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27th June 2006

Ms. Dorota Richards,
Office of Licensing and Guidance,
E.P.A.,
P.O. Box 3000,
Johnstown Castle Estate,
Co. Wexford.

Dear Dorota,

With reference to our IPPC application ref 748, I enclose supplementary information to the original information supplied.

Yours sincerely,

Eddie Cooke

Eddie Cooke
Quality & Technical Manager
SGPPL Ireland

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Environmental Protection Agency
28 JUN 2006

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Registered in Ireland No. 27944 • Registered Office: Kilrush, Co. Clare

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Saint-Gobain Performance Plastics IPPC Licence Application

Dispersion Modelling of Emissions to Air

12 June 2006
Final

Issue No 3
45078411 /

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Appendix A – ADMS Model Information

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1. INTRODUCTION

1.1. Background

URS Ireland was requested by Saint Gobain Performance Plastics to complete dispersion modelling of the main emissions to air from their site in Kilrush, Co. Clare. The EPA requested the preparation of an impact assessment as part of the site's application for an Integrated Pollution Prevention and Control (IPPC) licence. URS chose dispersion modelling as a means of consideration of the impacts of emissions to air. During a meeting with the EPA Licensing Inspector for the site in June 2005, it was agreed that only main emissions should be considered.

1.2. Site Operations

There are two production activities on site that result in emissions to air that are considered 'main emissions' as defined in the IPPC application guidance note:

1. In the 'Tower' production area, an aqueous flouropolymer (polytetrafluoroethylene, or PTFE) solution containing surfactants and other compounds in smaller quantities, is applied as a coating to various textile materials. The textile is passed through a bath in which the coating is applied to the material, and the material is then passed through a series of vertical towers where gas-fired burners heat the material to fix the PTFE coating to the textile. Extracted air from these towers is released to air via roof-mounted stacks. There are 14 main emission points from these towers (as specified in Table E of the licence application documents). Data on the stacks and their emissions as provided in Table E are employed in the modelling exercise. The input data employed in the model is described in more detail in Section 2;
2. In the other main production area, a pressure-sensitive adhesive is applied to textiles. The only main air emission point related to this process is the discharge stack from a Thermal Oxidiser (TO) installed at the site (emission point reference PSA6). The TO treats solvent laden gases extracted from two adhesive application lines located at the southern end of the production building. The TO operates at a temperature of approximately 750 °C to ensure destruction of the solvents in the waste gas stream.

The PTFE coating production facility usually runs 24 hours per day, 7 days per week with two to three weeks per annum shutdown for maintenance purposes. The pressure sensitive adhesion process operates approximately 80 hours per week.

1.3. The Dispersion Model

The dispersion model used for this study is ADMS 3.3, developed by Cambridge Environmental Research Consultants in the UK. This model is widely used in the UK, Ireland and Europe, and has been employed by URS in a wide range of modelling applications, including for the purposes of regulatory submission to the EPA (e.g. in

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relation to IPC/IPPC licensed sites). Further details on the model are included in Appendix A.

The dispersion model employs the emission data (and stack dimension parameters) from Table E.1(ii) and E.1(iii) of the IPPC Application Form (submitted to the Agency in September 2005) for each stack and assumes continuous emissions at the stated emission rates and temperatures. The impact of site buildings on dispersion of the stack releases is also assessed. Modelling of the emissions is carried out for each hour of a three-year period of meteorological data taken from Shannon Airport, in order to identify the worst-case ground level concentrations for each compound released from the stacks. The identified worst-case ground level concentrations can then be compared to available ground level concentration guideline values.

Section 2 of this report describes the model inputs and outputs, Section 3 details the available ground level concentration guideline values, while Section 4 presents the results of the modelling study.

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2. MODEL INPUTS

2.1. Meteorological Data

Prevailing weather conditions can have a significant impact on ground level concentrations of compounds released to air from stacks. Wind speed and direction, in particular, impact the location and magnitude of the maximum ground level concentrations.

A range of meteorological parameters is monitored by Met Éireann at their synoptic monitoring stations, including wind speed, wind direction, temperature, rainfall, cloud cover and humidity. There are significant variations between different stations in Ireland hence it is important that a station is chosen which is representative of the area under investigation. The Saint Gobain site is located close to the coastline on the northern shore of the Shannon Estuary. The meteorological data from the Shannon Airport synoptic monitoring station was identified as being representative of the meteorological conditions at the Saint Gobain site. The airport is also situated on the northern shore of the Shannon Estuary, approximately 40 kilometres east of Kilrush. In order to ensure that a range of likely meteorological conditions is included in the modelling assessment, three complete years of hourly meteorological data are included in the assessment, for 2001, 2002 and 2003.

The required meteorological input parameters for the model are:

- Wind speed;
- Wind direction;
- Temperature;
- Cloud cover;
- Month, day and hour data.

A summary of the temperature, wind speed and cloud cover data for each of the years is presented below, while wind roses for each year are included in Figures 2.1, 2.2 and 2.3. Cloud cover is measured in 'oktas', 0 to 8 shows the fraction, in oktas, of the celestial dome covered by all clouds.

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Table 2.1: Summary of Shannon Airport meteorological data used in the assessment

Parameter	2001	2002	2003
Average Cloud Cover (Oktas)	5.58	5.79	5.55
Minimum Wind Speed (m/s)	0.00	0.00	0.50
Average Wind Speed (m/s)	4.23	4.74	4.60
Maximum Wind Speed (m/s)	15.90	19.5	17.00
Minimum Temperature (°C)	-5.10	-0.90	-4.50
Average Temperature (°C)	10.64	10.92	11.10
Maximum Temperature (°C)	25.60	22.5	28.50

Figure 2.1: Wind rose for 2001, Shannon Airport

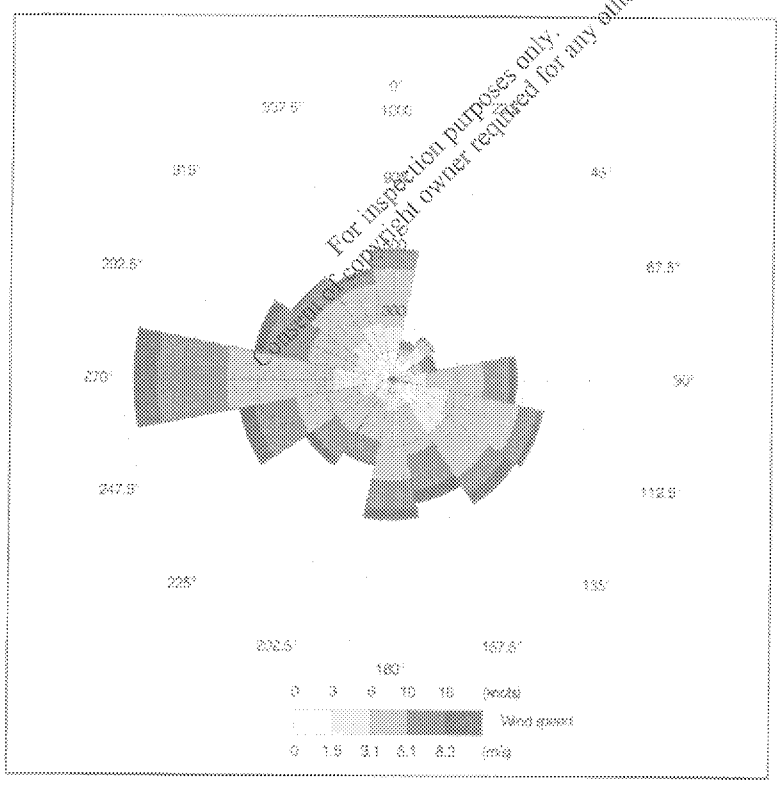

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Figure 2.2: Wind rose for 2002, Shannon Airport

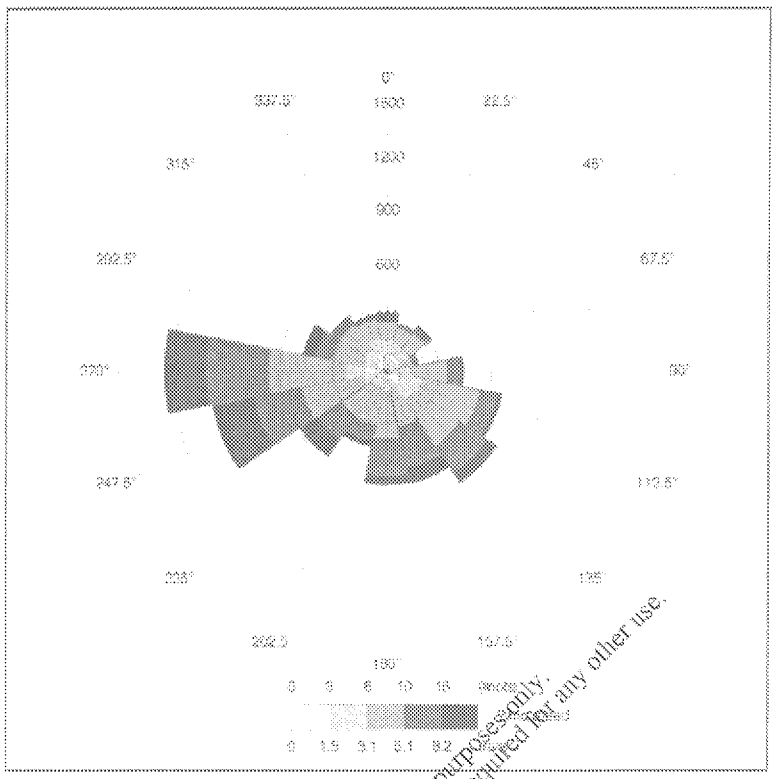
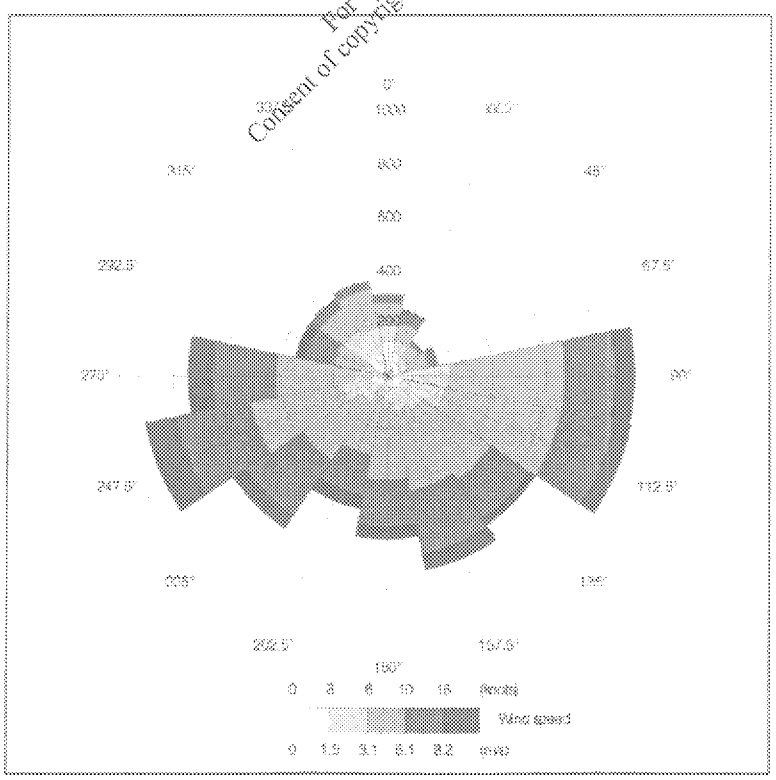


Figure 2.3: Wind rose for 2003, Shannon Airport



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2.2. Topography

Local topography can have a significant impact on the dispersion of released materials. The ADMS model is capable of including topographical data, if required. There are two parameters that can be employed in the model to describe local topography, as detailed below.

Surface Roughness

This parameter is specified in all modelling assessments. Surface roughness describes the degree of ground turbulence caused by the passage of winds across surface structures. Ground turbulence is greater in urban areas than in rural areas, for example, due to the presence of tall buildings.

The area surrounding the Kilrush site includes some other commercial/light industrial sites and private houses. Based on visits to the site a surface roughness value of 0.5 metres has been conservatively chosen which is typical of suburban/parkland areas and is considered to represent typical surface roughness in the site area.

Complex Terrain

The presence of steep hills (known as complex terrain) in the vicinity of a site can effect dispersion of emissions. A gradient of 1:10 or greater is normally taken as the criteria for inclusion of terrain in a modelling assessment. The topography in the immediate vicinity of the site is generally flat, with the gradient rising slightly towards the north of the site. Further to the south of the site the land also slopes downwards towards the town centre of Kilrush. Based on preliminary modelling completed by URS it is expected that the highest ground level concentrations will occur within 200 metres of the site, which is a relatively flat area, hence hills have not been considered as part of this assessment, as their overall impact is not expected to be significant.

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2.3. Building Effects

Buildings and other structures can have a significant impact on the dispersion of materials released to air. The main effect is to entrain pollutants into the cavity (leeward side) of the building, which is isolated from the main flow and in which a reversal of flow can occur. This can result in rapid grounding of undiluted plumes.

Typically buildings are considered to have an impact on dispersion if the building height is greater than 40 % of the stack height.

The main buildings on the site have been included in the assessment as it is considered that the buildings may have some impact on plume dispersion due to their location and height. Input of highly accurate dimensions for different areas of site buildings is not necessary, with a simplified building layout and conservative dimension specification typically being used in the assessment. For the purposes of the Saint Gobain site the site buildings have been broken up into two areas, firstly the taller 'extension' area, where the taller PTFE coating towers and stacks are located, and the remainder of the building, which is at a lower level. The dimensions of the buildings included in the modelling

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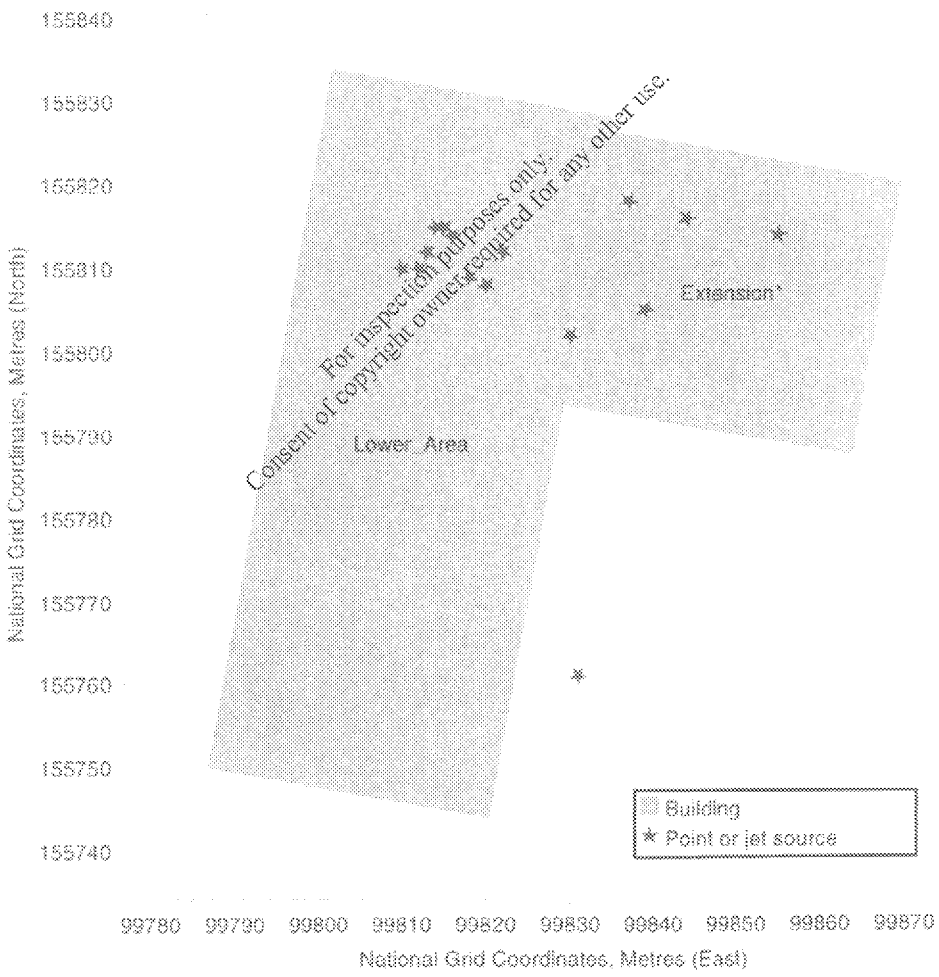
assessment are included in Table 2.2. The model representation of the buildings with respect to the air emission point is included in Figure 2.4.

Table 2.2: Dimensions for buildings included in the assessment

Building	Height (m)	Length (m)	Width (m)
Extension	14	35	32
Rest of building	8.5	33.9	85

Figure 2.4: Model representation of site buildings and emission points included in the model



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2.4. Emission Point Data

2.4.1. Stack Characteristics

The dimensions of the release points are presented in Table 2.3, including the height of the release point from ground level and the release temperature (all data are taken from Table E.1(ii) of the licence application).

Stack characteristic data was supplied in the form of drawings and spreadsheets from site management. URS also undertook a reconnaissance site visit to confirm the stack characteristics.

2.4.2. Emissions Data

All dispersion model input emissions data is summarised in Table 2.3.

The following parameters were modelled:

For all Tower Emissions:

- Ammonium perfluorooctanoate (or APFO, a fluorinated surfactant);
- Alkylphenol ethoxylate (or APE, trade name 'Triton®', a surfactant);
- Ethylene Glycol;
- Toluene.

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APFO and APE are contained in the aqueous PTFE solution and are important surfactants. These are parameters of most interest in respect of this dispersion modelling due to the hazardous nature of these compounds. APFO is classified as 'Toxic', with a very low occupational exposure limit (8 hour average of 0.01 mg/m^3), and is considered bio-persistent. APFO is a salt of the compound Perfluorooctanoic acid (PFOA) with similar properties to PFOA. There is currently risk assessment information relating to PFOA and its salts in the U.S. on a website dedicated to this subject[1]. APE carries an R-Phrase R53 (may cause long-term damage to the aquatic environment).

Ethylene glycol and toluene are contained in the PTFE solution in very small quantities.

Specific occupational exposure data could not be found for APE and so relevant data for nonylphenol ethoxylates, of which APE is a sub-group, was used instead.

In the case of APFO and APE, Saint Gobain management indicated that these compounds are significantly decomposed in the Tower process into many smaller molecular sized organic compounds. Attempts in the past to characterise these decomposition products has not been definitive because the range of decomposition

[1] Internet website: www.pfo-facts.com, created by the Society of Plastics Industry, Inc. to address questions about PFOA and products made from it.

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products, and associated relative concentrations, will differ greatly over even small variations in process conditions, such as operating temperature. Hence, as there is no data available for these decomposition products, it was impractical for URS to attempt to model decomposition products.

Input data to the dispersion model for both APFO and APE was calculated based on data supplied from a sister plant in the U.S., which uses very similar Tower technology. Data from the U.S operation was scaled to the Kilrush operation based on production rates. Saint Gobain estimates that, on average, approximately 66% by weight of the APE and 89% by weight of the APFO, is decomposed in the Tower process. This dispersion model input is the fraction estimated to be emitted from the Tower stacks and therefore not decomposed.

For the TO discharge stack

- Total organics.

Emissions from the TO are presented as total organics as the current licence limit is specified in terms of TA Luft Class II and Class III organics limits of 100 mg/m^3 and 150 mg/m^3, respectively. Based on these limits a release rate of 150 mg/m^3 total organics is chosen for the TO, with the release rate in Table 2.3 based on this concentration value and the volumetric flow rate also described in Table 2.3. The solvents entering the TO are reported to be xylene, toluene, ethyl acetate and ethyl benzene.

Actual monitoring data for 2006 indicates an average Total T.A. Luft Organics concentration from the thermal oxidiser of between 0 and 20 mg/Nm^3. Given this fact, the current emission limit value of 150 mg/Nm^3 for T.A. Luft III organics chosen for the dispersion model is very conservative.

Available air quality guideline values for the compounds detailed below are provided in Section 3.

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Table 2.3: Summary emissions data used in model

Parameter	T1	T2	T3	T4	T6	T8	T10	T11	T12	T15	T16	T17	T18	T19	PSA6
Stack Height (metres)	10.66	10.66	10.58	10.66	10.46	10.45	10.68	10.43	10.13	10.50	15.00	15.00	15.00	15.00	7.61
Stack Diameter (metres)	0.339	0.339	0.25	0.324	0.363	0.363	0.386	0.292	0.292	0.400	0.500	0.500	0.500	0.400	0.500
Air discharge rate (Nm^3/hr)	2,183	2,955	2,218	1,935	12,160	2,192	5,123	2,303	3,142	5,333	3,782	3,750	3,083	5,578	4,500
Gas Temperature (°C)	115	88	121	110	170	170	93	82	71	93	150	160	160	230	200
Toluene emission rate (g/s)	3.56E-05	3.56E-05	2.67E-05	8.89E-05	1.28E-04	1.28E-04	4.00E-05	2.67E-05	4.52E-05	4.00E-05	1.24E-04	1.24E-04	1.07E-04	1.04E-04	
Ethylene glycol emission rate (g/s)	5.08E-05	5.08E-05	3.81E-05	1.27E-04	1.83E-04	1.83E-04	5.72E-05	3.81E-05	6.45E-05	5.72E-05	1.78E-04	1.78E-04	1.52E-04	1.49E-04	
APE* emission rate (g/s)	1.79E-02	1.79E-02	1.34E-02	4.46E-02	6.43E-02	6.43E-02	2.01E-02	1.34E-02	2.27E-02	2.01E-02	6.25E-02	6.25E-02	5.36E-02	5.22E-02	
APFO* emission rate (g/s)	1.16E-04	1.16E-04	8.66E-05	2.89E-04	4.16E-04	4.16E-04	1.30E-04	8.66E-05	1.47E-04	1.30E-04	4.04E-04	4.04E-04	3.47E-04	3.38E-04	
Organics emission rate (g/s) – TO only															1.87E-01

Note: APFO = Ammonium perfluoro octanoate; APE = Alkyl phenol ethoxylate

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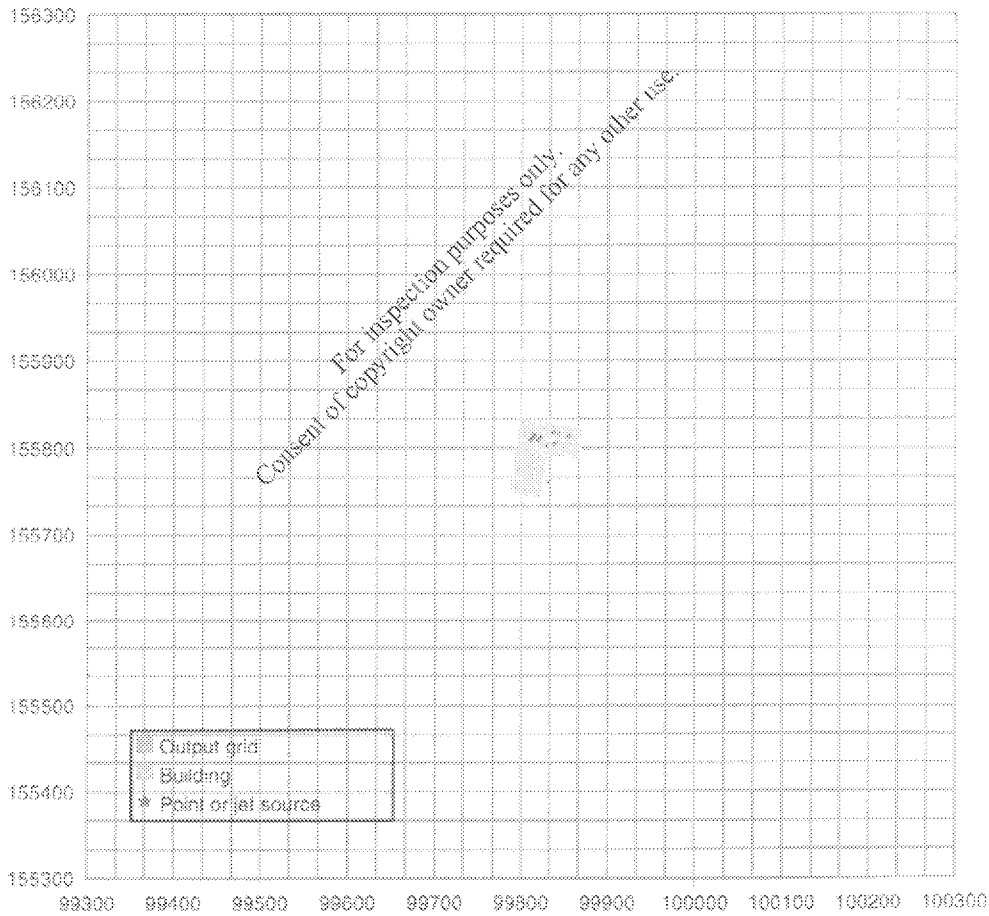
2.5. Model Outputs

The ADMS model setup allows definition of a grid of receptor points at which the ground level concentrations of the specified compounds are calculated by the model. For the purposes of this assessment, a square grid is taken, stretching to a distance of 500 metres to the north, south, east and west from the centre of the site, with a total of 960 receptor points (approximate 30 metre spacing between points). The receptor grid is illustrated in Figure 2.5.

The model calculates the concentrations for each hour of meteorological data for each receptor point and then calculates user defined statistics, which in the case of this modelling assessment are the maximum single hourly concentration at each receptor throughout the year, and also the 99th percentile 1-hour concentration for each year as reported in Section 3.

Figure 2.5: Receptor Grid for Model Output



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3. AIR QUALITY GUIDELINE VALUES

In order to assess the impact of the compounds released from the stack it is necessary to compare the predicted ground level concentration to available ambient air quality limit values, or in the absence of statutory limit values to compare the predicted concentrations to available guideline values.

No statutory limits were identified for any of the compounds listed in Table 2.3, hence available guideline values are employed based on the following:

- 8-hour Occupational Exposure Limits (OELs) divided by a factor of 40. OELs are taken from the 2002 Code of Practice for the Safety, Health and Welfare at Work (Chemical Agents) Regulations, 2001. No OEL is reported for alkylphenol ethoxylates. The OEL guideline values are compared to the maximum single predicted hourly concentration (i.e. the 100th percentile value) for each of the modelled years of meteorological data;

- Danish C-values. The Danish C-value is a parameter developed in Denmark to identify the significance of emissions from industrial installations, by looking at the contribution from the plant emissions to ambient air quality (i.e. no background concentrations should be considered). The ground level concentrations due to emissions from a plant are required to comply with the C-value for 99 % of hourly values. No Danish C-values were identified for APFO. It is also generally considered that the Danish C-values are highly conservative values, and should be looked at in conjunction with the OEL derived guidelines as detailed above. The C-value is compared to the 99th percentile concentration value for each year of meteorological data.

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The Danish C-value for nonylphenol ethoxylate is employed as representative of alkylphenol ethoxylates, as no other information was identified in relation to ground level guidelines values for alkylphenol ethoxylates.

Emissions from the TO are modelled as total organics, however the predicted ground level concentration must be compared to a specific guideline value. Although the TO almost completely destroys the solvents in the incoming gas stream, it is assumed for the purposes of the assessment that any organics identified in the stack gas stream consists of unburned solvents (i.e. the xylene, toluene, ethyl acetate and ethyl benzene entering the TO) in choosing an appropriate guideline for comparison with the predicted ground level concentration. In the absence of any applicable methodology or data to determine the proportion of each of these solvents in the waste gas from the TO, a guideline value for ground level organics concentrations due to TO emissions is derived based on the average of the individual guidelines values for each of the four solvents detailed above These guideline values, along with the derived guideline value for organics, are presented in Table 3.1.

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Table 3.1: Available 1-hour ambient air quality limit values

Parameter	CAS No.	OEL Derived Limit = OEL/40 (µg/m³)	C-Value (µg/m³)
Toluene	108-88-3	4,700	400
Ethylene Glycol	107-21-1	1,300	300
APFO	3825-26-1	0.25	Not available
APE	9002-93-1	No limit identified	50[A]
Xylene (mixed isomers)	1330-20-7	5,525	100
Ethylbenzene	100-41-4	10,875	500
Ethyl acetate	141-78-6	39,000	1000
Organics[B]	N/A	14,025	500

Notes:

A: Danish C-value for nonylphenol ethoxylates, proxy of alkylphenol ethoxylates

B: This guideline value is derived for organic emissions from the TO and is based on the average of the guideline values for toluene, xylene, ethylbenzene and ethylacetate.

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4. MODEL RESULTS AND DISCUSSION

4.1. Introduction & Results

The dispersion model output is presented in Table 4.1 as 1-hour concentration values. The parameters presented for each year of meteorological data are:

- Maximum single hourly concentration value for all modelled receptors, based on assumed continuous emissions for the complete year, i.e. the 100th percentile value;
- 99th percentile value, i.e. for each receptor this is the concentration value below which 99 % of the hourly concentration are reported (i.e. only 1 % of hourly predicted concentrations are above this value);

The model results predict only the impact due to the modelled emissions and do not take account of any potential background concentration. Background concentrations are not required for assessment using the Danish C-value, however it would be required to assess the cumulative impact (i.e. background + site specific impact) for comparison with the OEL derived guideline value. No ambient monitoring data are available for the site area for the modelled parameters, hence background concentrations cannot be taken into account. However, background concentrations would typically be expected to be low for these compounds and for the purposes of this modelling assessment are assumed to be zero.

Ground level organics concentrations due to emissions from the TO are compared to an average calculated guideline value for organics (see Section 3)

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Table 4.1: Predicted ground level concentration values (µg/m^3) for each year of meteorological data

Parameter	Guideline Value	2001	2002	2003
OEL Derived Limit Assessment				
Toluene 100th percentile	4,700	0.34	0.34	0.31
Ethylene Glycol 100th percentile	1,300	0.48	0.49	0.45
APFO 100th percentile	0.25	1.09	1.12	1.02
APE 100th percentile	NA	168.49	172.64	157.49
Organics 100th percentile	14,025	298.23	297.99	298.05
C-Value Assessment				
Toluene 99th percentile	400	0.23	0.28	0.24
Ethylene Glycol 99th percentile	300	0.33	0.40	0.35
APFO 99th percentile	NA	0.76	0.90	0.79
APE 99th percentile	50	117.17	139.16	121.71
Organics 99th percentile	500	280.78	279.65	284.52

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4.2. Discussion

4.2.1. Toluene

The worst case and 99th percentile ground level toluene concentrations (due to toluene emissions from the Towers) predicted by the model are low, and are significantly below the respective guideline values, hence no significant impact is expected.

4.2.2. Ethylene Glycol

The worst case and 99th percentile ground level ethylene glycol concentrations predicted by the model are low, and are significantly below the respective guideline values, hence no significant impact is expected.

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4.2.3. APFO

4.2.3.1. Current Emissions of APFO

Referring to Table 4.1, the calculated maximum ground level concentration for each of the three years of data (1.12 µg/m^3) is approximately 4.5 times greater than the OEL derived limit value.

There is no available Danish C-value for APFO hence the 99th percentile concentration cannot be used in assessing the likely impact.

It is useful, in the context of the above discussion to present a graphical representation of the dispersion model output for APFO maximum ground level concentrations (100th percentile). This is presented as bands of equal concentration (isopleths) at various distances from the APFO release source, i.e., the Saint-Gobain Tower emissions, in Figure 4.1. The predicted maximum ground level concentration of 1.12 µg/m^3 occurs more or less immediately within the Tower emissions points. As one moves out further from the Tower emission points, the predicted maximum ground level concentration decreases. It may be seen from Figure 4.1 that the predicted isopleth representing 0.25 µg/m^3 means that, at distances greater than the isopleth distance from source, the predicted maximum ground level concentration of APFO falls below the guideline value of 0.25 µg/m^3 presented in Table 4.1. Between the 0.25 µg/m^3 isopleth and the source, the identified receptors of note, outside of Saint-Gobain, are:

- Other industrial facilities (furniture and warehousing) to the north, east and south; and
- Agricultural land immediately beyond the western boundary of the Saint-Gobain production facility and which is used for grazing.

URS has not identified any private residential buildings or other similar receptors, such as schools, in the area described above. The nearest such receptor, a private residential dwelling, is located approximately 300 m to the north of the facility.

APFO is a salt of perfluorooctanoic acid (PFOA) and both PFOA and its salts are currently the subject of risk assessment in the United States. To date, albeit recognising the very low OEL (and therefore corresponding low guidance value of 0.25 µg/m^3), there are no human health effects known to be caused by PFOA[2]. Furthermore, whilst bio-persistent, environmental concentrations and pathways of human exposure to PFOA and its salts are unknown[3].

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[2] Reference: DuPont® press release, Geneva, December 14th 2005.

[3] Reference: "Draft Risk Assessment of the Potential Human Effects Associated with Exposure to Perfluorooctanoic Acid and its Salts", January 2005, U.S.EPA Office of Pollution Prevention and Toxics Risk Assessment Division.

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The derivation of APFO emissions data used as input to the dispersion model, and the behaviour of APFO in the Tower process, is described in Section 2.4.2. Decomposition rates of APFO vary with operational conditions in each Tower area unit operation. Therefore, there is the possibility that actual APFO emission rates may vary across the Tower emission points. This means that decomposition may be greater than currently estimated (resulting in lower mass emission rates of APFO) or the converse situation may result. Monitoring of emissions for this compound from the Tower emissions may facilitate more accurate appraisal of actual emission rates (and therefore dispersion model accuracy) but this may require monitoring over some time to reflect varying Tower operation conditions.

4.2.3.2. Future Emissions of APFO

The dispersion model presented in this report has assumed a concentration in the PTFE dispersion of 0.15% w/w APFO. This has resulted in the APFO emission rate estimates from the Tower emission points as presented in Table 2.3 (and allowing for thermal degradation in the Tower process) and therefore the dispersion model results presented in Table 4.2.

Currently, Saint-Gobain is carrying out trials with a surfactant product that contains significantly less APFO. This surfactant mix contains an average of 0.0025% by weight APFO (as against the current usage of 0.15% by weight) and so the use of this material has a significant bearing on APFO emissions.

If it is assumed that a full switch to the lower APFO content surfactant mix is made, then the appropriate results in Table 4.2 may be adjusted as presented in Table 4.2. This assumes that the level of thermal decomposition of APFO is maintained at 89% by weight as previously described for current surfactant use. However, even if there is a reduction in the percentage of APFO decomposed with the lower APFO content surfactant, the actual reduction in APFO concentration in the surfactant mix being used in the Tower process from 0.15% by weight to 0.0025% by weight (a factor of 60 reduction) is far more significant in the context of reduced APFO emissions to atmosphere.

It may be seen from Table 4.2 that a switch to a low APFO content surfactant mix as described above is predicted to result in maximum ground level concentrations two orders of magnitude below the appropriate guideline value and therefore emission of APFO in this situation would have a negligible impact on the receiving environment.

The same limitations on decomposition of APFO as presented in Section 4.2.3.1 also apply for a scenario involving use of low APFO content surfactant mixes.

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Table 4.2: Predicted ground level concentration values (µg/m³) for each year of meteorological data, APFO.

Parameter	Guideline Value (µg/m³)	2001	2002	2003
APFO 100th percentile – Current APFO usage at 0.15% w/w	0.25	1.09	1.12	1.02
APFO 100th percentile – Possible future APFO usage at 0.0025% w/w	0.25	0.0182	0.0187	0.017

4.2.4. APE

The worst-case 99th percentile ground level APE concentration for each of the three years of data (139.16 µg/m³) is approximately 2.8 times higher than the reported guideline value for nonylphenol ethoxylate, suggesting a potential environmental impact. However, it should be noted that the Danish C-values are considered to be highly conservative. URS is continuing to search for more suitable guideline values and specific to alkyphenol ethoxylates rather than nonylphenol ethoxylates.

No occupational exposure limits were identified for APE hence the 100th percentile value cannot be used in the assessment (however the 100th percentile is not significantly above the 99th percentile value). URS is attempting to identify other suitable guideline values for APE for comparative purposes with the above C-Value assessment.

The discussion above on the decomposition of APFO also applies equally to APE.

Figure 4.2 is a similar isopleth representation of the dispersion model output for APE (99th percentile concentrations) as that prepared for APFO (Figure 4.1). The interpretation of Figure 4.2 is the same as for Figure 4.1 presented in Section 4.2.3.1.

Related to the discussion on low APFO content surfactant mix presented in Section 4.2.3.2, a move to usage of such a mix would also result in the replacement of APE with a compound with a lower potential to adversely impact the receiving environment and to be used in similar concentrations as APE. This compound is called 'Linear Alkyl Ethoxylate' or LAE. The difference between LAE and APE is that LAE is a lower chain and linear fatty alcohol ethoxylate which is readily biodegradable. This is in contrast to APE which has a more complicated structure and with a benzene ring, thus the designation of Risk Phrase R53 ' "may cause long term damage to the environment'.

As with APE, URS does not have sufficient data to generate an appropriate guideline value specifically for LAE. However, given the above conclusion on APE, the outcome of switching to LAE would be significantly better in terms of potential environmental impact.

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4.2.5. Organics

Emissions of organics from the TO are modelled based on the current licence limit. Comparison of the 100th percentile concentrations with the OEL derived guideline value for xylene indicates that the predicted concentrations are significantly below the guideline value, with the highest concentration over the three years being 2.1 % of the limit value. The predicted worst-case ground level concentrations are also below the individual solvent OEL derived guideline values as presented in Table 3.1.

Comparison of the worst case 99th percentile value (284.52 µg/m^3) with the calculated Danish C-value for organics indicates that predicted concentration is approximately 57 % of the guideline value. The worst-case 99th percentile concentration is also below the Danish C-value for the individual solvents assumed in the waste (see Section 3), with the exception of xylene.

Also, ongoing measurement of organics emissions from the TO stack indicates concentrations typically in the range 0 – 20 mg/m^3, hence in practice ground level concentrations would tend to be significantly lower than predicted based on a concentration of 150 mg/m^3.

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5. CONCLUSION

URS carried out dispersion modelling for a number of main emissions from the Saint-Gobain process, based on data and information supplied by site management.

The results of the modelling conclude that:

1. Predicted worst-case ground level concentrations of both ammonium perfluorooctanoate (APFO) and alkyl phenol ethoxylate (APE) exceed relevant guideline values within a certain distance of the source (the Tower stacks). However, this conclusion must be considered in the context of :

    a. Limitations in the knowledge of the APE compound (refer to Section 2.4.2); and

    b. The limitation of monitoring data available for the dispersion model.

2. As one moves out further from the Tower emission points, the predicted maximum ground level concentration decreases for both APFO and APE. The calculated maximum ground level guideline concentration presented in this report is 0.25 µg/m^3. Between the 0.25 µg/m^3 isopleth and the source, the identified receptors of note, outside of Saint-Gobain, are:

    - Other industrial facilities (furniture and warehousing) to the north, east and south; and

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- Agricultural land immediately beyond the western boundary of the Saint-Gobain production facility and which is used for grazing.

However, URS has not identified any private residential buildings or other similar receptors, such as schools, in the area described above. The nearest such receptor, a private residential dwelling, is located approximately 300 m to the north of the facility.

APFO is a salt of perfluorooctanoic acid (PFOA) and both PFOA and its salts are currently the subject of risk assessment in the United States. To date, albeit recognising the very low OEL (and therefore corresponding low guidance value of 0.25 $\mu g/m^3$), there are no human health effects known to be caused by PFOA. Furthermore, whilst bio-persistent, environmental concentrations and pathways of human exposure to PFOA and its salts are unknown.

3. Saint Gobain is actively pursuing the possibility of the use of a less harmful surfactant mix utilising a substantially reduced APFO content and a less complex surfactant to replace APE. This would result in almost negligible ground level concentrations of APFO. Again, however, this is subject to the same limitation as above on emissions monitoring;

4. Predicted worst-case ground level concentrations for all other parameters modelled, and for all emission points modelled, are well below relevant guideline values.

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Figure 4.1: 2002 APFO 100th Percentile Plot

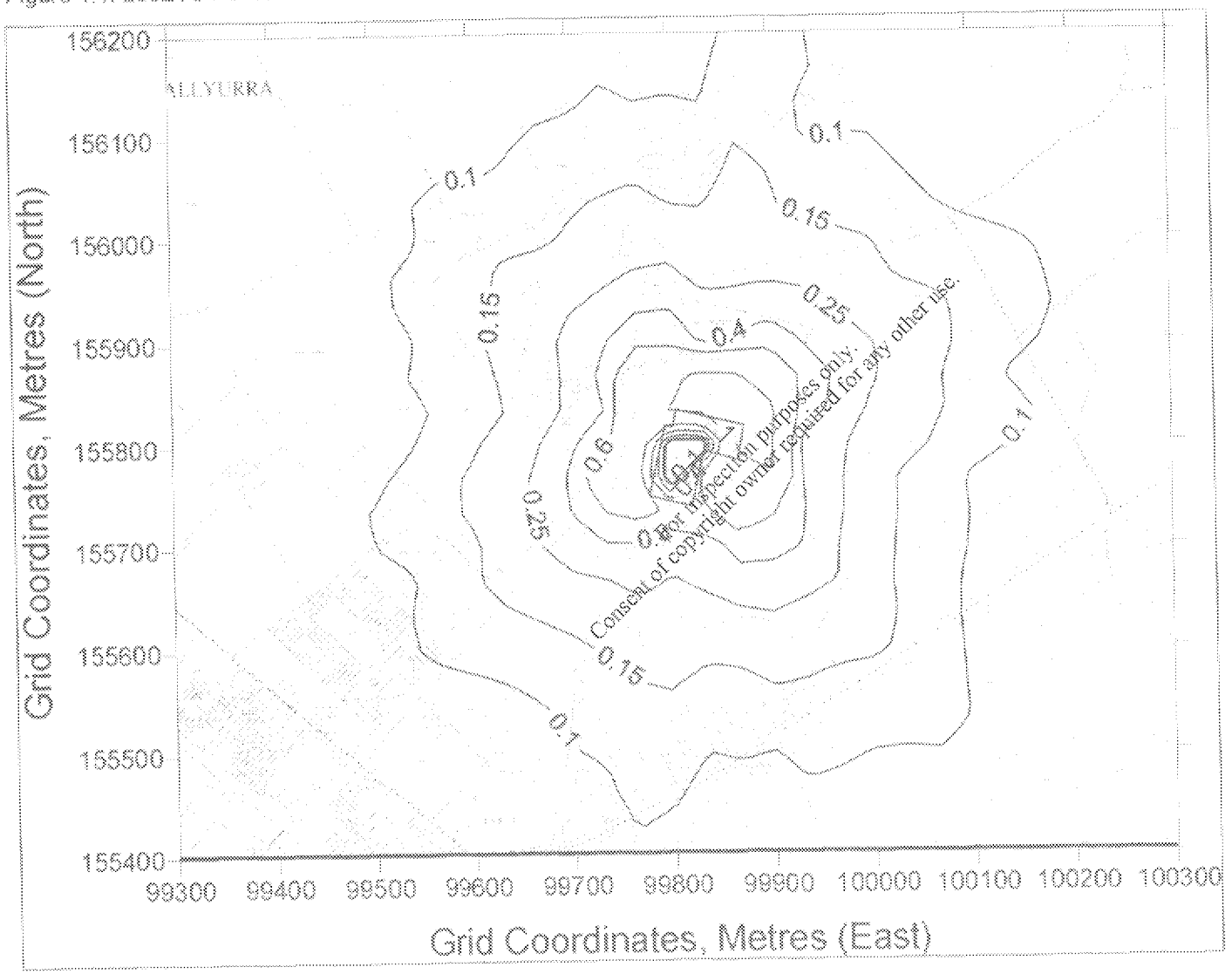

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Figure 4.2: 2002 APE 99th Percentile Plot

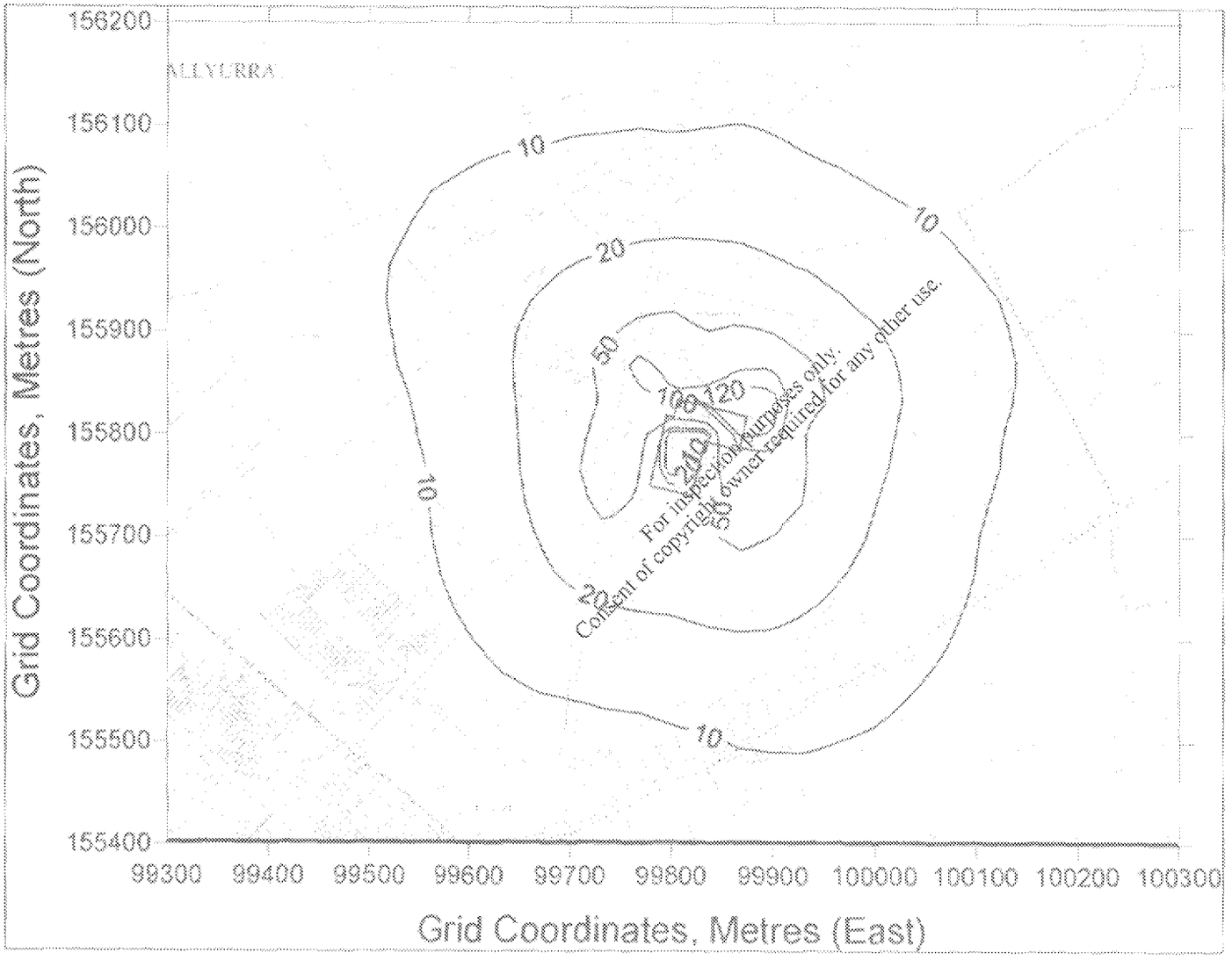

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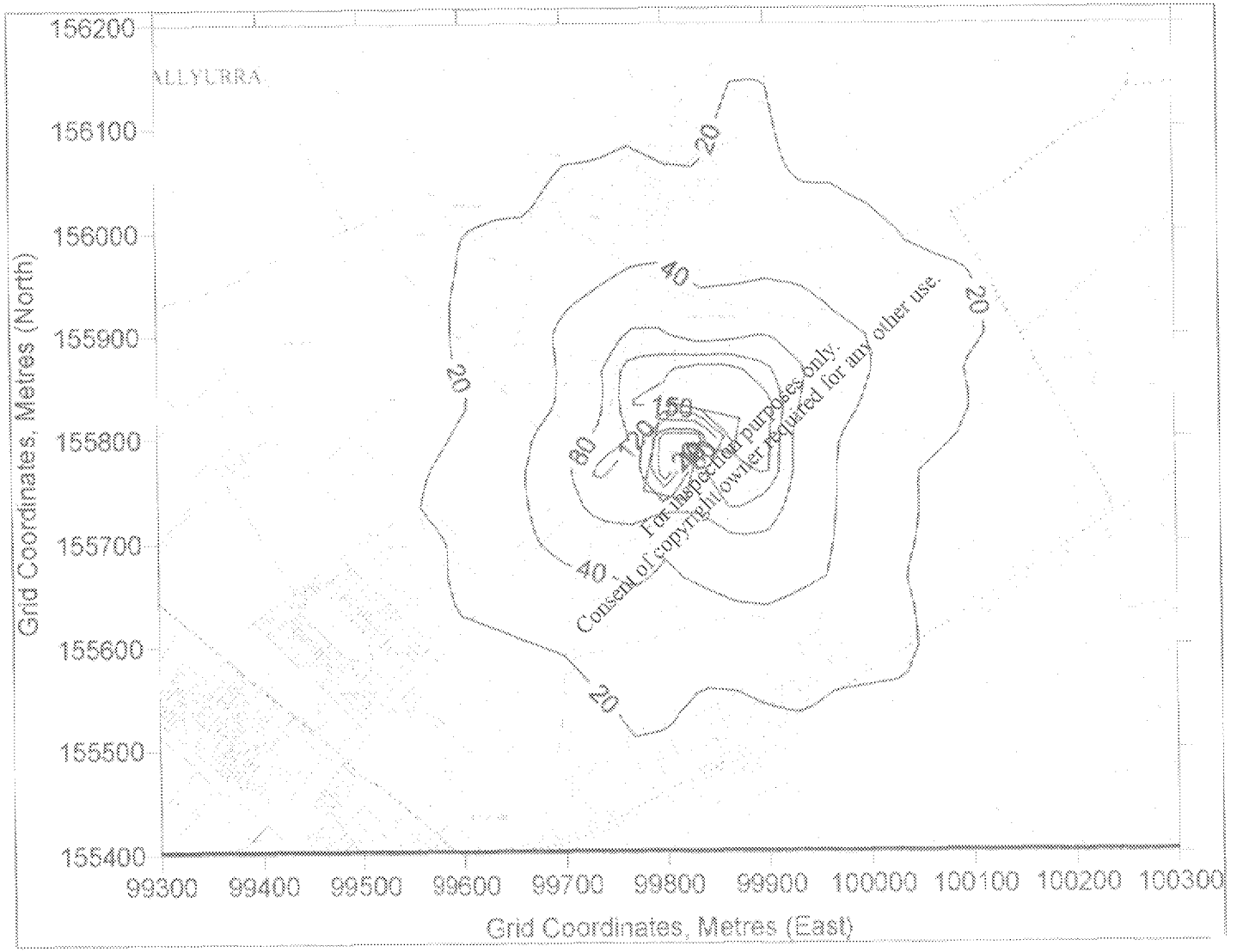
Figure 4.3: 2002 APE 100th Percentile Plot



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Appendix A - ADMS Model Information

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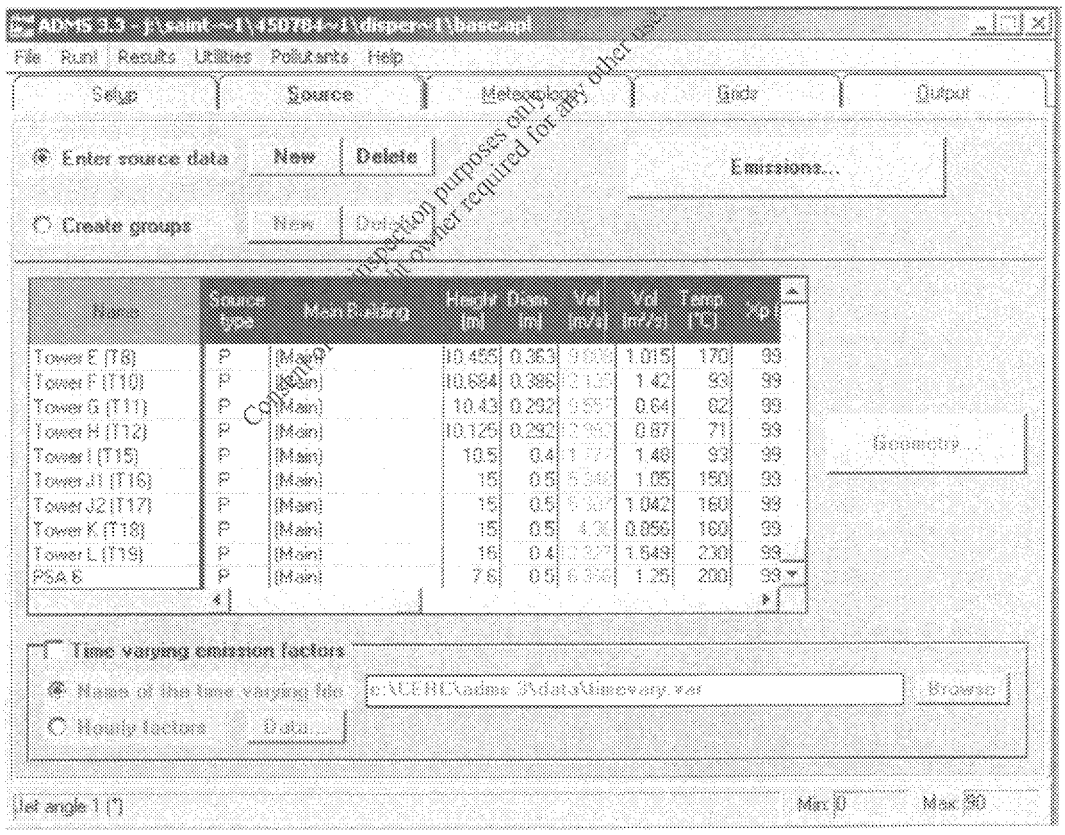
Appendix A – ADMS Model Information

The ADMS model is an advanced modelling system which requires a variety of input data to ensure realistic predictions of ground level concentrations due to stack emissions. Required inputs include building dimension data, terrain data, surface roughness data, source data (Stack height, diameter, flow rate, emission rates for each compound to be modelled), meteorological data and receptor data.

This assessment considers the impact of releases of substances from the stacks. No account is taken of the effect of any fugitive or accidental releases. Air dispersion models are used for calculating air pollution concentrations given information about the pollutant emissions and the nature of the atmosphere (factors affecting the dispersion and dilution in the atmosphere). The resultant pollutant concentrations can be compared with air quality standards, objectives or guidelines.

ADMS is a Windows based programme, which requires inputs on a number of tabs for a variety of different parameters. An example of one of the tabs is presented in the screenshot below. This is the screen where the source parameters are described.



The impact of a release on the environment will be dependent on many factors, including:

the rate of release of each substance;

- other release characteristics, such as release location, release velocity and the temperature of the released material;

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- the physical properties of the released substance (such as its physical form or particle size);
- the chemical properties of the released substances;
- the nature of the receiving medium, particularly its dispersive and transfer characteristics and how these vary with time;
- ambient concentrations of released substances already present in the environment;
- the locations of receptors in the environment sensitive to the released substances; and
- the degree of sensitivity of these receptors to enhanced concentrations of released substances.

To quantify these effects and to establish the predicted ground level concentrations of species emitted from on-site sources, *URS* has undertaken detailed air dispersion modelling for the site. The selected model for use in this assessment is ADMS3, produced by Cambridge Environmental Research Consultants (CERC). This model is a 'new-generation' model, which represents local meteorological conditions in a more technically correct way than the older models that utilise semi-empirical stability classes. The main features of ADMS3 are:

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- all on-site sources can be modelled together in the same run, to provide an integrated assessment of the whole site;
- site-specific hourly-sequential meteorological data is used in the modelling assessment to provide worst-case ground level concentrations for realistic conditions;
- meteorology is treated in a more comprehensive way than in early dispersion models, using the Monin-Obukhov length instead of the semi-empirical stability classes;
- worst-case conditions can be modelled e.g. adverse combinations of meteorology and emissions, which could result in pollution episodes;
- effects such as steep terrain, coastline and building effects can be taken into account;
- model outputs can be calculated for a wide range of averaging periods and percentiles, allowing direct comparison with all relevant ambient air pollutant standards and objectives.

The ADMS3 model takes a range of parameters including stack dimensions, emission conditions and representative meteorological data, and calculates the maximum concentrations at specified intervals from the emission source using sequential computer

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algorithms. It is generally considered that air dispersion models are conservative models, over-predicting ground level concentrations. All results quoted in this report are the maximum values predicted by the model, and therefore in the opinion of *URS* represent the worst case.

The use of an advanced model such as ADMS3 rather than a simpler screening model is considered the best available analytical technique and enables the incorporation of terrain and building effects on dispersion (if required).

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