxins and furans @ 11% O2	pg/Nm³	100	9.8 - 190
Carbon monoxide	mg/Nm³	125	<1.0 – 9.7

Notes:

1 CAR = POEO (Clean Air) Regulation 2002 (released Sept 2005)

2 Ranges are based on the highest and lowest readings of PoP tests for Allied Feeds and Lednez projects

Comparing the predicted stack estimates (based on historical performance), it is apparent that there is a large margin of safety for most pollutants with respect to the CAR stack limit. Smaller but acceptable margins exist for NOx and solid particles. Dioxins and furans are predicted to meet stack criteria and relevant GLCs based on a most likely interpretation of treatability data, but may exceed based on a worst case interpretation.

Based on the results of the modelling study (PAEHolmes 2010), the maximum emissions from the proposed remediation are not predicted to have a significant impact on air quality in the surrounding area. It is also noted that this assessment has been based on the minimum performance specifications and they therefore represent potential maximum impacts.