Appendix H
Air Model Report

AIR QUALITY IMPACT ASSESSMENT OF THE PROPOSED OLYWEST PORK PROCESSING FACILITY, WINNIPEG, MANITOBA

Prepared for:
OlyWest MB Limited Partnership

Prepared by:
Earth Tech (Canada) Inc.
850 Pembina Highway
Winnipeg, Manitoba R3M 2M7

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EXECUTIVE SUMMARY

The Purpose of this report is to present the findings of the air quality modeling performed for the environmental assessment of the proposed Olywest Pork Processing plant in Winnipeg, Manitoba. Parameters modeled include particulate matter, carbon monoxide, oxides of nitrogen, and sulphur dioxide based upon natural gas usage at the site and emissions from the protein recycling system. The main thrust of the air quality model for the OlyWest site is quantification of odour emissions due to the high degree of public interest related specifically to the potential odour effects of the proposed development on nearby receptors.

The analysis included the development of source inputs for the model through design data collection. Emissions were then estimated based on sample collection and analyses, vendor supplied information, OlyWest/Olymel experience, and USEPA emission factors. The modeling protocol was then prepared and estimated background air quality concentrations were sourced. The selected models were described as well as receptor grids and meteorological data.

Table ES.1 includes a summary of the relevant criteria and the airborne parameter concentrations.

Table ES.1: Summary of Parameter Concentrations

Parameter	Units of Measurement	Averaging Period	Maximum Predicted Ambient Concentration	Maximum Acceptable Level Concentration
PM_{10}	$\mu g/m^3$	24 hours	38.1	50
$PM_{2.5}$	$\mu g/m^3$	24 hours	19.3	30
Carbon Monoxide	mg/m^3	1 hour	3.97	35
		8 hour	2.23	15
NO_2	$\mu g/m^3$	1 hour	185.6	400
		24 hour	103.1	200
		Annual	26.1	100
SO_2	$\mu g/m^3$	1 hour	171.7	900
		24 hour	143.1	300
		Annual	0.01	60
Odours	Odour Units (IITRI)	3 min	2.19	2 – residential
			4.96	7 – industrial

In conclusion the modeled parameter concentrations, when combined with the assumed background concentrations do not exceed the referenced criteria based upon the modeled conditions. The exception to this is the predicted odour concentrations at 2 residential receptors, however the model predicts excursions of 0.2 OU or less in 3 hours out of 5 years.

Section 1.0
Introduction

SECTION 1.0
INTRODUCTION

1.1 INTRODUCTION AND PURPOSE

The Purpose of this report is to present the findings of the air quality modeling performed for the environmental assessment of the proposed Olywest Pork Processing plant in Winnipeg, Manitoba. Some of the steps involved in pork processing will generate minor airborne emissions such as particulate matter, carbon monoxide, oxides of nitrogen, sulphur dioxide, and odours (combustion sources). These emissions have been briefly modeled under a number of assumptions for information, however they are considered relatively minor. The main thrust of the air quality model for the OlyWest site has concentrated on quantification of odour emissions. This is due to the high degree of public interest related specifically to the potential odour effects of the proposed development on nearby receptors. Odour data has been collected by OlyWest in order to aid in predicting the strength and extent of odour effects from the proposed development. The results of the computerized air dispersion modeling and an assessment of the resulting air quality are summarized within this report.

The proposed location of the OlyWest MB Limited Partnership (OlyWest) pork processing plant is within the St. Boniface Industrial Park in the City of Winnipeg, Manitoba. The proposed plant will process hogs into various primal cuts and incorporate an integrated protein recycling facility capable of producing meat, bone and blood meal. Liquid blood will also be recovered for sale. An on-site wastewater pretreatment system (consisting of screens, DAF, and chemical addition) will pretreat the majority of the plant's wastewater prior to discharge to the development's pumping station and forcemain which will deliver the wastewater to the City of Winnipeg non-combined sewer system.

Earth Tech (Canada) Inc. has conversed with regulator representatives in several jurisdictions with respect to existing airborne emission data for hog processing facilities and outside of the combustion sources (boilers, dryers and singers), no data is known to exist pertaining to the hog pens, kill and cut operation, and furthermore none are required to be collected by the regulators. The fact that this data is not generally a collection requirement demonstrates the very low significance of perceived impact that these operations have on the environment (in terms of airborne emissions), outside of odour concerns.

The model used to predict airborne pollutant concentrations for this report was the United States Environmental Protection Agency's Industrial Source Complex Short Term air model (ISCST3). Data has been formatted, processed and presented using the ISC-AERMOD View Windows interface produced by Lakes Environmental. Manitoba Conservation's Objectives and Guidelines for Various Air Pollutants, Ambient Air Quality Criteria provide reference criteria for the model results while the odour modeling was conducted in accordance with Manitoba Conservation's Draft Air Dispersion Modeling Protocol For Estimating Odour Nuisance Impacts (1996).

Section 2.0
Facility Description

SECTION 2.0
FACILITY DESCRIPTION

2.1 SITE LOCATION

The proposed location of the OlyWest MB Limited Partnership (OlyWest) pork processing plant is within the St. Boniface Industrial Park in the southeast area of the City of Winnipeg, Manitoba, immediately north of the CNR Symington Rail Yards/Intermodel Terminal west of Plessis Road and 1200 m south of Dugald Road. The site location is indicated in Figure 2.1 in Appendix A. The terrain in the vicinity of the proposed plant site is relatively flat with an approximate site elevation of 232 masl. The legal description of the approximately 100 acre site is as follows:

> *Shown on Misc Plan 7781:Legal Description of City of Winnipeg Lands (part CT C53237 and part C60035). Block 202 Roman Catholic Mission Property Plan 433 WLTO and all those portions of Blocks 159, 166, 195, 196 and 201 Roman Catholic Mission Property Plan 433 WLTO, which lie to the South of the Southern limit of the Right of Way of The Greater Winnipeg Water District Plan 2474 WLTO. Exc out of said Block 202, Parcel A, Plan 14869 WLTO.*

The surrounding land use is considered to be predominantly urban; however, rural residential land use exists in the R.M. of Springfield east of Plessis Road. The approximate combined urban and rural residential population density within 3 km of the subject site is estimated as 588 persons/km^2 (Earth Tech, 2006). The nearest residential receptors to the site include approximately 30 residences along the south side of Dugald Road and then along Plessis Road, south of Dugald Road, the closest of which exist within approximately 1.3 km of the plant buildings on the site. The closest institutional land use is the Springs Church property, approximately 1.2 km to the southwest of the plant buildings. All other lands within 1.3 km of the plant buildings are vacant or occupied by other industrial entities. Approximately 90 businesses currently operate in the industrial park.

2.2 PLANT OPERATIONS

The point source stack emission locations consist of:

- Two packed media towers that provide multi-stage treatment for odourous emissions from the protein recycling system, the meal storage, the wastewater treatment area and general plant air;
- 65 hog pen ventilation stacks which provide temperature control and odour mitigation;
- One ventilation stack over the truck bedding material/manure solids storage area, and;
- One theoretical boiler to simulate emissions from natural gas usage on the site.

All of the stacks were digitized to UTM coordinates based on a NAD83 datum and drawings supplied by Olymel S.E.C./L.P.

The metric equivalent of the stack parameter data provided by Olymel S.E.C./L.P., The Dupps Company and SCP as vendors to OlyWest are summarized in Table 2.1.

Table 2.1: Summary of Stack Parameter Data

Emission Unit	Stack ID m	Stack Height m	Number of Stacks	Outlet Gas Temp deg. K	Exit Velocity m/s
Protein Recycling Room Air Scrubber #1	1.68	15.2	1	301	18.20
Protein Recycling Room Air Scrubber #2	1.68	15.2	1	301	18.20
Theoretical Boiler*	0.80	11.1	1	440	10.00
Hog Pen Stacks					
VE-4	0.81	9.6	1	299	5.63
VE-5	0.81	9.6	1	299	5.63
VE-6	0.81	9.6	1	299	5.63
VE-7	0.81	9.6	1	299	5.63
VE-8	0.81	9.6	1	299	5.63
VE-9	0.81	9.6	1	299	5.63
VE-10	0.81	9.6	1	299	5.63
VE-11	0.81	9.6	1	299	5.63
VE-12	0.81	9.6	1	299	5.63
VE-13	0.81	9.6	1	299	5.63
VE-14	0.81	9.6	1	299	5.63
VE-15	0.81	9.6	1	299	5.63
VE-16	0.81	9.6	1	299	5.63
VE-17	0.81	9.6	1	299	5.63
VE-18	1.09	9.6	1	299	4.60
VE-19	1.09	9.6	1	299	4.60
VE-20	0.81	9.6	1	299	5.63
VE-21	1.09	9.6	1	299	4.60
VE-22	1.09	9.6	1	299	4.60
VE-23	1.09	9.6	1	299	4.60
VE-24	1.09	9.6	1	299	4.60
VE-26	0.81	9.6	1	299	5.63
VE-27	1.09	9.6	1	299	4.60
VE-28	1.09	9.6	1	299	4.60
VE-29	0.81	9.6	1	299	5.63
VE-30	1.09	9.6	1	299	4.60
VE-31	1.09	9.6	1	299	4.60
VE-32	0.81	9.6	1	299	5.63
VE-33	0.81	9.6	1	299	5.63

Emission Unit	Stack ID m	Stack Height m	Number of Stacks	Outlet Gas Temp deg. K	Exit Velocity m/s
VE-34	1.09	9.6	1	299	4.60
VE-35	1.09	9.6	1	299	4.60
VE-36	0.81	9.6	1	299	5.63
VE-37	1.09	9.6	1	299	4.60
VE-38	0.81	9.6	1	299	5.63
VE-39	1.09	9.6	1	299	4.60
VE-40	1.09	9.6	1	299	4.60
VE-41	1.09	9.6	1	299	4.60
VE-42	1.09	9.6	1	299	4.60
VE-43	1.09	9.6	1	299	4.60
VE-44	1.09	9.6	1	299	4.60
VE-45	1.09	9.6	1	299	4.60
VE-46	0.81	9.6	1	299	5.63
VE-47	1.09	9.6	1	299	4.60
VE-48	1.09	9.6	1	299	4.60
VE-49	1.09	9.6	1	299	4.60
VE-50	0.81	9.6	1	299	5.63
VE-51	1.09	9.6	1	299	4.60
VE-52	1.09	9.6	1	299	4.60
VE-53	0.81	9.6	1	299	5.63
VE-54	1.09	9.6	1	299	4.60
VE-55	0.81	9.6	1	299	5.63
VE-56	1.09	9.6	1	299	4.60
VE-57	1.09	9.6	1	299	4.60
VE-58	0.81	9.6	1	299	5.63
VE-59	1.09	9.6	1	299	4.60
VE-60	1.09	9.6	1	299	4.60
VE-61	0.81	9.6	1	299	5.63
VE-62	1.09	9.6	1	299	4.60
VE-63	0.81	9.6	1	299	5.63
VE-64	1.09	9.6	1	299	4.60
VE-65	1.09	9.6	1	299	4.60
VE-66	1.09	9.6	1	299	4.60
VE-67	0.81	9.6	1	299	5.63
VE-68	1.09	9.6	1	299	4.60
VE-69	1.09	9.6	1	299	4.60
Truck Bedding/Manure Solids	0.33	8.1	1	301	8.5
Hog Trucks	-	-	-	-	-

The odour sources were grouped for the purpose of the analysis into four groups, one included the protein recycling stacks, one included the hog pen exhaust, one comprised of just the bedding material exhaust and one was composed of the four hog trucks.

The protein recycling group included the two packed media scrubber stacks at a release height of approximately 15.2 m above ground level with an exhaust flow of 85,000 cfm each and an odour unit emission rate of 150 OU (see Appendix B). These were varied according to the schedule of the protein recycling operation which essentially ran from 7:30 a.m. to 12:30 a.m. each weekday with no operation on Saturday or Sunday. This was applied uniformly throughout the year. The odour removal efficiency of the proposed emission control equipment was provided by SCP Control.

The hog pen exhaust group included 65 ventilation chimneys with odour emissions factored up by 2780/2200 to account for the different number of hogs at the sample location than while full at the proposed plant, see Appendix B) at various flow rates from a height of 9.6 m above ground level. The emissions from this group were factored according to hog pen occupation time which included occupation in varying numbers from 6:30 a.m. through 12:30 a.m. during the week, with occupation starting at 4:00 p.m. on Sundays to await the Monday kill shift. The emissions were further factored according to the number of air changes per hour specified by Olymel as 60 per hour in the summer (assumed maximum 100% ventilation rate) and 6 per hour in the winter (assumed 10% ventilation rate); spring and fall ventilation rates were assumed to be 50%. The model is considered conservative in that the odour emissions are based upon the pens being full (2780 hogs) while any occupation occurs (i.e. if there are 200 hogs in the pens the odour emission rate is still modeled as if 2780 hogs are present).

The bedding material exhaust group included one stack/vent with a release height of 8.1 m above ground level with an exhaust rate of 0.7 m^3/s. The background data collected at the time of sampling for this source indicated that no net odour difference was found during our testing; however, a concentration of 5 OU (Appendix B) was used to be conservative. This source was modeled as a constant source throughout the 5 year period.

The group of hog trucks included four 53 foot (16.2 m) long full hog trailers lined up one after the other in a queue to turn left from Plessis Road to enter the industrial park. This is a conservative assumption since a truck arrival rate at the plant is estimated to be three per hour. Furthermore, if more than three trucks were attempting to unload at the site at any given time they would likely be queued closer to the plant, which would place them, as an odour source, further away from residential receptors. These sources were modeled as a single line source approximately 60 m long and 2.6 m wide. The odour emission rate (Appendix B) was used based upon samples collected from a similar trailer as detailed in Appendix B. The exhaust rate of 12.6 m^3/s was determined based upon measured wind speed and known ventilation area across the trailer. This source was modeled as a constant source throughout the 5 year period to be conservative in modeling the odour effects from the hog truck source.

Section 3.0
Regulatory Requirements

SECTION 3.0
REGULATORY REQUIREMENTS

3.1 MODELING TECHNIQUES

Verbal consultation with the Manitoba Conservation Air Quality Section indicated that the proposed usage of ISCST3 as a model would be acceptable for this project. ISCST3 was proposed to estimate air quality impacts from the proposed plant based on familiarity with the model and data availability.

3.2 MANITOBA AMBIENT AIR QUALITY CRITERIA

The predicted air quality impacts estimated through the use of the computer model have been compared to Manitoba Conservation's Ambient Air Quality Criteria.

Pollutant types modeled included particulate less than or equal to 10 micrometers in diameter (PM_{10}), particulate less than or equal to 2.5 micrometers in diameter ($PM_{2.5}$), oxides of nitrogen (NO_x), carbon monoxide (CO) and sulphur dioxide (SO_2). In addition odour units were modeled from different sources using emission rates from similar sources at different locations or from vendor data.

In the absence of general NO_x criteria, all modeled NO_x emissions were assumed to be NO_2 for comparison to Manitoba Conservation's Objectives. The results of modeling the CO, SO_2 and odour emissions were also compared to the provincial objectives. A summary of the referenced objectives for the various pollutants is included as Table 3.1.

Table 3.1: Modeled Parameters Reference Objectives

Name of Pollutant	Units of Measurement	Averaging Period	Maximum Acceptable Level Concentration	Maximum Desirable Level Concentration
PM_{10}	$\mu g/m^3$	24 hours	50	-
$PM_{2.5}$	$\mu g/m^3$	24 hours	30	-
Carbon Monoxide	mg/m^3	1 hour	35	15
		8 hours	15	6
NO_2	$\mu g/m^3$	1 hour	400	-
		24 hour	200	-
		Annual	100	60
SO_2	$\mu g/m^3$	1 hour	900	450
		24 hour	300	150
		Annual	60	30
Odours	Odour Units*	3 min	2 (residential) 7 (industrial)	<1

* - IITRI measurement assumed

3.3 INDIVIDUAL PARAMETER MODELING RESULTS

In each case (with the exception of odour) the model estimated maximum concentrations, generated as a result of the proposed facility, will be added to background concentrations to predict maximum ambient concentrations and provide indications of potential air quality impacts. The combined background and model estimated concentrations will be compared to referenced objectives from Manitoba Conservation on the basis of one or more of three criteria levels:

The Maximum Tolerable Level (MTL): A time based concentration of air contaminant beyond which, due to a diminishing margin of safety, appropriate action is required to protect the health of the general population;

The Maximum Acceptable Level (MAL): Deemed essential to provide adequate protection for soils, water, vegetation, materials, animals, visibility, personal comfort and well-being; and;

The Maximum Desirable Level (MDL): The long term goal for air quality that provides a basis for an anti-degradation policy for the pristine areas of Manitoba and for the continuing development of control technology.

The ambient concentrations predicted in this air quality assessment are primarily compared to the MAL concentrations as well as the MDL concentration objectives.

Section 4.0
Model Configuration

SECTION 4.0
MODEL CONFIGURATION

This section presents the proposed options and rationale for the five main sections of the ISC input programming: Control, Source, Receptors, Meteorological Data and Output.

4.1 CONTROL

The model was processed using regulatory defaults, which entailed the following configuration changes:

- Use of stack tip downwash;
- Use of buoyancy-induced dispersion;
- Neglect gradual plume rise;
- Use of the calms processing feature;
- Use of upper-bound concentration estimates for sources influenced by building downwash from super-squat buildings;
- Use of default vertical potential temperature gradients; and,
- Use of default wind profile exponents.

Only concentrations, not deposition were modeled as no significant mists were anticipated. The urban dispersion coefficient was selected based upon the surrounding land usage and a residential population density of approximately 588 persons/km^2 (Earth Tech 2006). The model was also configured to idealize surrounding terrain height as flat terrain.

4.2 SOURCE

A summary of the locations of each of the sources is provided in Table 4.1. The location of each source is provided in UTM Coordinates which were graphically transferred from Olywest supplied information or inferred from general building process locations.

Table 4.1: Summary of Geographic Source Locations

Emission Unit	Easting m	Northing m
Protein Recycling Room Air Scrubber #1	640443	5526392
Protein Recycling Room Air Scrubber #2	640445	5526383
Theoretical Boiler*	640433	5526415
Hog Pen Stacks		
VE-4	640442	5526292

Emission Unit	Easting m	Northing m
VE-5	640441	5526289
VE-6	640457	5526286
VE-7	640455	5526283
VE-8	640440	5526286
VE-9	640455	5526281
VE-10	640439	5526283
VE-11	640453	5526277
VE-12	640438	5526280
VE-13	640452	5526274
VE-14	640436	5526277
VE-15	640451	5526271
VE-16	640435	5526274
VE-17	640450	5526268
VE-18	640435	5526306
VE-19	640432	5526307
VE-20	640430	5526308
VE-21	640426	5526309
VE-22	640430	5526293
VE-23	640421	5526297
VE-24	640418	5526298
VE-26	640420	5526312
VE-27	640417	5526313
VE-28	640414	5526314
VE-29	640412	5526315
VE-30	640409	5526316
VE-31	640406	5526318
VE-32	640403	5526319
VE-33	640415	5526299
VE-34	640409	5526301
VE-35	640404	5526303
VE-36	640398	5526306
VE-37	640396	5526321
VE-38	640394	5526322
VE-39	640391	5526324
VE-40	640387	5526325
VE-41	640395	5526307
VE-42	640391	5526308
VE-43	640385	5526311
VE-44	640429	5526289
VE-45	640426	5526290
VE-46	640423	5526291
VE-47	640417	5526293
VE-48	640424	5526276
VE-49	640421	5526277

Emission Unit	Easting m	Northing m
VE-50	640418	5526278
VE-51	640415	5526279
VE-52	640411	5526296
VE-53	640406	5526298
VE-54	640400	5526300
VE-55	640409	5526282
VE-56	640406	5526283
VE-57	640403	5526284
VE-58	640401	5526285
VE-59	640398	5526286
VE-60	640395	5526288
VE-61	640392	5526289
VE-62	640394	5526303
VE-63	640387	5526305
VE-64	640384	5526307
VE-65	640381	5526308
VE-66	640385	5526291
VE-67	640382	5526292
VE-68	640379	5526294
VE-69	640376	5526295
Truck Bedding/Manure Solids	640438	5526305
Hog Trucks	641767	5526165

4.2.1 Odours

Odour is measured in terms of Odour Units (OUs) by an odour panel. An OU is defined as the volume that a 1 m^3 sample of odourous air would occupy when diluted to the odour threshold. For example one volume of fresh air combined with an equal volume of odourous air would indicate two OUs if the odour was just barely detectable. If six volumes of fresh air were required to dilute one volume of odourous air to the point where an odour panel could just detect the odour, the rating would be seven OUs. The detection threshold of the odour panel is determined by the D_{50} dilution, or the dilution at which the half the panel members can just detect the odour and half cannot.

As the availability of odour data specific to the hog processing industry is not generally available, and since the effects of odours on the general public has become one of the primary issues for the proposed development, Earth Tech conducted an odour sampling program to provide the necessary source data for the model. Details on the sampling program are provided in Appendix B to this document and include:

- Identification of potential odour sources at the proposed development
- Determination of likely odour data sources

- Collection of odour samples and sampling methodology, and
- Interpretation of results for use in modeling.

For the odour model, the odourous sources included the two packed media exhaust stacks from the protein recycling facility/wastewater treatment, the 65 hog pen ventilation chimneys, the vent from the truck bedding material/manure solids storage area and the in-bound hog trucks (assumed worst case four trucks in line at one time to enter the industrial park from Plessis Road). The singers were initially thought to be a potential odour source; however, further investigation indicated that this was a minimal source of odour. As a result, singers were not modeled as an odour source for this project.

4.2.2 Other Parameters

The model was simplified for all other parameters to only include emissions from the protein recycling exhaust points and a theoretical boiler. No significant emissions in terms of air quality were anticipated from the hog pens/manure storage as this information is not typically monitored. Emissions information on other parameters from the remaining sources is quite limited for the same reason and is also not normally the subject of monitoring requirements. In fact, most of the emissions generated at the site outside of odour, and noise are products of combustion of natural gas in the boilers and singers. Accordingly the emission factors from the document, *AP 42, Fifth Edition, Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources* were obtained via the US EPAs Webfire (Web Factor Information Retreival) system. The emission factors corresponding to a theoretical natural gas-fired external combustion boiler were used to determine emission rates based upon the total estimated annual natural gas usage at the plant (Summarized in Tables 4.2 and 4.3). In addition, information was provided by the protein recycling emission control vendor to characterize protein recycling emissions based upon emissions from other facilities. This information has been used for guidance only, since the nature of the emission rates and the conditions under which they were obtained are not necessarily strictly representative of the proposed development. There are no literature emission factors specific to rendering/protein recycling facilities.

Table 4.2: US EPA Emission Factors for Theoretical Boiler

Factor ID	Level 1	Level 2	Level 3	Level 4	Pollutant
8052	External Combustion Boilers	Industrial	CO Boiler	Natural Gas	Carbon monoxide
8053	External Combustion Boilers	Industrial	CO Boiler	Natural Gas	Nitrogen oxides (NOx)
8054	External Combustion Boilers	Industrial	CO Boiler	Natural Gas	PM, filterable
8056	External Combustion Boilers	Industrial	CO Boiler	Natural Gas	PM10, filterable
8058	External Combustion Boilers	Industrial	CO Boiler	Natural Gas	PM2.5, filterable
8059	External Combustion Boilers	Industrial	CO Boiler	Natural Gas	Sulfur oxides (SOx)
6063	External Combustion Boilers	Industrial	CO Boiler	Natural Gas	Volatile organic compounds (VOC)

Note: Data obtained from WebFIRE Internet database on July 29, 2006 from

http://cfpub.epa.gov/oarweb/index.cfm?action=fire.main

Table 4.3: Summary of Calculated and Supplied Emission Factors for Model from AP42 and Protein Recycling Vendor

Assumed Natural Gas Usage in Theoretical Boiler						
Natural Gas Consumed (m^3/yr)	Natural Gas Consumed (ft^3/yr)	Parameter	Emission Factor [1] (lb/Mft^3)	Estimated Annual Emission (lb/yr)	Estimated Annual Emission (kg/yr)	Estimated Emission Rate (g/s)
6500000	229545300	CO	35	8034.0	3644.2	0.116
6500000	229545300	NO_x	140	32136.3	14576.8	0.462
6500000	229545300	PM_{10}	13.7	3144.7	1426.4	0.045
6500000	229545300	$PM_{2.5}$	13.7	3144.7	1426.4	0.045
6500000	229545300	SO_x	0.6	137.7	62.5	0.002
Protein Recycling Stack Data (Vendor Supplied)						
		NO_x		5115.8	2320.5	0.0735
		PM_{10}		15738.8	7139.0	0.226

Note 1: Data obtained from WebFIRE Internet database on July 29, 2006 from

http://cfpub.epa.gov/oarweb/index.cfm?action=fire.main

The utilized/supplied emission parameters are provided in more detail in Section 5.0 of this report.

4.3 RECEPTORS

The receptor grid for the air dispersion modeling included 932 receptors arranged based upon Manitoba Conservation's Draft Guideline as follows:

- A dense interior 100 by 100 metre grid extending 1 km from the centroid of the plant emission sources (including within the site property);
- An intermediate 500 by 500 metre grid from the interior grid to 5 km from the centroid of the plant emission sources;
- 32 discrete receptors representing the nearest identified residences along Plessis Road and Springs Church; and
- A series of 39 receptors defined along the perimeter "fenceline" of the plant site at 100 m spacing to illustrate contaminant concentrations at the site boundary.

Figure 4.1 in Appendix A indicates the general layout of the defined receptors around the site.

In addition, to determine the frequency of odour events by time and radius from the site, a polar receptor grid network was generated on 100 m intervals over 16 - 22.5° angular increments outside of the site boundaries.

4.4 BUILDING DOWNWASH REQUIREMENT ANALYSIS

The characteristics of the plant site including building sizes and locations and source locations were processed using BPIP-View™ produced by Lakes Environmental, a Windows™

interface to EPA's Building Profile Input Program (BPIP). The location of each of the modeled structures was defined relative to the UTM coordinate system. Building dimensions and relative locations were entered graphically, based upon site layout drawings provided by Olymel S.E.C./L.P. The BPIP output provided the building locations and wind-direction specific projected building widths to the ISCST program. The BPIP input building identifications and heights are summarized in Table 4.4. A graphical view of the digitized site plan indicating relative building sizes, locations and stacks is included as Figure 4.2 in Appendix A.

Table 4.4: BPIP – View Building Height and Identification

Building I.D.	Building Description	Height (ft)	Height (m)
BLDG:1	Cooler and Evisceration	25	7.6
BLDG:2	Shipping and Palletizing	25	7.6
BLDG:3	Holding Pens and Receiving	20	6.1
BLDG:4	Maintenance	30	9.1
BLDG:5	Offices	15	4.6
BLDG:6	Pallet Storage	30	9.1
BLDG:7	Protein Recycling and Wastewater	30	9.1
BLDG:8	Cut Floor and Offices	40	12.2
BLDG:9	Freezer	48	14.6
BLDG:10	Carcass Splitting	30	9.1
BLDG:11	Kill Floor and Stunning	25	7.6

The stack heights proposed for the plant construction were lower than the preliminary GEP stack heights produced by the BPIP program. Considering this and the comparably large projected building widths compared to the stack heights, building downwash effects were modeled.

4.5 METEOROLOGICAL DATA

Meteorological data obtained from Environment Canada for the years 1996 through 2000 was utilized for the model application. Data from the City of Winnipeg Airport station was utilized for surface data. However, the City of Winnipeg station does not record upper air information (mixing heights, etc.) This data was provided from the station in The Pas, Manitoba as has been done on previous projects that were accepted by provincial regulators. Figure 4.3 in Appendix A includes a windrose representative of the weather data set used for this project.

4.6 BACKGROUND AIR QUALITY

Background concentrations of the various modeled pollutants were gathered from the Manitoba Conservation Air Quality Section Website including the CCME Canada Wide Standard (CWS) for $PM_{2.5}$. The closest representative source of ambient air quality data was the air monitoring station located at 65 Ellen Street in downtown Winnipeg, Manitoba (approximately 9 km west of the site). The background air quality data was obtained in order to add it to the estimated air quality impacts of the proposed facility for comparison to applicable criteria. The selected background air quality estimates are summarized in Table 4.5 including their source, and averaging period. For the modeled parameters with the exception of odours and $PM_{2.5}$, peak values were selected from the most recent year available on the Manitoba Conservation website (2005) where available in order to provide conservative air quality estimates.

Table 4.5: Ambient Background Air Quality

Name of Pollutant	Data Source	Units of Measurement	Averaging Period	Ambient Background Air Quality
$PM_{2.5}$	2003 CWS Metric in Manitoba, CWS for PM & Ozone	$\mu g/m^3$	24 hour - 3 year average 98th percentile	17
PM_{10}	Winnipeg, Manitoba 2005 – 65 Ellen St.	$\mu g/m^3$	24 hour – maximum	22.86
Carbon Monoxide	Winnipeg, Manitoba	mg/m^3	1 hour max 8 hour max	3.96 2.22
NO_2	Winnipeg, Manitoba 2005 – 65 Ellen St.	$\mu g/m^3$	1 hour max 24 hour max Annual Mean	149 74.9 23.6
SO_2	Winnipeg, Manitoba (1990-1991) 65 Ellen Street,	$\mu g/m^3$	1 hour max 24 hour max Annual Mean	171.6 143 0
Odours		Odour Units*	3 min	Assumed None

* - IITRI Assumed

Section 5.0
Emission Data

SECTION 5.0
EMISSION DATA

5.1 EMISSION RATE

Input data for the model was obtained from a number of sources including sample collection and analyses from similar facilities, vendor/manufacturer-supplied information and emission factors from *AP 42, Fifth Edition Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources* from US EPA. The source of model data varied by the parameter of concern. The methodology followed in the collection of data for the odour model is detailed in Appendix B. The model data for the remaining parameters was obtained as indicated in Section 4.0 by idealizing the plant emissions as a combination of emissions from the protein recycling system and a theoretical boiler. All of the emission data is summarized in Table 5.1. The odour emissions are based upon representative measurements and past experience at a functionally similar Olymel pork processing plant in Quebec, a representative hog truck in Manitoba and vendor/manufacturer information in the case of the protein recycling system. Values in this Table include emission control reductions. The truck emissions were modeled as a volume line source in the model to simulate four waiting hog trucks for the odour model. In addition, the site layout, emission source locations, and orientation were provided in the form of drawings.

5.2 CONVERSION OF DATA FOR MODEL USE

Manitoba Conservation's odour criteria (2 OU for residential areas and 7 OU for industrial areas) date back to at least 1985 (pers. Comm. Bert Krawchuk, Manitoba Conservation Air Quality Section). More recently Manitoba Conservation has utilized a nuisance odour clause in Environment Act Licences and used the odour criteria numbers as guidelines suitable for modeling proposed developments (such as the OlyWest plant). This is significant as different odour measurement methods have been developed for different jurisdictions in the last couple decades and the testing conducted on the Earth Tech-collected samples was done under a recently finalized European standard known as EN 13725: Air Quality – Determination of odour concentration by dynamic olfactometry. The data from this testing has been converted to results that would be comparable to the Manitoba Conservation criteria, namely the Illinois Institute of Technology Research Institute (IITRI) method. Both methods follow ASTM E679-91 – Standard practice for determination of odour and taste thresholds by a forced-choice ascending concentration series method of limits but a different type of olfactometer is utilized with a different flow rate. A conversion factor was supplied by St. Croix Sensory Inc. to allow use and direct comparison of the model results to Manitoba Conservation's criteria.

Table 5.1: OlyWest Emission Parameter Summary

OlyWest Limited, Winnipeg, Manitoba Facility-Wide Emission Inventory Estimate											
Emission Unit	Emission Rate						Stack ID m	Stack Height m	Number of Stacks	Outlet Gas Temp deg. K	Exit Velocity m/s
	PM_{10} g/s	NO_2 g/s	CO g/s	SO_2 g/s	Odour OU/s	$PM_{2.5}$ g/s					
Protein Recycling Room Air Scrubber #1	0.226	0.073	-	-	6017	-	1.68	15.2	1	301	18.20
Protein Recycling Room Air Scrubber #2	0.226	0.073	-	-	6017	-	1.68	15.2	1	301	18.20
Theoretical Boiler*	0.045	0.462	0.116	0.002	-	0.045	0.80	11.1	1	440	10.00
Hog Pen Stacks											
VE-4					Appendix B		0.81	9.6	1	299	Appendix B
VE-5					Appendix B		0.81	9.6	1	299	Appendix B
VE-6					Appendix B		0.81	9.6	1	299	Appendix B
VE-7					Appendix B		0.81	9.6	1	299	Appendix B
VE-8					Appendix B		0.81	9.6	1	299	Appendix B
VE-9					Appendix B		0.81	9.6	1	299	Appendix B
VE-10					Appendix B		0.81	9.6	1	299	Appendix B
VE-11					Appendix B		0.81	9.6	1	299	Appendix B
VE-12					Appendix B		0.81	9.6	1	299	Appendix B
VE-13					Appendix B		0.81	9.6	1	299	Appendix B
VE-14					Appendix B		0.81	9.6	1	299	Appendix B
VE-15					Appendix B		0.81	9.6	1	299	Appendix B
VE-16					Appendix B		0.81	9.6	1	299	Appendix B
VE-17					Appendix B		0.81	9.6	1	299	Appendix B
VE-18					Appendix B		1.09	9.6	1	299	Appendix B
VE-19					Appendix B		1.09	9.6	1	299	Appendix B
VE-20					Appendix B		0.81	9.6	1	299	Appendix B
VE-21					Appendix B		1.09	9.6	1	299	Appendix B
VE-22					Appendix B		1.09	9.6	1	299	Appendix B
VE-23					Appendix B		1.09	9.6	1	299	Appendix B
VE-24					Appendix B		1.09	9.6	1	299	Appendix B
VE-26					Appendix B		0.81	9.6	1	299	Appendix B
VE-27					Appendix B		1.09	9.6	1	299	Appendix B
VE-28					Appendix B		1.09	9.6	1	299	Appendix B
VE-29					Appendix B		0.81	9.6	1	299	Appendix B
VE-30					Appendix B		1.09	9.6	1	299	Appendix B
VE-31					Appendix B		1.09	9.6	1	299	Appendix B
VE-32					Appendix B		0.81	9.6	1	299	Appendix B
VE-33					Appendix B		0.81	9.6	1	299	Appendix B
VE-34					Appendix B		1.09	9.6	1	299	Appendix B
VE-35					Appendix B		1.09	9.6	1	299	Appendix B
VE-36					Appendix B		0.81	9.6	1	299	Appendix B
VE-37					Appendix B		1.09	9.6	1	299	Appendix B
VE-38					Appendix B		0.81	9.6	1	299	Appendix B

VE-39					Appendix B		1.09	9.6	1	299	Appendix B
VE-40					Appendix B		1.09	9.6	1	299	Appendix B
VE-41					Appendix B		1.09	9.6	1	299	Appendix B
VE-42					Appendix B		1.09	9.6	1	299	Appendix B
VE-43					Appendix B		1.09	9.6	1	299	Appendix B
VE-44					Appendix B		1.09	9.6	1	299	Appendix B
VE-45					Appendix B		1.09	9.6	1	299	Appendix B
VE-46					Appendix B		0.81	9.6	1	299	Appendix B
VE-47					Appendix B		1.09	9.6	1	299	Appendix B
VE-48					Appendix B		1.09	9.6	1	299	Appendix B
VE-49					Appendix B		1.09	9.6	1	299	Appendix B
VE-50					Appendix B		0.81	9.6	1	299	Appendix B
VE-51					Appendix B		1.09	9.6	1	299	Appendix B
VE-52					Appendix B		1.09	9.6	1	299	Appendix B
VE-53					Appendix B		0.81	9.6	1	299	Appendix B
VE-54					Appendix B		1.09	9.6	1	299	Appendix B
VE-55					Appendix B		0.81	9.6	1	299	Appendix B
VE-56					Appendix B		1.09	9.6	1	299	Appendix B
VE-57					Appendix B		1.09	9.6	1	299	Appendix B
VE-58					Appendix B		0.81	9.6	1	299	Appendix B
VE-59					Appendix B		1.09	9.6	1	299	Appendix B
VE-60					Appendix B		1.09	9.6	1	299	Appendix B
VE-61					Appendix B		0.81	9.6	1	299	Appendix B
VE-62					Appendix B		1.09	9.6	1	299	Appendix B
VE-63					Appendix B		0.81	9.6	1	299	Appendix B
VE-64					Appendix B		1.09	9.6	1	299	Appendix B
VE-65					Appendix B		1.09	9.6	1	299	Appendix B
VE-66					Appendix B		1.09	9.6	1	299	Appendix B
VE-67					Appendix B		0.81	9.6	1	299	Appendix B
VE-68					Appendix B		1.09	9.6	1	299	Appendix B
VE-69					Appendix B		1.09	9.6	1	299	Appendix B
Truck Bedding/Manure Solids	-	-	-	-	Appendix B	-	0.33	8.1	1	301	Appendix B

* Fictional stack to simulate emissions from natural gas use at the site.

Section 6.0
Model Results

SECTION 6.0
MODEL RESULTS

This section summarizes the model output results for each of the modeled parameters including PM_{10}, $PM_{2.5}$, NO_2, CO, SO_2 and Odour. Furthermore, each is compared to the applicable criteria.

6.1 OUTPUT

Model output was tailored to the individual referenced objectives i.e., a model output of high-first-high 24-hour averages for each of the receptors was generated for the PM_{10} model since the referenced criteria is a 24-hour average. In the case of the odour model, the output run was generated as 1 hour averages, converted to 3 minute averages, and then graphically interpreted as concentration isopleths overlaid on an air photo base map and a site layout plan.

The remaining parameters were modeled and the resulting maximum predicted value was added to the assumed background concentration for comparison to Manitoba Conservation's Ambient Air Quality Objectives and Guidelines. A summary of the model output is provided as Appendix C including the high value and location. In the case of the odour model, the output reads as a 1 hour average, however the results were already adjusted internal to the model to account for a 3 minute average as per Manitoba Conservation's draft guidelines.

None of the total concentrations (maximum predicted concentration plus assumed background concentrations) exceeded the applicable maximum acceptable level (MAL) from Manitoba Conservation with the insignificant exception of odour; the results are summarized in tabular form at the end of this section.

6.2 $PM_{2.5}$ MODELING RESULTS

The model-predicted maximum 24 hour average concentration resulting from plant emissions was 2.3 $\mu g/m^3$. It occurred on the plant site, just northeast of the cooler building (BLDG1). The background concentration value of 17 $\mu g/m^3$ was determined corresponding to the $PM_{2.5}$ CWS metric in Manitoba for 2003. It represents a 24 hour average, 98^{th} percentile annual ambient measurement, averaged over three consecutive years from the Ellen St. station in the City of Winnipeg. The sum of the estimated $PM_{2.5}$ modeling results and background concentration (19.3 $\mu g/m^3$) predicts that maximum ambient concentrations less than 30 $\mu g/m^3$ (the MAL) will occur as a result of the plant. A graphical representation of the predicted concentration isopleths was not generated as the criteria for this parameter was satisfied.

6.3 PM_{10} MODELING RESULTS

The model-predicted maximum 24 hour average PM_{10} concentration resulting from plant emissions was 15.3 $\mu g/m^3$. It occurred on the plant site, just northeast of the cooler building (BLDG1). The background concentration used was the 2005 24-hour PM_{10} maximum

concentration of 22.86 µg/m^3 from the City of Winnipeg's Ellen St. Station. The sum of the estimated maximum PM_{10} modeling result (15.3 µg/m^3) and assumed background concentration (22.86 µg/m^3) predicts that ambient concentrations, as a result of the plant, will not exceed the provincial MAL guideline of 50 µg/m^3. A graphical representation of the predicted concentration isopleths was not generated as the criteria for this parameter was satisfied.

6.4 NITROGEN OXIDE (NO_X) MODELING RESULTS

Manitoba Conservation does not currently have an overall NO_x concentration objective; however, they have adopted a number of objectives for NO_2. Based upon past consultation with Manitoba Conservation for other projects, all of the plant NO_x emissions were assumed to be NO_2.

The maximum 1 hour average model-predicted NO_2 concentration was 36.6 µg/m^3. the predicted location of the maximum concentration was on the site, just northeast of the cooler building (BLDG1). The background concentration assumed for this parameter was the 2005 maximum ambient 1 hour concentration of 149 µg/m^3 from the City of Winnipeg Ellen St. Station as reported by Manitoba Conservation. The addition of the model-predicted value and the background concentration resulted in a maximum ambient concentration of 185.6 µg/m^3. This result was far below the provincial MAL objective of 400 µg/m^3.

The maximum 24 hour average model-predicted NO_2 concentration was 28.2 µg/m^3. the predicted location of the maximum concentration was on the site, just northeast of the cooler building (BLDG1). The background concentration assumed for this parameter was the 2005 maximum ambient 24 hour concentration of 74.9 µg/m^3 from the City of Winnipeg Ellen St. Station as reported by Manitoba Conservation. The addition of the model-predicted value and the background concentration resulted in a maximum ambient concentration of 103.1 µg/m^3. This result was far below the provincial MAL objective of 200 µg/m^3.

The maximum annual average model-predicted NO_2 concentration was 2.5 µg/m^3. the predicted location of the maximum concentration was on the site, just northeast of the cooler building (BLDG1). The background concentration assumed for this parameter was the 2005 mean ambient annual concentration of 23.6 µg/m^3 from the City of Winnipeg Ellen St. Station as reported by Manitoba Conservation. The addition of the model-predicted value and the background concentration resulted in a maximum ambient concentration of 26.1 µg/m^3. This result was far below the provincial MAL objective of 100 µg/m^3 and the 60 µg/m^3 MDL objective. Graphical representations of the predicted concentration isopleths for the NO_2 models were not generated as the guideline criteria for this parameter were satisfied in all cases.

6.5 CARBON MONOXIDE (CO) MODELING RESULTS

The maximum 1 hour average model-predicted CO concentration was 7.9 $\mu g/m^3$ or 0.0079 mg/m^3. The predicted location of the maximum concentration was on the site, just northeast of the cooler building (BLDG1). The background concentration assumed for this parameter was the 2005 maximum ambient 1 hour concentration of 3.96 mg/m^3 from the City of Winnipeg Ellen St. Station as reported by Manitoba Conservation. The addition of the model-predicted value and the background concentration resulted in a maximum ambient predicted concentration of 3.97 mg/m^3. This result was far below the provincial MAL objective of 35 mg/m^3.

The maximum 8 hour average model-predicted CO concentration was 6.9 $\mu g/m^3$ or 0.0069 mg/m^3. The predicted location of the maximum concentration was on the site, just northeast of the cooler building (BLDG1). The background concentration assumed for this parameter was the 2005 maximum ambient 8 hour concentration of 2.22 mg/m^3 from the City of Winnipeg Ellen St. Station as reported by Manitoba Conservation. The addition of the model-predicted value and the background concentration resulted in a maximum ambient predicted concentration of 2.23 mg/m^3. This result was far below the provincial MAL objective of 15 mg/m^3.

6.6 SULPHUR DIOXIDE (SO_2) MODELING RESULTS

As SO_2 data was not collected at the Ellen St. Station in 2005, 1990-1991 data collected at Ellen St. in the City of Winnipeg was used that was previously provided by Manitoba Conservation in their Manitoba Ambient Air Quality Criteria Annual Report – 1991, Report No. 94-07. The data was used to approximate background conditions at the subject site. The annual mean concentration was 0 ppm while the peak 1 and 24 hour data values were 0.06 ppm (172 $\mu g/m^3$) and 0.05 ppm (143 $\mu g/m^3$), respectively.

The maximum 1 hour average model-predicted SO_2 concentration was 0.14 $\mu g/m^3$. The predicted location of the maximum concentration was on the site, just northeast of the cooler building (BLDG1). The addition of the model-predicted value (0.14 $\mu g/m^3$) and the background concentration (172 $\mu g/m^3$) resulted in a maximum ambient predicted concentration of 172.14 $\mu g/m^3$. This result was far below the referenced MDL of 450 $\mu g/m^3$ and the MAL of 900 $\mu g/m^3$.

The maximum 24 hour average model-predicted SO_2 concentration was 0.10 $\mu g/m^3$. The predicted location of the maximum concentration was on the site, just northeast of the cooler building (BLDG1). The addition of the model-predicted value (0.10 $\mu g/m^3$) and the background concentration (143 $\mu g/m^3$) resulted in a maximum ambient predicted concentration of 143.1$\mu g/m^3$. This result was far below the referenced MAL of 300 $\mu g/m^3$.

The annual average model-predicted SO_2 concentration was 0.009 $\mu g/m^3$. The predicted location of the maximum concentration was on the site, just northeast of the cooler building (BLDG1). The addition of the model-predicted value (0.009 $\mu g/m^3$) and the background concentration (0 $\mu g/m^3$) resulted in a maximum ambient predicted concentration of 0.009 $\mu g/m^3$. This result was far below the referenced MAL of 60 $\mu g/m^3$ and MDL of 30 $\mu g/m^3$.

6.7 ODOUR MODELING RESULTS

Odour modeling for the facility was undertaken in accordance with Manitoba Conservation's Draft Air Dispersion Modeling Protocol for Estimating Odour Nuisance Impacts, 1996. Odour emission rates for each of the modeled sources were determined as indicated in Appendix B. This odour emission rate was then multiplied by the respective air flows from the various sources on the proposed OlyWest MB Limited Partnership (OlyWest) plant to determine an odour flow rate (OU/s). The flow rate was modeled as an emission rate to predict ambient odour concentrations in the study area which was then multiplied by a factor of 0.000001 to adjust units from μOU to OU and again multiplying by a factor of 7 to adjust the averaging period from hourly peak values to 3 minute values.

Assuming that no significant cumulative background odour exists on or near the site, maximum odours are predicted to occur approximately 200 m south of the plant property and approximately 370 m south of the hog receiving area of the building at a theoretical concentration of 4.9 OU (Figure 6.1). This maximum falls within the general area of the CNR Symington yards and is well within the industrial MAL of 7 OU. The results of the modeling also indicate a concentration of 2 OU (the residential MAL) will be met prior to extending over residential property with the exception of a few of the southernmost residential properties along the northern portion of Plessis Rd, south of Dugald. The estimated odour concentrations over these properties are predicted to be essentially 2 OU. Over the five year (43,848 hour) period modeled this occurred over two-1 hour periods at three of the residences; two residences at 10:00 – 11:00 p.m. on July 24, 1997 (theoretical odour concentrations of 2.19 and 2.03 OU) and one residence at 11:00 – 12:00 a.m. on July 30, 1998 (theoretical odour concentration of 2.00 OU). Given the precision and conservative assumptions of the model these three excursions should not be considered an exceedance of the criteria. A graphical representation of the modeled odour isopleths are presented in Appendix B.

Table 6.1 provides a summary of the frequency of odour concentrations in excess of 2 OU by distance from the centroid of the modeled sources (over the holding pens) based upon a polar receptor grid.

Table 6.1: Summary of Detectable Odour Frequency by Distance from Plant Source

Distance From Source Centroid (km)	Total With Detectable Odour Concentration at any Point Within Radius (>2 OU)	
	Hours out of 43848 (5 years)	Critical Receptor Classification
0 to 1	2045 (4.7%)	Industrial
1 to 1.4	32 (0.07%)	Industrial
1.4 to 2	10 (0.02%)	Residential
2 to 5	0	Residential

Section 7.0
Summary and Conclusions

SECTION 7.0
SUMMARY AND CONCLUSIONS

An ambient air quality impact analysis was conducted for OlyWest MB Limited Partnership's (OlyWest) proposed pork processing plant. The analysis started with the development of source inputs for the model. Emissions were estimated based on sample collection and analyses, vendor supplied information, OlyWest/Olymel experience, and USEPA emission factors. Equipment capacities and stack parameters were obtained and wind-direction specific building dimensions were calculated with USEPA's BPIP computer program.

The modeling protocol was then prepared. Estimated background air quality concentrations were given, selected models were described, receptor grids were developed, and meteorological data was presented.

The model results combined with the assumed background pollutant concentrations have been presented. Table 7.1 includes a summary of the relevant criteria and the airborne parameter concentrations.

Table 7.1: Summary of Parameter Concentrations

Parameter	Units of Measurement	Averaging Period	Maximum Predicted Ambient Concentration	Maximum Acceptable Level Concentration
PM_{10}	$\mu g/m^3$	24 hours	38.1	50
$PM_{2.5}$	$\mu g/m^3$	24 hours	19.3	30
Carbon Monoxide	mg/m^3	1 hour	3.97	35
		8 hour	2.23	15
NO_2	$\mu g/m^3$	1 hour	185.6	400
		24 hour	103.1	200
		Annual	26.1	100
SO_2	$\mu g/m^3$	1 hour	171.7	900
		24 hour	143.1	300
		Annual	0.01	60
Odours	Odour Units (IITRI)	3 min	2.19	2 – residential
			4.96	7 – industrial

In conclusion the modeled parameter concentrations, when combined with the assumed background concentrations do not exceed the referenced criteria based upon the modeled conditions described in this report. The exception to this is the predicted odour concentrations at 2 residential receptors, however the model predicts excursions of 0.2 OU or less in 3 hours out of 5 years.

Section 8.0
References

SECTION 8.0
REFERENCES

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