Odour Research Laboratories Australia

ODOUR IMPACT ASSESSMENT REPORT

INDEPENDENT PRINT MEDIA GROUP

WARWICK FARM, NSW

PROJECT NO.: 4144/08

DATE: OCTOBER 2008

P W STEPHENSON

M BRECKO

Odour Research Laboratories Australia

A Division of Peter W. Stephenson & Associates Pty Ltd
ACN 002 600 526 (Incorporated in NSW)
ABN 75 002 600 526

Newington Business Park
Unit 7/2 Holker Street
Newington NSW 2127 Australia
Tel: (02) 9737 9991
Fax: (02) 9737 9993
E-Mail: peter@orla.com.au

ODOUR IMPACT ASSESSMENT REPORT

INDEPENDENT PRINT MEDIA GROUP

WARWICK FARM, NSW

PROJECT NO.: 4144/08

DATE: OCTOBER 2008

P W STEPHENSON

M BRECKO

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

1.1 OVERVIEW

Odour Research Laboratories Australia (ORLA) has been commissioned by Independent Print Media Group (IPMG) to prepare an Odour Impact Assessment report to submit to the Director-General for the proposed development of the printing facility and associated activities at Warwick Farm, New South Wales (NSW). Refer to Appendix A for a copy of the Director-General Requirements.

This Odour Impact Assessment report provides:

- A review of odour sources in the Warwick Farm area
- Compliance of the project with the *Technical Framework* and associated *Technical Notes: Assessment and Management of Odour from Stationary Sources in NSW, 2006* prepared by NSW Department of Environment and Climate Change (DECC)
- Compliance of the project with *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* issued by the NSW Department of Environment and Climate Change (DECC)
- Compliance of the project with the NSW *Protection of Environment Operations Act (POEO Act)* and associated *Clean Air Regulations 2002*.

1.2 KEY ELEMENTS OF THE PROPOSED DEVELOPMENT

IPMG seeks approval from the Director-General for the development of the printing facility and associated activities at Warwick Farm.

This site is located at 23 Scrivener Street, Warwick Farm and occupies 7.94 hectares with a warehouse and buildings of 34,400 square metres (m^2). The real property description of the site is Lot 1 DP 774089. Refer to Figure 1-1 for location of the site.

A key element of the proposed development is to ensure minimal impact on the environment. This report covers the assessment of odour and associated impacts that this proposed process and operation may have on the surrounding environment.

The existing warehouse and buildings on the site are currently owned by Kimberly – Clark Australia (KCA). KCA currently use the warehouse and site for distribution of their absorbent paper based products such as nappies, tissues and paper towels.

1.3 THE PROPONENT

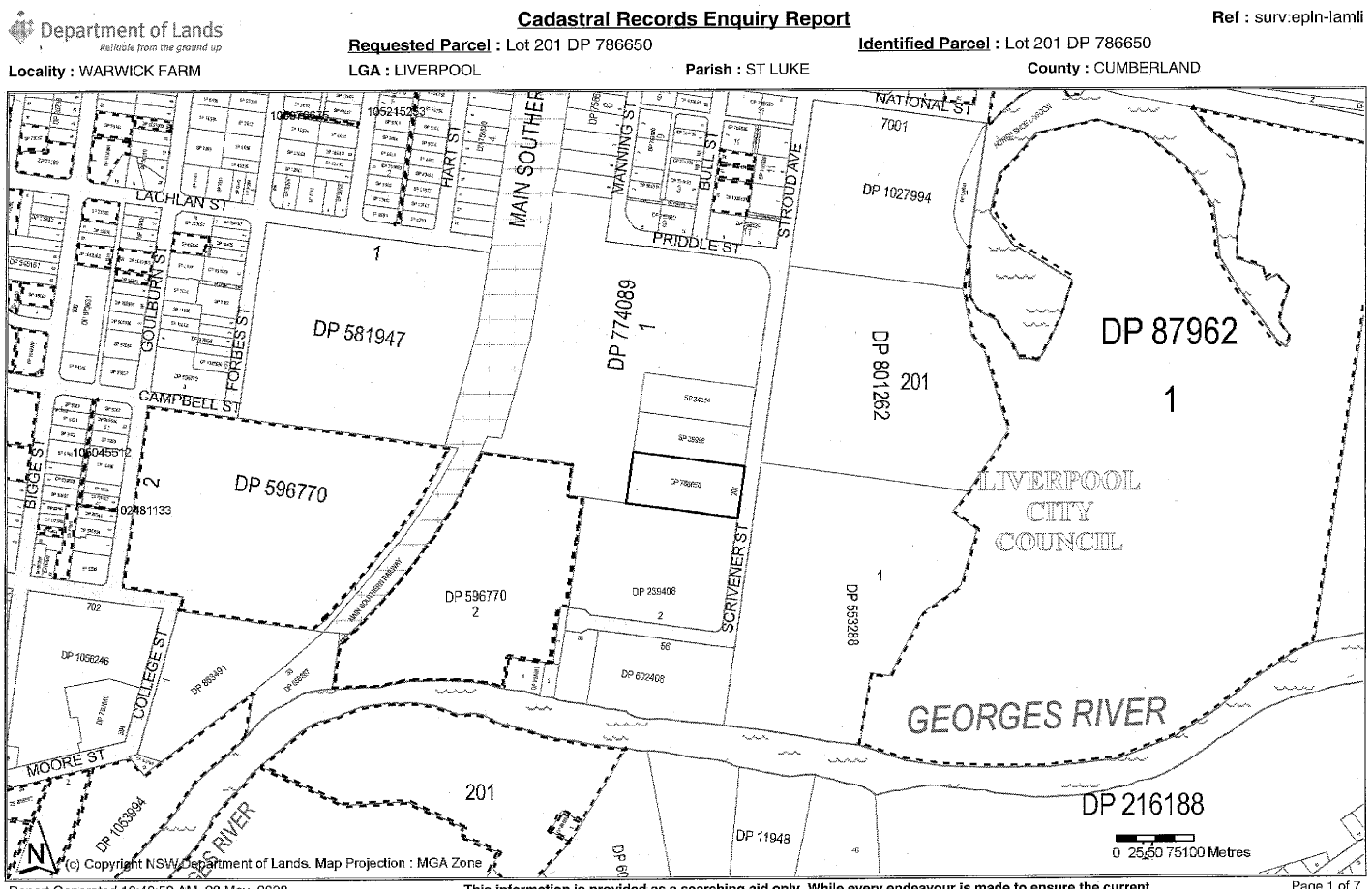
IPMG is a market leading print group in Australia with operations extending from pre-media to distribution. Its origins date back to 1887, however since then the company has grown into a multi-million dollar, integrated printing group with the capacity to handle the most demanding print products in Australia.

IPMG printing companies together make up the largest privately held print group in Australasia.

IMPG operations specialise primarily in heat set web offset products, a broad range of high quality sheet-fed machines and the necessary ancillary equipment. Plants are located in Sydney, Melbourne and Brisbane.

IPMG is proposing to install new rotogravure presses at the Warwick Farm site which will require refurbishment of the existing warehouse and an extension of 4,000m^2 on the eastern side of the building. Refer Figure 2-1.

FIGURE 1-1 LOCATION OF THE SITE



2 DESCRIPTION OF PROPOSED OPERATIONS

2.1 PROPOSED OPERATIONS

OVERVIEW OF MAIN AREAS OF THE PRINTING PROCESS

IPMG is a major entity in print production of newspapers, magazines and catalogues for national distribution. The following groups of activities would occur at the proposed Warwick Farm print facility:

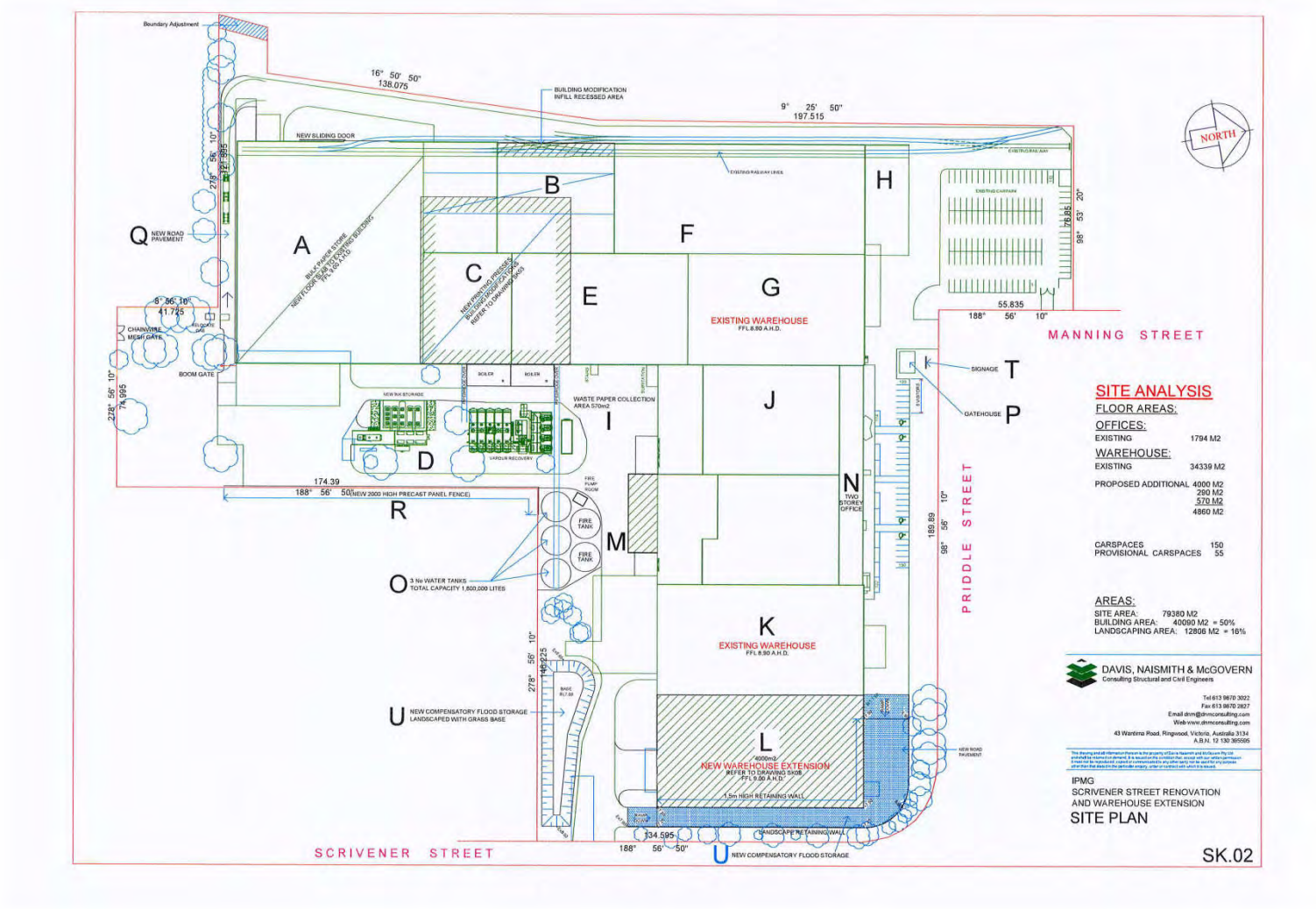
- Receiving
- Warehouse
- Print production, including cylinder preparation and the roto-gravure printing press operations
- Binding
- Despatch.

Refer to Figure 2-1 for a site plan of the proposed development. Section 2.2 outlines the proposed hours of operation, while Section 2.3 provides an overview of potential odour emission sources both from on-site printing activities and other sources off-site.

2.2 HOURS OF OPERATION

IPMG proposes to operate the printing facility 24 hours per day, seven days per week.

FIGURE 2-1 SITE PLAN



2.3 POTENTIAL ODOUR EMISSION SOURCES

2.3.1 PRINTING PROCESS

The operational area that is considered a primary potential odour source is the Press Room. The ink that is used in the presses contains toluene as a solvent for diluting the ink solids. Toluene has the potential to be odorous. The Vapour Recovery System (VRS) will be used to clean the toluene gaseous emissions prior to release to atmosphere. The toluene recovered from the exhaust gas stream will be re-used in the printing process. This VRS will minimise odorous emissions to atmosphere.

The ink storage tanks and transfer of ink from Stolt transport container tanks which carry the ink from the manufacturer are not considered sources of odour emission.

The reason for this conclusion is that the potentially odorous toluene solvent vapours emitted during the transfer of ink from the tanker transport to the storage tank, where ink displaces air in the headspace of the storage tank, will be returned to the tanker transport via a sealed pumping system. The air displaced from the tank will be the equivalent volume to the liquid delivered to the storage tank from the transport tanker. This returned vapour is then recovered by the manufacturer or transport company at their purpose designed terminal facility. Therefore this presents a closed loop with solvent emissions and odours being contained in the transport vessel and not emitted to atmosphere.

This vapour recovery activity is a recognised standard process used in the petroleum industry throughout most metropolitan cities of Australia.

Section 3 provides an overview of the regulatory emission limits that are associated with odour and odorous chemical emissions.

Section 4 provides a description of the Press Room, including the printing process and its associated emission control and toluene solvent recovery system (VRS). Refer to Area C of Figure 2-1 for location of this part of the process.

2.3.2 OTHER POTENTIAL ODOUR SOURCES ASSOCIATED WITH THE PROPOSED PRINTING PROCESS

Natural gas fired boilers will be required onsite to produce steam for supplying heat to the Dryers on each Press for curing printed ink; and, to supply actual live steam to the vessel in the VRS that is undergoing desorption. This desorption stage will demand steam to desorb the collected toluene from the surface of the activated carbon in the VRS and then recover the solvent for re-use.

There are two 8 MW natural gas fired boilers proposed for installation as part of this development. Each boiler will be operated in either Standby or Duty phase. The boilers are located adjacent to Area I in Figure 2-1.

These boilers will emit oxides of nitrogen and sulphur dioxide in low concentrations which generally would not be expected to be odorous. Carbon Monoxide will also be emitted but it is odourless. However, for completeness these emissions have been reviewed for their potential to have an odour impact on the receptors in the surrounding neighbourhood. Refer Table 3-1 for detail.

2.3.3 OTHER ODOUR SOURCES IN THE ADJACENT WARWICK FARM AREA

There are a number of potential odour sources in the Warwick Farm area including:-

- Sydney Water Sewage Treatment Works
- Georges River
- Warwick Farm Racecourse
- Local Stables and stable bedding
- Other heavy industry including Visy Recycling
- Main Rail Link and associated locomotive movements.

3 REGULATORY LIMITS – ODOUR

3.1 OVERVIEW

The NSW Protection of the Environment Operations (POEO) Act 1997 requires that Scheduled activities (as listed in Schedule 1 of the Act) do not produce offensive odour.

An offensive odour is defined in the POEO Act as:

"an odour that …..is harmful to (or is likely to be harmful to) a person … or interferes unreasonably with (or is likely to interfere unreasonably with) the comfort or repose of a person who is outside the premises from which it is emitted…"

It is proposed that IPMG Warwick Farm will not be classified as a Scheduled Premise, and therefore may not need to directly comply with the POEO Act. However, even as a non-scheduled premise, which would then fall under Liverpool Council jurisdiction, it will most likely still be necessary to comply with these odour assessment requirements.

The documents T*echnical Framework: Assessment and Management of Odour from Stationary Sources in NSW* and associated T*echnical Notes* were published in 2006 to assist with implementation of the *POEO Act* and to facilitate standardisation of odour assessment and management practices in NSW. In particular, the *Technical Framework* is a guide for consent authorities and regulators for assessing proposals and setting licence and consent conditions.

Proposals for new activities must demonstrate that the relevant odour criteria outlined in Section 3.2 are met.

3.2 SOURCE EMISSIONS

Schedule 4 of POEO (Clean Air) Regulations refers to Standards of Concentration for Scheduled Premises: General Activities and Plant for air pollutants other than odour.

Table 3-1 summarises the emission limits for odorous emissions from the various stacks associated with the Press Room and Boiler House. Group 6 refers to Premises which are currently being scheduled or new developments awaiting Approval after 1 September 2005.

However, it is understood that this plant will not be Scheduled and, hence, will be regulated by limits for Non-Scheduled premises; that is, Group C. However, there are limited Regulatory requirements for Group C emissions so the more stringent Group 6 Limits have been included to facilitate assessment.

There are no Group C emission limits for odour.

TABLE 3-1 POEO EMISSION LIMITS – GROUP 6

Activity	Air Impurity	Emission Control (Stack)	Group 6 Limits of Concentration (mg/m^3)
Press Room	VOC (toluene) (as n-propane)	VRS	40
Steam generation by NAG Boilers	Oxides of Nitrogen	Stack	350
Steam generation by NAG Boilers	Sulphur Dioxide	Stack	NS
Steam generation by NAG Boilers	Carbon Monoxide (Odourless)	Stack	NS

Note:

mg/m^3 = milligrams per cubic metre @ 0C and 1 atmosphere pressure

VRS = Vapour Recovery System

NS = Not Specified

3.3 ODOUR ASSESSMENT CRITERIA AT GROUND LEVEL– COMPLEX MIXTURES

All activities carried out in NSW must use best management practices to prevent or minimise odour emissions.

For complex mixtures of odour, odour assessment criteria are prescribed in odour units (ou). Refer *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (August 2005)* Table 7.5: Impact assessment criteria for complex mixtures of odorous air pollutants (nose-response-time average, 99th. percentile (EPA 2001). The number of odour units (ou) in each odour assessment criteria (range of 2 ou to 7 ou) is inversely proportional to population (greater than 2000 to less than 2 people). Refer to Table 3-2 for summary of the impact assessment criteria.

TABLE 3-2 DECC IMPACT ASSESSMENT CRITERIA FOR COMPLEX MIXTURES (NOSE-RESPONSE-TIME AVERAGE, 99TH PERCENTILE)

Population of Affected Community	Odour Units (ou)
Urban (>~2000 or more) and/or schools and hospitals	2.0
~500	3.0
~125	4.0
~30	5.0
~10	6.0
Single rural residence (~2)	7.0

The IPMG proposed printing operation will be required to comply with the 2 ou criteria outside the boundary of the site based on the assumption that the odour emission will be a complex mixture of odorous compounds. However, since the primary odorous chemical involved in the printing process will be toluene, it may be appropriate to not classify this odour assessment as complex but rather defer to the Impact Assessment Criteria (IAC) for the single odorous emission compound, toluene. This IAC for toluene has been developed based on the odorous nature of toluene.

3.4 GROUND LEVEL CONCENTRATION IMPACT ASSESSMENT CRITERIA (IAC) – INDIVIDUAL POLLUTANTS

The NSW DECC *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (August 2005)* sets out the design ground level concentration (DGLCs) to be met at the nearest sensitive receptor.

These DGLC's are presented in *Approved Methods – Impact Assessment Criteria (IAC)* Table 7.4a of for individual odorous air pollutants. This Table presents the IAC for toluene as 0.36 milligrams per cubic metre (mg/m^3) with an averaging period of 1 hour.

This IAC for toluene has been designed based on the odorous nature of this air pollutant rather than toxicity.

The odour threshold for toluene is reported as being in the range of 8 to 19 mg/m^3. These Odour Thresholds have been collated by the American Society for Testing and Materials (ASTM) in their *Compilation of Odor and Taste Threshold Values Data*.

Therefore, an IAC at ground level of 0.36 mg/m^3 would be below the odour threshold for toluene and should have no detectable odour.

Furthermore, toluene is the only VOC to be used in this process and may thus be considered to be a single odorous chemical emission rather than a "complex mixture of odorous air pollutants" as referred to in the *Approved Methods*.

Hence, ORLA is using the IAC at ground level for toluene as the odour assessment criteria for this proposal. If the IAC at ground level is met, then ORLA is assuming the Odour Assessment Criteria of 2 ou for complex mixtures will also be achieved because the IAC was developed by DECC for toluene as an individual odorous pollutant.

However, if the odour associated with the Boiler House emissions appeared significant relative to the toluene solvent emission from the VRS serving the Press Room then the total emission would need to be treated as a complex mixture.

The IAC (1-Hour Average) for each of the Boiler House emission parameters that potentially may have an odour characteristic is:

- Oxides of Nitrogen - 0.246 mg/m^3
- Sulphur Dioxide - 0.570 mg/m^3
- Carbon Monoxide (odourless) - 30 mg/m^3

4 POTENTIAL ODOUR EMISSION SOURCE: PRESS ROOM AREA

4.1 ORGANIC VAPOURS FROM PRINTING PROCESS - DESCRIPTION

The Press Room will consist initially of 2 x 8 unit roto-gravure presses, which are located side by side, with provision for a third press. The Press Room is located in Area C of Figure 2-1.

The paper rolls are delivered automatically to the reel stands at the rear of each press adjacent to the paper store.

The paper roll up to 3.18 metres wide, is unwrapped and prepared prior to being lifted onto the reel-stands where the paper is unwound from the roll by the press. Each press consists of 8 printing units each printing unit prints and dries one of 4 primary colours first to one side of the web of paper then to the reverse side of the web of paper in a continual process.

Toluene vapour is emitted from each printing unit during the drying phase of the printing process; it is collected via sealed hoods and ducted back to the VRS. The VRS is located in Area D in Figure 2-1, externally to the main building where the toluene is recovered for re-use. Section 4.2.1 provides detail on the VRS.

4.2 ODOUR EMISSION CONTROLS – TOLUENE SOLVENT VAPOUR RECOVERY

Toluene is the solvent that dilutes and carries the ink to the roto-gravure press and is integral to the printing process. Rather than being incinerated the solvent is removed from the print process via sealed hoods and ducting to the solvent VRS (Activated Carbon). The solvent is removed from the air using activated carbon adsorption and the toluene solvent is recovered from the surface of the carbon by steam separation/regeneration process.

Section 4.2.1 describes in detail the Activated Carbon VRS to be used, while Section 4.2.2 outlines where the recovered toluene solvent from the VRS is stored on site for re-use.

4.2.1 ACTIVATED CARBON VAPOUR RECOVERY SYSTEM (VRS)

Regenerable Type Adsorbers

This regenerable activated carbon adsorption technology using steam as the regeneration medium is proposed for IPMG at Warwick Farm and has been incorporated into the design of the facility.

The adsorption process occurs under defined pressure and temperature conditions. By changing the pressure or temperature of the adsorber beds, the activated carbon can be made to release the adsorbed material. This released material (recovered solvent) can then be captured and either re-used in the process or sold back to the ink manufacturer for re-use in ink production. Common on site regeneration techniques are the injection of steam into the carbon beds or drawing a vacuum on the carbon beds. The proposed VRS utilises the former; that is, steam extraction/regeneration techniques.

The activated carbon beds in a regenerable activated carbon system generally need to be replaced every 5 years or so because toluene solvent molecules or droplets, which become trapped in the interstices of the carbon, can gradually build up in the activated carbon beds, reducing the adsorption capacity of the carbon which can lead to the need for increased desorption times and shorter time for each adsorption cycle.

Advantages of a VRS over a thermal oxidation/incineration unit are both the recovery of reusable solvent and a substantial reduction in Greenhouse Gas Emissions from both solvent emissions and products of combustion emissions from the thermal oxidation process including Carbon Dioxide (CO_2) and Oxides of Nitrogen (NO_x) emissions.

Figure 4-1 presents schematic drawing of the VRS.

Refer to Figure 4-2 for plan layout of the Recovered Solvent Storage Tanks and the VRS which incorporates five adsorption vessels which contain approximately 21 tonnes of carbon each. These adsorption vessels are programmed to cycle to desorption on demand or, alternatively, on a fixed time cycle during the solvent vapour recovery process.

Figure 4-3 presents building elevations in particular, Part South Elevation, which shows location of VRS and a stack height of 15 metres.

The type of VRS proposed is currently operated in Italy, Europe and USA with typical discharge concentrations of 15 mg/m^3 of toluene which is in compliance with POEO (Clean Air) Regulation limit of 40 mg/m^3 (as n-propane). Refer Table 4-1 for recent continuous emission measurements (CEMS) from a similar printing plant in Europe.

FIGURE 4-1 SOLVENT VAPOUR RECOVERY SYSTEM SCHEMATIC

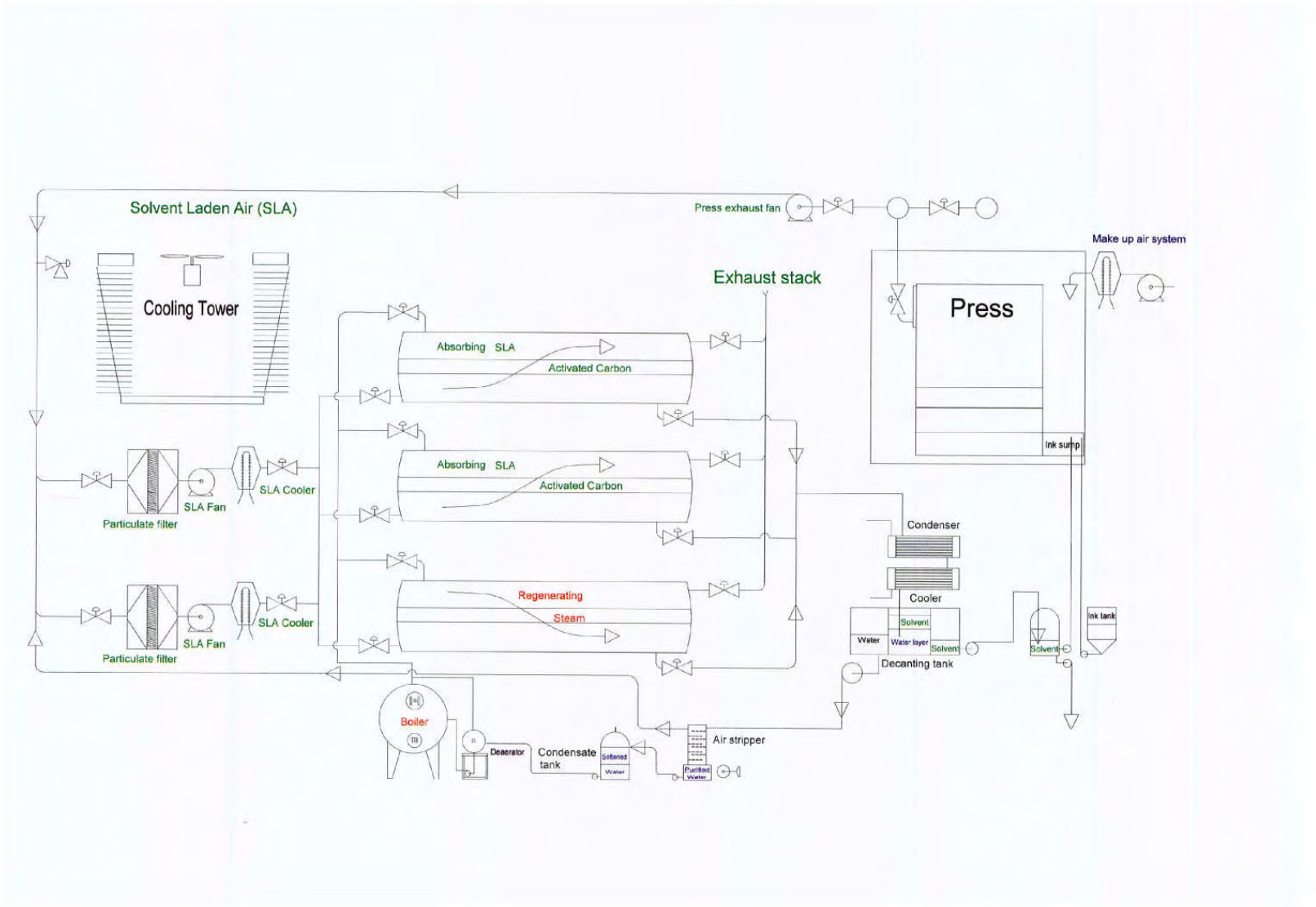


FIGURE 4-2 VAPOUR RECOVERY SYSTEM AND STORAGE TANK LAYOUT PLANS

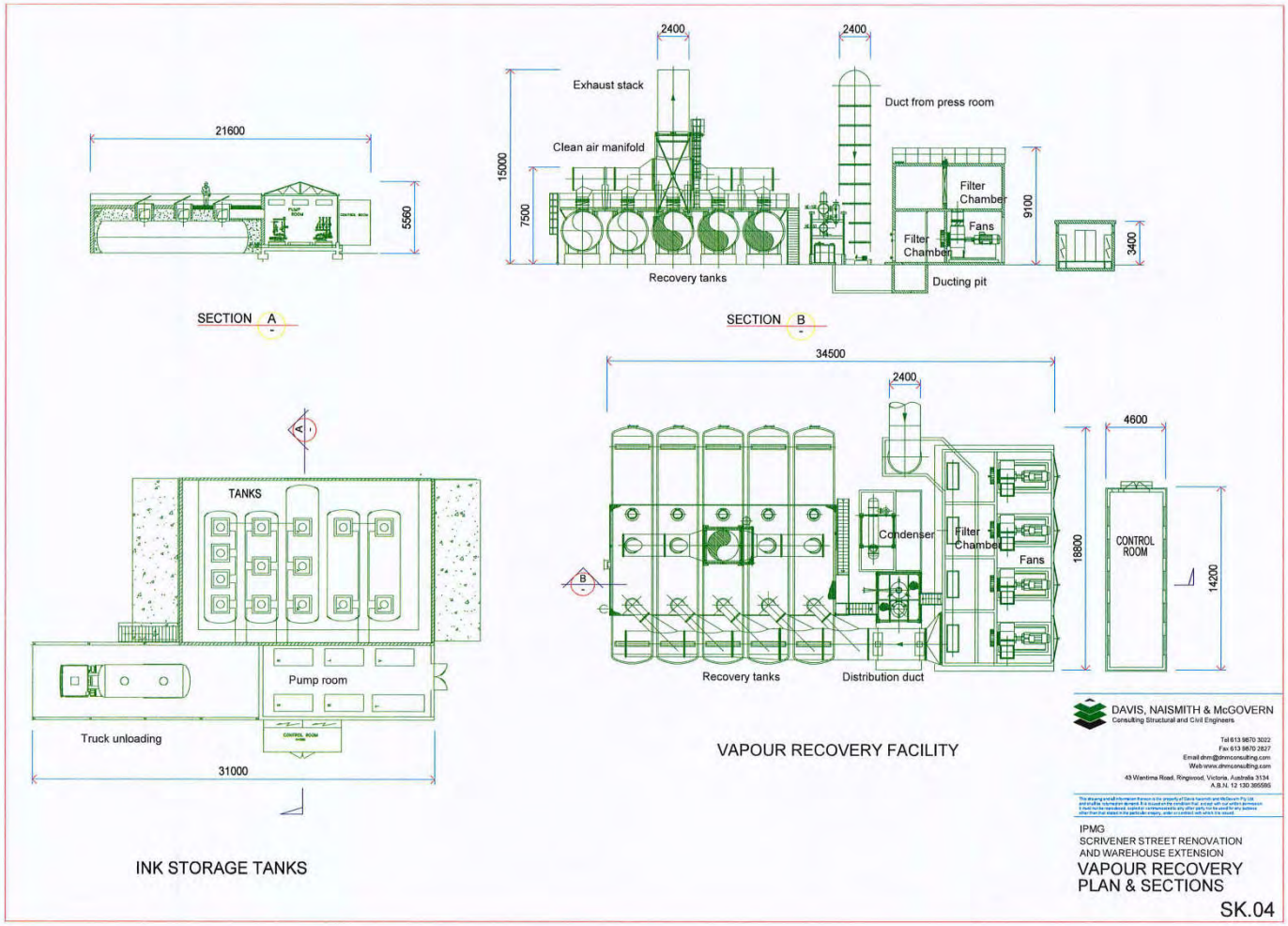


FIGURE 4-3 BUILDING ELEVATIONS

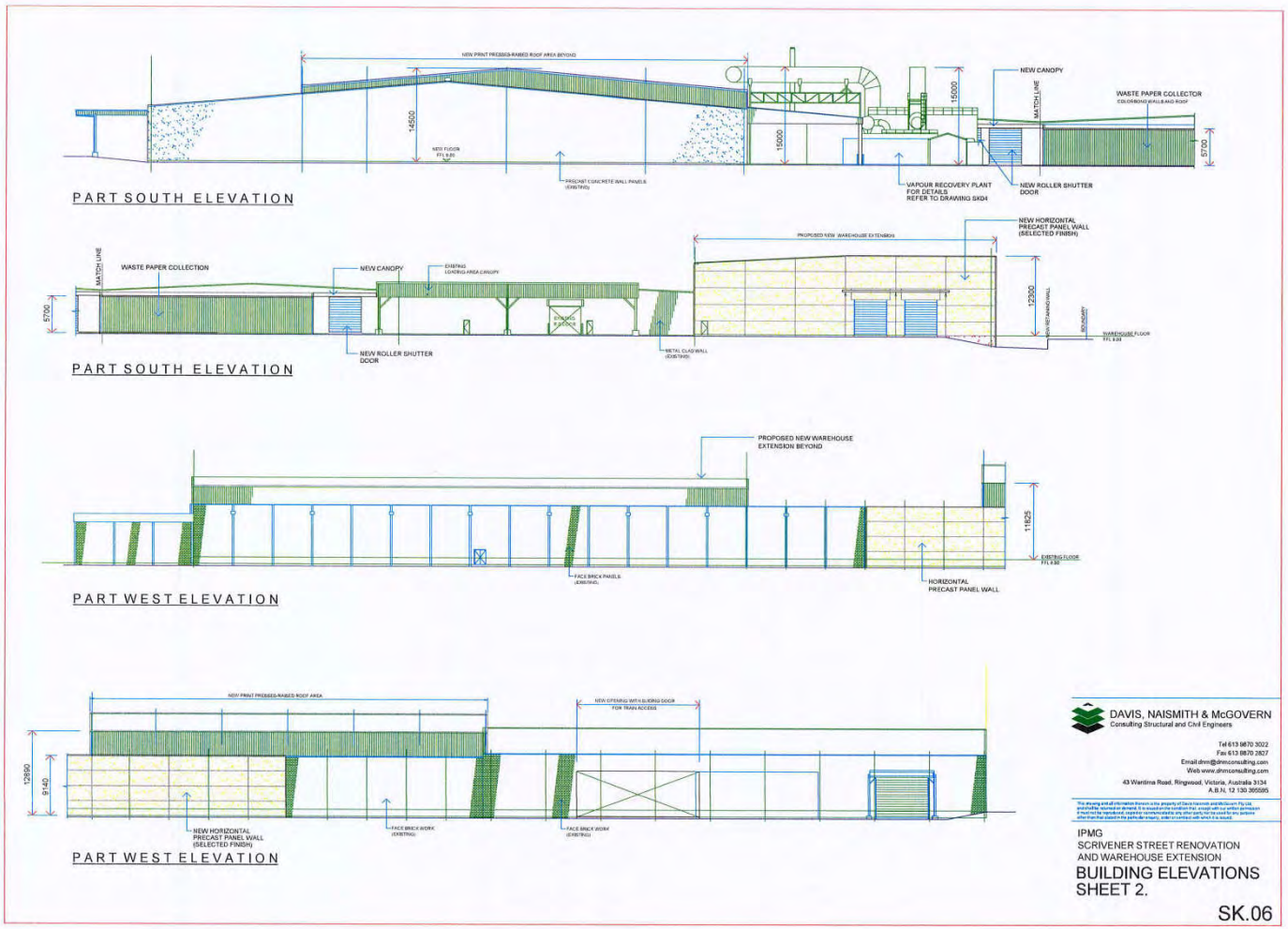


TABLE 4-1 CONTINUOUS TOLUENE EMISSION MEASUREMENT SYSTEM (CEMS) RESULTS FROM ROTO-GRAVUREPRINTING PRESSES SERVED BY A VRS (LENGLETGRAVURE,FRANCE)

Date	Average Toluene Emission Concentration (mg/m³)	Average VOC (as n-propane) emission concentration (mg/m³)
28/7/2008	8.83	4.26
29/7/2008	5.88	2.83
30/7/2008	13.51	6.51
31/7/2008	58.20	28.1
1/8/2008	7.65	3.69
2/8/2008	5.73	2.76
3/8/2008	6.49	3.13
4/8/2008	5.26	2.54
5/8/2008	4.45	2.15
6/8/2008	4.66	2.25
7/8/2008	9.03	4.35
8/8/2008	4.59	2.21
9/8/2008	6.58	3.17
10/8/2008	5.81	2.80
11/8/2008	5.71	2.75
12/8/2008	2.93	1.41
13/8/2008	5.73	2.76
14/8/2008	4.84	2.33
15/8/2008	5.10	2.46
16/8/2008	3.30	1.59
17/8/2008	3.42	1.65
18/8/2008	7.91	3.81
19/8/2008	6.86	3.31
20/8/2008	2.91	1.40
21/8/2008	10.04	4.84
22/8/2008	5.44	2.62
23/8/2008	3.70	1.78
24/8/2008	4.54	2.19
25/8/2008	4.39	2.12
26/8/2008	5.91	2.85
27/8/2008	3.33	1.61

Key:
mg/m³ = milligrams per cubic metre

5 ODOUR EMISSIONS AND GROUND LEVEL IMPACTS

5.1 PROPOSED STACK EMISSIONS

The VRS and the Boilers have been designed to release minimal odour emissions to atmosphere. The predicted emission concentrations and relative mass emission rates and emission limits are outlined in Table 5-1.

TABLE 5-1 PROPOSED EMISSION LEVELS FROM EXHAUSTGAS CLEANING SYSTEMS

Activity	Air Impurity	Emission Control (Stack)	Proposed Emission Concentrations (mg/m^3)	Proposed Mass Emission Rate(g/s)	Group 6 Limits of Concentration (mg/m^3)
Press Room	VOC (toluene)(reported as n-propane)	VRS	35**	1.4	40*
Steam generation by NAG Boilers	Oxides of Nitrogen	Stack	5 – 100	0.023 - 0.455	350
Steam generation by NAG Boilers	Sulphur Dioxide	Stack	< 5	< 0.023	NS
Steam generation by NAG Boilers	Carbon Monoxide (Odourless)	Stack	0 - 90	0 – 0.410	NS

Notes re Table 5-1:

Mass Emission Rates calculated based on the given exhaust gas flow rates for the nominated emission sources; that is,

- VRS = 40 m^3/s and for
- Boiler = 4.55 m^3/s

* calculated		Regulation limit for VOC (as n-propane) reported as the equivalent molecular weight of toluene
** VOC	=	Proposed worst case toluene emission reported as if it were n-propane as required by Group 6 of Clean Air Regulations
<	=	less than
g/s	=	grams per second
NAG	=	Natural Gas fired boilers
NS	=	Not Specified
mg/m^3	=	milligrams per cubic metre @ 0C and 1 atmosphere pressure
VOC	=	Volatile Organic Compounds
VRS	=	Vapour Recovery System

5.1.1 CONCLUSION

Although the collected data and calculated mass emission rates show that VOC (as toluene) emissions and other boiler emission parameters comply with the Group 6 emission limit as set out in the *POEO (Clean Air) Regulation 2002,* they do not indicate whether these gaseous emissions will give rise to odour at ground level.

Therefore, even with this ready compliance IPMG has gone the extra step to show that the toluene and associated odour emissions, that comply with the Regulation stack emission limits, will also comply with Ground Level Impact Assessment Criteria.

5.2 PREDICTED GROUND LEVEL CONCENTRATIONS OF ODOROUS COMPOUNDS – INDIVIDUAL IMPACT ASSESSMENT CRITERIA (IAC)

5.2.1 INTRODUCTION

Toluene was selected as the emission parameter of choice as an indicator of the likely impact of odorous emissions from this proposed process; that is, toluene is the emission parameter from this site which is most likely to be a source of odour emission. Thus, toluene was used as the appropriate test of suitability for odour emissions from the proposed process and associated emission controls.

As previously referred to in Section 3.3, the DECC Impact Assessment Criteria (IAC) for toluene is 0.36 mg/m^3 which is much lower than the previously referenced threshold of detection of toluene odour (8 to 19 mg/m^3) .

Therefore, if the predicted ground level concentration (GLC) of toluene is less than the IAC for toluene then odour will not be detectable at ground level. By definition odour becomes detectable at one (1) odour unit (ou) concentration which is referred to as the Threshold of Detection for that particular odour. The DECC IAC for toluene of 0.36 mg/m^3 which, by definition, is based on the threshold of detection of toluene odour.

Therefore, if the ground level concentration of a particular odorous compound is less than the IAC for that odorous compound then the odour concentration will be less than 1 ou. It then follows that that the odour associated with that GLC will also be less than the DECC Odour Assessment Criteria of 2 ou.

However, this line of reasoning is only relevant if there is a complex mixture of odorous compounds. Where there is an individual compound that will have the predominant influence on any odour impact then the IAC will take precedence. In this situation the 2 ou Odour Assessment Criteria ceases to be relevant.

5.2.2 ATMOSPHERIC DISPERSION MODELLING

BACKGROUND

Holmes Air Sciences was engaged by ORLA to conduct atmospheric dispersion modelling of toluene emissions from the proposed VRS to determine the impact at ground level of these emissions. This dispersion modelling was performed using the computer based AUSPLUME dispersion model.

This modelling process requires various input data to define the local characteristics. These characteristics include a terrain file to show both natural and built topographic variations, meteorological file to reflect the variables of wind speed and wind direction, temperature and relative humidity and an emissions inventory file to define what mass of emissions would be discharged from the stacks on-site.

This data is then entered into the Regulatory AUSPLUME Dispersion Model which is used to predict what the ground level concentration of these emissions would be after discharge from the stack. AUSPLUME dispersion model was developed for the Victorian EPA and is still considered the Regulatory model of choice for Gaussian distribution of emissions in non-complex terrain. The output of the model will then be used to confirm an appropriate stack height and pollution control efficiency of the VRS.

TYPE OF IMPACT ASSESSMENT

Modelling was undertaken using the computer based dispersion model AUSPLUME, version 6.0. AUSPLUME is a Gaussian plume dispersion model whose mathematical basis derives from the Victorian Environment Protection Authority's "Plume Calculation Procedure" (EPAV 1985), which is an extension of the ISC model of Bowers et al. (1979). It is designed to predict ground-level concentrations or dry deposition of pollutants emitted from one or more sources, which may be stacks, area sources, volume sources, or any combination of these. Line source are not explicitly handled, but it is possible to improvise by modelling with multiple volume sources (Environment Protection Authority of Victoria).

AUSPLUME requires as input:

- A meteorological data set which contains information on wind speed, wind direction, wind direction variability (sigma theta), temperature, mixing height and stability class
- Information on each emission source to be considered
- Information on significant buildings in the area surrounding the emission points
- And optionally, if terrain features are to be taken into consideration, a terrain data set for both the topography and buildings.

METEOROLOGICAL DATA

Meteorological data used in the dispersion modelling was obtained for Liverpool by Holmes Air Sciences from nearby Sydney Water Sewerage Treatment Plant and Bureau of Meteorology.

The presence of topographic features, buildings or vegetation increases the ground's surface roughness. For all but the unstable categories (where convective turbulence dominates), the effect of surface roughness is to increase the vertical mixing of the plume because of the enhanced mechanical turbulence generated as the air moves over the ground.

Reported values of surface roughness in the literature vary greatly even for the same nominal land use. AUSPLUME allows the user to enter the surface roughness (Environment Protection Authority of Victoria).

TERRAIN DATA AND DISCREET RECEPTORS

The local terrain is relatively flat, therefore additional terrain data was not incorporated in the model. The model receptor grid was set at 100 metre spacing in the east-west and north-south directions over the full model domain.

As the purpose of the modelling was to determine the predicted impact of emissions on the residential area surrounding the site, no specific discreet receptors were set up in the model.

BUILDING WAKE/DOWNWASH EFFECTS

As winds approach buildings and other structures, the wind tries to flow over or around the structure. This results in higher air pressures on the upwind side of the structures and lower air pressures on the downwind (lee) side of the structures. Depending on the discharge height of the stack relative to building or structure heights the lower pressures on the downwind side of buildings can cause plumes from stacks and other building openings to be trapped in the wake air flows, which increase ground level impacts and decrease the effects of dispersion on the downwind side of the buildings. This scenario is referred to as building wake or building down wash effects.

The AUSPLUME model contains options for including the effects of building wakes/downwash in the calculations, and the PRIME method of wake effect calculation was used for the modelling undertaken for this report.

The PRIME method requires the projected building heights and widths as input to calculate the effects of building downwash (the projected building heights and widths will vary depending on the building geometry and the wind direction). A utility within AUSPLUME, the US Building Profile Input Program (BPIP) was used to estimate the projected building heights and widths required. This version of BPIP also estimates additional parameters required by the PRIME building downwash algorithms.

Building downwash (wake) effects from major structures on the site were incorporated in the modelling. Figure 5-1 shows the plan view of building structures which have been incorporated in the model and their orientation in relation to the stack.

INPUT DATA

To optimise the modelling process a number of potential combinations of stack height and emission rate were selected.

Initially, there were three (3) different stack heights modelled. Stacks heights of 12 metres, 15 metres and 24 metres were selected to determine if a short stack of similar height to surrounding buildings would suffice or whether a tall stack, which would require further planning approval, may be required to satisfactorily disperse the toluene emission. However, when the modelling predictions for the shorter stack heights complied with IAC's, the taller stack option was deleted.

Toluene emission rates of 1.2 and 1.6 grams per second were derived as emissions input data from an exhaust gas flow rate of 30 or 40 cubic metres per second and a discharge concentration of 40 mg/m^3.

This concentration is numerically equal to the POEO Clean Air Regulation limit for VOC's as n-propane but the toluene emission will be approximately 50% of this emission limit. These modelling scenarios are presented in Table 5-2.

TABLE 5-2 ATMOSPHERIC DISPERSION MODELLING SCENARIOS

	Case 1	Case 2	Case 3	Case 4
Stack Height (m)	12	12	15	15
Exhaust Gas Flow Rate (m^3/s)	30	40	30	40
Stack Exit Velocity (m/s)	11.3	15	11.3	15
Toluene Emission Rate (g/s)	1.2	1.6	1.2	1.6

Notes:
Constants used in Modelling Scenarios in Table 5-2 were:-

- Stack Tip Diameter = 1.84 m
- Exhaust Gas Temperature = 25 °C
- VOC (as toluene) Emission Concentration = 40 mg/m^3

Key:
°C = Degrees Celsius
g/s = grams per second
m = metres
m/s = metres per second
mg/m^3 = milligrams per cubic metre@ 0 °C and 1 atmosphere pressure

SENSITIVE RECEPTORS/ SURROUNDING LAND-USES

The location of the proposed development at Warwick Farm is surrounded by industrial facilities to the East and South, Liverpool Hospital to the South West, residential property to the North and across the Rail Line to the West and High School across the main South West rail line to the West of the site.

Figure 5-1 is an aerial photograph of the site and areas in the immediate vicinity, while Figure 5-2 shows the location of the local schools and hospital. The nearest industrial site, residence(s), hospital, high school were used in the dispersion modelling as receptors.

FIGURE 5-1 AERIAL PHOTOGRAPH OF THE PROPOSED IPMG SITE

FIGURE 5-2 SITE SHOWING LOCAL SCHOOLS AND HOSPITAL

5.2.3 ATMOSPHERIC DISPERSION MODELLING RESULTS

These scenarios were modelled using the computer-based AUSPLUME dispersion model. Table 5-3 summarises the results from the AUSPLUME dispersion modelling based on a 1-hour averaging period as required by the *Approved Methods* in NSW.

TABLE 5-3 DISPERSION MODELLING PEAK GROUND LEVEL CONCENTRATION OF TOLUENE RESULTS – 1 HOUR AVERAGING PERIOD 99TH. PERCENTILE.

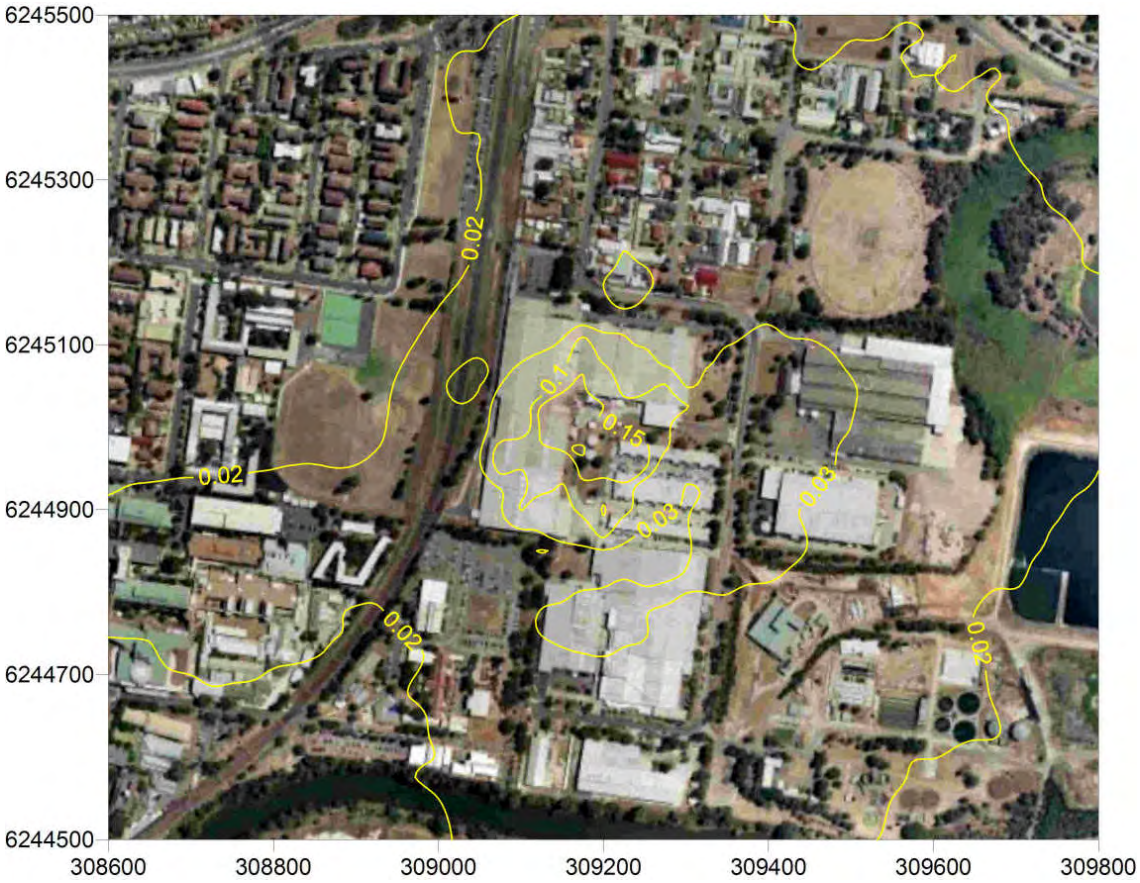
Toluene Ground Level Concentration (mg/m^3)	A: Boundary (Industrial) (33 m from stack)	B: Manning St Residence (250 m from stack)	C: Priddle & Manning St (218 m from stack)	D: Hospital (500 m to rear buildings)	E: High School (500 m)	DECC DGLC (Impact Assessment Criteria) for toluene (mg/m^3)
Case 1	0.10	0.03	0.05	<0.03	<0.03	0.36
Case 2	0.15	0.05	0.05	<0.03	<0.03	0.36
Case 3	0.15	0.03	0.03	0.02	<0.02	0.36
Case 4	0.2	0.06	0.06	0.03	<0.02	0.36

Although Table 5-3 reports the 99th percentile the actual modelling was performed to the more stringent 99.9th percentile. Figures 5-3 and 5-4 present the 99.9th percentile 1-hour average plots of the results for Cases 3 and 4 respectively of atmospheric dispersion modelling of toluene emissions from the proposed printing operations.

As discussed in Section 3.3, if the toluene IAC is complied with, then the odour associated with toluene will be below the odour threshold for toluene and therefore not be detectable at ground level; that is, less than 2 ou. The modelling showed compliance with the IAC and therefore odour levels at the nearest sensitive receivers will also comply with the 2 ou Odour Impact Assessment Criteria.

Alternatively, if toluene is the individual pollutant with odour potential then the IAC for toluene takes precedence and the 2 ou Odour Assessment Criteria proscribed for complex mixtures is no longer the relevant criteria to determine odour impact at ground level.

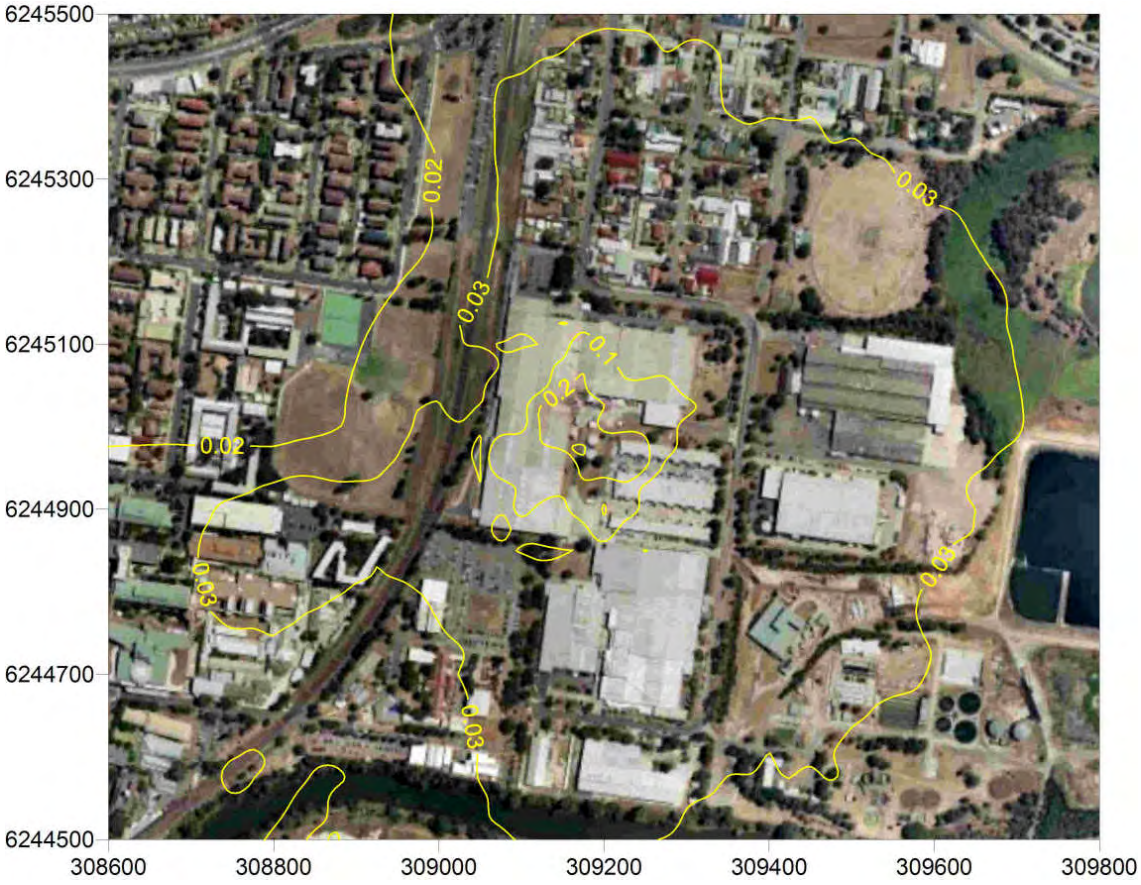
FIGURE 5-3 DISPERSION MODELLING PLOT OF TOLUENE EMISSIONS (CASE 3)



Predicted 99.9th percentile 1-hour toluene concentration (mg/m³)
Emission rate of 1.2 g/s

Key:
Dimensions in metres: Grid is 1200 metres by 1000 metres

FIGURE 5-4 DISPERSION MODELLING PLOT OF IMPACT ASSESSMENT (CASE 4)



Predicted 99.9th percentile 1-hour toluene concentration (mg/m^3)
Emission rate of 1.6 g/s

Key:
Dimensions in metres: Grid is 1200 metres by 1000 metres

5.2.4 OTHER ODOROUS EMISSION PARAMETERS

In addition to toluene from the printing process, some boiler emission parameters were identified as potentially being odorous. The mass emission rates for the additional parameters of oxides of nitrogen and sulphur dioxide in addition to toluene have been presented in Table 5-1. These mass emission rates have in turn been compared with the IAC's for oxides of nitrogen and sulphur dioxide previously presented in Section 3.3.

Each gaseous emission parameter will disperse at the same rate as toluene. Therefore, each of these other emission parameters from the Boiler house will readily comply with the IAC's and will therefore not present a chemical or odour impact outside the boundary of the site. This conclusion has been drawn from the relative mass emission rates and IAC's for the chemical compounds nominated in Table 3-3.

5.2.5 CONCLUSION

The predicted ground level concentrations of toluene presented in Table 5-3 indicate that all stack heights and emission rates will readily disperse the toluene emissions prior to coming to ground and, hence, will comply with the Impact Assessment Criteria as specified in the *Approved Methods for Modelling*.

Table 7.4a of these *Approved Methods for Modelling and Assessment of Air Pollutants in New South Wales* – Impact Assessment Criteria (IAC) for individual odorous air pollutants states the IAC for toluene as 0.36 mg/m^3 with an averaging period of 1 hour. This IAC for toluene has been designed based on the odorous nature of this air pollutant. If the IAC is complied with then the odour associated with toluene will be below the odour threshold for toluene and therefore not be detectable at ground level.

Similarly, the same dispersion rates will enable the boiler emission parameters of oxides of nitrogen and sulphur dioxide to be dispersed to less than their respective IAC's and also not be detectable at ground level outside the site boundary.

The prime reasons for the ready compliance with the IAC's are:-

- the design toluene solvent collection efficiency of the VRS rather than the stack height and
- the boiler design efficiency.

Therefore, a stack height of 15 metres was selected for the VRS for architectural and structural engineering reasons because the modelling has predicted ready compliance with IAC. The boiler stacks have been designed at 18 metres. Refer to Figure 4-3 for elevation drawing of the VRS and Stack.

6 CONCLUSIONS

The following conclusions are drawn from the data and assessment presented in this document:-

- **Toluene Emissions-Press Room**: Emissions of solvents, in particular toluene, will be controlled and recovered by a Vapour Recovery System (VRS). The recovered solvent will be returned to process with excess solvent being returned to supplier for reprocessing or sale. Emissions of Toluene will comply with the more stringent Group 6 Clean Air Regulation emission limits.

- **Toluene ground level concentration**s will be determined by the design efficiency of the VRS rather than stack height. That is, the toluene emission will be collected for re-use by the VRS rather than being emitted to atmosphere and then relying on time and distance to disperse those emissions.

  However, despite this ready compliance of stack emissions with the Group 6 Clean Air Regulation emission limits by recovering the solvent emission, dispersion modelling has also been performed to determine compliance of the ground level impact of these emissions with the Impact Assessment Criteria.

- **The Impact Assessment Criteria (IAC)** for the ground level concentrations of toluene is readily complied with using either a 12 metre or a 15 metre high discharge stack. Based on the mass emission rates, stack heights and the AUSPLUME dispersion modelling the odour potentially associated with toluene, oxides of nitrogen and sulphur dioxide will also comply with relevant IAC's.

- **Odour Impact Assessment Criteria** The IAC for toluene has been designed based on the odorous nature of this air pollutant. Therefore, if the predicted ground level concentrations (GLC) of toluene are less than the IAC for toluene then odour will not be detectable at ground level. By definition odour becomes detectable at one (1) odour unit (ou) concentration which is referred to as the Threshold of Detection for that particular odour. The DECC IAC for toluene of 0.36 mg/m^3 is based on the threshold of detection of toluene odour.

  Thus, if the ground level concentration of a particular odorous compound is less than the IAC for that odorous compound then the odour concentration will be less than 1 ou. It then follows that that the odour associated with that GLC will also be less than the DECC Odour Assessment Criteria of 2 ou.

- **Individual Odorous Compound rather than Complex Mixture.** Toluene is the only volatile organic compound to be used in this process and may thus be considered to be an individual odorous chemical emission rather than a "complex mixture of odorous air pollutants" as defined in the *Approved Methods*. This would imply that the IAC for toluene, which has been derived from the odorous nature of toluene, would take precedence over the 2 ou Odour Assessment Criteria for complex mixtures.

APPENDIX A – DIRECTOR GENERAL REQUIREMENTS

NSW GOVERNMENT
Department of Planning

Manufacturing & Rural Industries
Major Development Assessment
Phone: (02) 9228 6495
Fax: (02) 9228 6466
Email: megan.webb@planning.nsw.gov.au
Level 4 Western Gallery
23-33 Bridge Street
GPO Box 39
SYDNEY NSW 2001

Ms Vivienne Goldschmidt
JBA Urban Planning Consultants Pty Ltd
Level 7, 77 Berry St
NORTH SYDNEY NSW 2060

Dear Ms Goldschmidt

Director-General's Requirements
Warwick Farm Printing Project
Project Application 08_0088

The Department has received your application for the Warwick Farm Printing Project.

I have attached a copy of the Director-General's requirements for the project. These requirements have been prepared in consultation with the relevant agencies, and are based on the information you have provided to date. I have also attached a copy of the agencies comments for your information.

Please note that the Director-General may alter these requirements at any time.

If your proposal is likely to have a significant impact on matters of National Environmental Significance, it will require an approval under the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act). This approval is in addition to any approvals required under NSW legislation. It is your responsibility to contact the Department of Environment, Water, Heritage and the Arts in Canberra (6274 1111 or http://www.environment.gov.au) to determine if the proposal requires an approval under the EPBC Act. The Commonwealth Government has accredited the NSW environmental assessment process, so if it is determined that an approval is required under the EPBC Act, please contact me immediately as supplementary Director-General's requirements may need to be issued.

I would appreciate it if you would contact the Department at least two weeks before you propose to submit your Environmental Assessment for the project. This will enable the Department to determine the:

- applicable fee (see Division 1A, Part 15 of the Environmental Planning and Assessment Regulation 2000);
- consultation and public exhibition arrangements; and
- number of copies (hard-copy or CD-ROM) of the Environmental Assessment that will be required for exhibition purposes.

Once it receives the Environmental Assessment, the Department will review it in consultation with the relevant agencies to determine if it adequately addresses the Director-General's requirements, and may require you to revise it prior to public exhibition.

The Department is required to make all the relevant information associated with the project publicly available on its website. Consequently, I would appreciate it if you would ensure that all the documents you subsequently submit to the Department are in a suitable format for the web, and arrange for an electronic version of the Environmental Assessment to be hosted on a suitable website during the exhibition period.

If you have any enquiries about these requirements, please contact Megan Webb.

Yours sincerely

7 May 2008

Chris Wilson
Executive Director
Major Project Assessment
As delegate for the Director-General

2

Director General's Requirements

Section 75F of the *Environmental Planning and Assessment Act 1979*

Application number	08_0088
Project	Development of a printing, warehouse and distribution facility and associated infrastructure.
Location	23 Scrivener St, Warwick Farm, Lot 1 DP 774089
Proponent	Independent Print Media Group Pty Ltd
Date of Issue	7 May 2008
Date of Expiration	7 May 2010
General Requirements	The Environmental Assessment must include: • an executive summary; • a detailed description of the project, including the: – need for the project; – alternatives considered; – engineering and/or architectural plans for the proposed building works; and – various stages of the project; • consideration of the project against any relevant statutory provisions, including whether it is consistent with the objects of the *Environmental Planning and Assessment Act 1979*; • a general overview of all the environmental impacts of the project, identifying the key issues for further assessment; • a detailed assessment of the key issues specified below, and any other significant issues identified in the general overview of environmental impacts of the project (see above), which includes: – a description of the existing environment; – an assessment of the potential impacts of the project, including any cumulative impacts; – a description of the measures that would be implemented to avoid, minimise, mitigate, offset, manage, and/or monitor the impacts of the project; • a Statement of Commitments, outlining the proposed environmental management, mitigation and monitoring measures for the project; • a conclusion justifying the project, taking into consideration the costs and benefits of the project and the suitability of the site; and • a signed statement from the author of the Environmental Assessment certifying that the information contained in the report is neither false nor misleading.
Key Issues	• **Development Controls** – demonstrate that the proposal is generally consistent with the Liverpool Council's relevant *Development Control Plans*, and justify any inconsistencies between the project and these DCPs; • **Soil and Water** – including: – flooding; – a detailed water balance for the project, outlining the measures that would be implemented to minimise the use of water on site; – wastewater predictions, and the measures that would be implemented to treat, reuse and/or dispose of this water; – the proposed erosion and sediment controls during construction; – the proposed stormwater management system; and – consideration of the potential salinity, contamination and acid sulfate soil impacts of the project; • **Noise** – including construction, operational and traffic noise;

3

	• **Traffic and Parking** – including: – a detailed traffic impact study of the project on the safety and performance of the surrounding road network, and a description of the measures that would be implemented to upgrade and/or maintain this network over time; and – an assessment of the potential parking demand of the project; • **Hazards and Risk** - including a Preliminary Hazard Analysis (PHA) of the project; • **Air Quality** – particularly the potential Volatile Organic Compounds (VOCs) and dust emissions; • **Odour**; • **Visual Impacts** – including landscaping, the design and articulation of the building, lighting, any signage; impacts on nearby sensitive receivers and any measures to mitigate impacts; • **Greenhouse Gas and Energy** – calculate the scope 1 and 2 emissions of the project, and describe what measures would be implemented to ensure the operations on site are energy efficient; and • **Waste** – identify, classify and quantify the likely waste streams that would be generated by the project during construction and operation, and describe what measures would be implemented to minimise, reuse and/or dispose of this waste.
References	The Environmental Assessment should take into account relevant State government technical and policy guidelines. While not exhaustive, guidelines which may be relevant to the project are included in the attached list.
Consultation	During the preparation of the Environmental Assessment, you should consult with the relevant local, State or Commonwealth government authorities, service providers, community groups or affected landowners. In particular you must consult with the: • Department of Water and Energy; • Roads and Traffic Authority; and • Liverpool City Council. The consultation process and the issues raised must be described in the Environmental Assessment.
Deemed refusal period	60 days

State Government Technical and Policy Guidelines - For Reference

Aspect	Policy /Methodology
Soil and Water	
Erosion & Sediment Control	Managing Urban Stormwater: Soils & Construction (Landcom)
Stormwater	Managing Urban Stormwater: Council Handbook. Draft (EPA)
	Managing Urban Stormwater: Treatment Techniques (EPA)
	Managing Urban Stormwater: Source Control. Draft (EPA)
	Managing Urban Stormwater: Harvesting and Reuse (DEC)
Flooding	Floodplain Management Manual (DNR)
	Floodplain Risk Management Guideline
Acid Sulfate Soils	Acid Sulfate Soil Manual (ASSMAC)
Salinity	NSW Salinity Strategy (DLWC)
Water Quality	National Water Quality Management Strategy: Australian Guidelines for Fresh and Marine Water Quality (ANZECC/ARMCANZ)
	National Water Quality Management Strategy: Implementation guidelines (ANZECC/ARMCANZ)
	Using the ANZECC Guideline and Water Quality Objectives in NSW (DEC)
	Bunding and Spill Management (EPA)
	Approved Methods for the Sampling and Analysis of Water Pollutants in NSW (DEC)
Wastewater Reuse	National Water Quality Management Strategy: Guidelines for Sewerage Systems - Effluent Management (ARMCANZ/ANZECC)
	National Water Quality Management Strategy - Guidelines For Water Recycling: Managing Health And Environmental Risks (Phase1) (EPHC, NRMMC & AHMC)
Groundwater	National Water Quality Management Strategy Guidelines for Groundwater Protection in Australia (ARMCANZ/ANZECC)
	NSW State Groundwater Policy Framework Document (DLWC)
	NSW State Groundwater Quality Protection Policy (DLWC)
	Draft NSW State Groundwater Quantity Management Policy (DLWC)
Contamination	Australian and New Zealand Guidelines for the Assessment and Management of Contaminated Sites (ANZECC & NHMRC)
	National Environment Protection (Assessment of Site Contamination) Measure 1999 (NEPC)
	Managing Land Contamination - Planning Guidelines SEPP 55 – Remediation of Land (DUAP and EPA)
Noise	
	NSW Industrial Noise Policy (DECC)
	Environmental Criteria for Road Traffic Noise (NSW EPA)
	Environmental Noise Control Manual (DECC)
Traffic and Transport	
	Guide to Traffic Generating Development (RTA)
	Road Design Guide (RTA)
	Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (DECC)

5

Hazards & Risks	
	Applying Sepp 33: Hazardous And Offensive Development Application Guidelines (DUAP)
	Hazardous Industry Planning Advisory Paper No. 6 (HIPAP No 6): *Guidelines for Hazardous Analysis*, (DUAP)
	Multi-Level Risk Assessment (DUAP)
Air Quality	
	Protection of the Environment Operations (Clean Air) Regulation 2002
	Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DECC)
	Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (DECC)
Odour	
	Technical Framework: Assessment and Management of Odour from Stationary Sources in NSW (DEC)
	Technical Notes: Assessment and Management of Odour from Stationary Sources in NSW (DEC)
Visual	
	Control of Obtrusive Effects of Outdoor Lighting (Standards Australia, AS 4282)
Greenhouse Gas and Energy	
	National Greenhouse Accounts (NGA) Factors
	Guidelines for Energy Savings Action Plans (DEUS)
Waste	
	Waste Avoidance and Resource Recovery Strategy 2007 (DECC)
	Environmental Guidelines: Assessment Classification and Management of Non-Liquid and Liquid Waste (DECC)