Odour Assessment
Using AERMOD Dispersion Model
with Site-Specific Data

Coronation Organics Processing Centre
& Anaerobic Digester

Prepared For:

2682517 Ontario Inc.
Scarborough, Ontario

Prepared By:

CH FOUR BIOGAS
Your Organic Energy Potential Realized.

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Main Office
1128 Clapp lane.
Manotick, Ontario K4M 1A7
T: 613 224 8308

CH Four Biogas, Inc.
info@CHFour.ca
www.CHFour.ca

Western Region Office
201-20349 88th Ave.
Langley, BC. V1M 2K5
T: 778 370 5202

EXECUTIVE SUMMARY

This dispersion modelling Odour Assessment using site-specific meteorological data was completed as part of 2682517 Ontario Inc.'s Environmental Compliance Approval (ECA) application with the Ministry of Environment Conservation and Parks. The purpose of this report is to identify potential odour sources, explain odour control mechanisms and to determine the potential impact of these odours in the community.

The proposed facility will generate renewable natural gas and an organic fertilizer via the anaerobic digestion of organic food residual materials. The facility will receive and clean organic residues for use in the anaerobic digestion facility at the site. The process of anaerobic digestion generates a liquid organic fertilizer and biogas which is cleaned and injected into the natural gas grid as renewable natural gas. The project diverts organic residues from landfill and generates renewable natural gas from the organic residues that, when untreated, emit methane and carbon dioxide to the atmosphere.

This Report provides a description of the proposed facility and a summary of dispersion modelling of odour emissions from the facility. The Ministry of Environment Conservation and Parks (MECP) dispersion model, AERMOD (version 16216r) is used. All calculations and data that is required for the evaluation of emissions can be found in this Report or in the Appendices. This assessment considers building downwash effects and uses Ministry approved site-specific meteorological data.

There are two potential sources of odours at the facility – an odour control stack that treat odours from the reception and pre-processing of feedstocks within the organics processing centre and the biogas upgrader.

An odour emission value of 1,000 odour units (ou) is used at both stacks although test results from a similar facility that uses the same odour control mechanisms indicate emission rates of less than 100 ou are expected from the stacks at the facility. The odour impact is determined at 4 specific human receptors that are identified in this Report. AERMOD results are provided in 1-hour averages which are converted to 10-minute averages as per MECP requirements.

The results of the dispersion modelling indicate that the resulting possible odours are below the MECP's requirement of 1 odour unit at all four human receptors.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

1 FACILITY DESCRIPTION

1.1 2682517 Ontario Inc.

2682517 Ontario Inc. is developing an organics processing centre (OPC) in Scarborough, Ontario. The facility will accept and process organic residuals for use as a feedstock for anaerobic digestion to produce renewable natural gas (RNG) for injection into the natural gas grid and digestate (organic fertilizer).

1.2 Facility Location

The facility is located at 633 Coronation Drive in Scarborough, ON. The location is zoned as Heavy-Industrial. Appendix A contains drawings of the facility that are relevant to this odour assessment.

1.3 NAICS Code

The most relevant and applicable North American Industry Classification (NAICS) codes are 562920 Materials Recovery Facilities and 562210 Waste Treatment and Disposal. The facility is a waste processing, resource recovery and disposal plant that uses anaerobic digestion to convert organic residues biogas for generation of renewable natural gas and organic fertilizer.

1.4 Process Description

The OPC is able to process up to 1240 tons per day of organics. Of this material, the anaerobic digester system can process up to 620 tons/day. Any organic material that is processed through the OPC that is not used as feedstock to the anaerobic digester will be exported from site to other operating anaerobic digester facilities or other appropriately permitted locations.

All units used throughout this Report are metric tons.

A more detailed description of the process can be found in the Design and Operation Report for the facility but a summary of the process, particularly with regard to odour potential, is described below.

Organics for processing are delivered to the OPC and processed according to the type of material. All deliveries are made within the Receiving Building. All feedstock that is delivered to the site is brought to the reception building where there are three kinds of receiving: dock receiving for Intermediate Bulk Containers (IBCs), truck load receiving for roll off containers and tractor trailers and bulk liquid receiving. The OPC is equipped with fast acting doors with air curtains to mitigate odour escape from the facility. All of the air in the building is continuously drawn from the building and cycled through an odour control to ensure that all air within the building is treated through the odour control unit prior to recirculation into the building or discharge to the environment.

The OPC contains a 50 m^3 Surge Tank is located within the Organics Reception Building which is used to allow for fluid movement of feedstocks within the facility and pumps directly to the Hydrolyzer Tank.

Organics can be transferred to the 4,000 m^3 hydrolyzer tank from the OPC liquid surge tank, directly from a delivery truck or immediately after being processed through the OPC. The hydrolyzer tank is used to pre-treat all of the feedstocks prior to use in the anaerobic digester (AD). The hydrolyzer tank facilitates the breakdown of feedstocks and to increase the efficiency of the treatment process in the anaerobic digesters. For emission control purposes, the headspace of the hydrolyzer is connected to the headspace of the anaerobic digesters.

There are two 7,000 m^3 completely mixed anaerobic digesters which will process up to 620 tons/day of organic feedstocks that are brought to the site, producing biogas and digestate (organic fertilizer). On a daily basis, approximately 2,800 m^3 of biogas/hour (1,680 m^3 of renewable natural gas/hour) and 560 tons/day of digestate will be produced by the anaerobic digester.

The anaerobic digesters have a two-stage configuration; the first stage does the bulk of the conversion from feedstock to biogas. The second stage is for polishing/final biogas recovery stage with a short residence time which also assists in digestate (effluent) emission reduction. The anaerobic digesters will operate at a minimum temperature of 35 degrees Celsius and are designed to be able to operate in either the mesophilic or thermophilic temperature range.

The heat required to run the facility is generated through the use of natural gas boilers. The electricity required to run the facility is from the use of the existing three phase power at the site.

The membrane roof of the anaerobic digester is a double membrane and is essentially impermeable to methane gas. As such there is no methane released from the digester to the atmosphere through the digester membrane.

Biogas is composed of approximately 60% methane, 40% carbon dioxide and trace impurities (less than 500 ppm hydrogen sulphide during regular operation of the digester). The anaerobic digesters are designed to be able to inject small quantities of oxygen (less than 0.2%) into the biogas zone to aid in biological desulphurization of the biogas in the anaerobic digester tanks. If hydrogen sulphide is above 500 ppm H_2S, ferric chloride or ferric hydroxide can be added to the digester to convert H_2S to $Fe_2(SO_4)_3$ which is contained in the digestate. During standard operation, hydrogen sulphide is removed from the biogas prior to the biogas being upgraded to renewable natural gas (over 98% methane content) which is injected into the natural gas grid. In the unlikely event that the biogas cannot be upgraded, the system is designed with a flare that is capable of flaring all of the biogas generated in the facility and a pressure relief valve (PRV) which is a Code required safety feature.

The secondary product from the digester is called digestate and it is an organic fertilizer. Digestate is pumped to the truck filling station or hydrolyzer tank (to adjust pH or solids content in the hydrolyzer tank if required) by adjusting valves. The intention is to continuously transfer digestate off-site where the digestate will be stored until it is land applied as an organic fertilizer.

2 INITIAL IDENTIFICATION OF SOURCES AND CONTAMINANTS

2.1 Odour Emission Sources

There are two odour emission sources (OES) associated with the project and they are indicated on drawings OES1 and OES2 in Appendix A.

The two odour emission sources associated with the project are listed below:

Odour Emission Source 1 – STACKOP1 Odour Control at OPC
Odour Emission Source 2 – STACKOP2 Biogas Upgrader

2.2 Human Receptors

There are four human receptors associated with the project and they are indicated on drawings OES1 and OES2 in Appendix A.

The four human receptors associated with the project are listed below:

A. Coronation Drive
B. Factory, Chemical Court
C. Railway
D. Factory, Food Product Manufacturing Plant

2.3 AERMOD Averaging Conditions

The AERMOD model predicts one-hour average concentrations so each output concentration is converted to 10-minute average concentrations using the averaging period conversion factor of 1.65 as per the MECP Dispersion Modelling Guidelines.

3 ODOUR EMISSION SOURCE DESCRIPTIONS

The operating conditions that result in the two sources of odour emissions are detailed below. The site plan diagram, process flow and mass flow diagram found in Appendix A can be referenced for visual aid.

3.1 Odour Emission Source 1: Odour Control at Organics Processing Centre (OPC)

Odour Emission Source 1 consists of the exhausted clean air from the carbon filter for the OPC. The OPC is where organic residuals are brought for processing prior to use as a feedstock in the anaerobic digester system or for export from site.

All entry ways to the facility are equipped with fast acting doors and air curtains. Doors are closed prior to material being off-loaded from the trucks and all doors remain closed except for when a truck is entering or leaving the building. All of the air in the building is continuously drawn from the building and cycled through an odour control to ensure that all air within the building is treated through the odour control unit prior to recirculation into the building or discharge to the environment.

Odour control for the 28,000 ft^2 (2601 m^2) building consists of a carbon filter that is sized to process 62,500 ft^3 air/min (106,188 m^3 air/hour) through a stack that is 36" in diameter. The scrubber system contains 21,146 kg of Sulfursorb-A media for odour control and air treatment. The activated carbon filter is sized to provide 1.5 years of air treatment, although the lifespan of the filter will vary depending upon the nature of the feedstocks being received at the facility.

Following ASHRAE Guidelines 1 cfm per square foot of building must be removed from the building, as such a total of 47,572 m^3/hour of treated air will be discharged from the building, the remainder will be recycled back into the building (58,616 m^3/hour). The treated air is Odour Emission Source 1 "STACKOP1".

The odour control system is designed with continuous emissions monitoring (CEM) technology to monitor hydrogen sulphide concentration. The scrubber is designed to provide continuous air treatment even during media change out. The scrubber is subdivided length-wise so that each side can work independently from one another. During carbon change out, one side is shut down for media change-out while the other side remains in operation with a lower flow. Once change-out has occurred, air flow would be switched to the other side. Spent media is removed and landfilled appropriately. In addition to the use of the CEM hydrogen sulphide sensors, sniff tests and a daily site walk around are part of ensuring adequate odour control on-site.

Odour emissions from this source are considered to be 1,000 ou as a high value worst case scenario.

3.2 Odour Emission Source 2: Biogas Upgrading

The headspaces of the hydrolyzer tank and the anaerobic digesters are connected. As such gas generated in hydrolyzer tank (approximately 140 m^3 CO_2/hour) and biogas generated in the anaerobic digesters (approximately 2,800 m^3 biogas/hour) are treated via the biogas upgrading system. The gas that captured in the anaerobic digesters will contain less than 500 ppm H_2S. Due to the connection of the hydrolyzer headspace it is anticipated that the biogas will contain some mercaptans. In addition, if oxygen is injected into the headspace of the anaerobic digesters for biological desulphurization, then the gas may also contain up to 0.2% oxygen.

The raw biogas is pre-treated prior to being upgraded to renewable natural gas using an H_2S and mercaptan scavenger called Sulfatreat. The biogas upgrading system consists of two pre-treatment scrubbers to be able to provide continuous biogas pre-treatment in the event of breakthrough of H_2S in the treatment media.

Following the pre-treatment, biogas then enters the Pressure Swing Adsorption (PSA) upgrader where it is "purified" to create renewable natural gas. The biogas upgrader separates carbon dioxide from the methane to create renewable natural gas.

The vented tail gas from the biogas upgrader is Odour Emission Source 2 "STACKOP2". Odour emissions from this source are considered to be 1,000 ou as a high value worst case scenario.

3.3 Odour Control System

The lifespan of the filter will vary depending upon the nature of the feedstocks being received at the facility. Each of the odour emission sources is designed with continuous emissions monitoring (CEM) technology to monitor hydrogen sulphide concentration. Both odour control systems are designed to provide continuous air treatment during media change out.

In addition to the use of the CEM hydrogen sulphide sensors, sniff tests and a daily site walk around are part of ensuring adequate odour control on-site. The CEM is connected to the facility's supervisory control and data acquisition (SCADA) system. If a sensor detects break-through the SCADA will immediately notify the operator of the facility with an alarm so that media change out can begin immediately.

The non-toxic spent media from both systems is removed and landfilled, or recycled, as appropriate.

The odour emission data that is used in the dispersion modelling of the proposed anaerobic digester facility is set to 1,000 ou from each stack. This value was used as a worst-case scenario. Appendix F contains data from odour emission testing from an existing anaerobic digester facility (Seabreeze Agri-Energy in Delta, British Columbia) that processes similar feedstocks as the Coronation Organics Processing Centre and Anaerobic Digester and uses similar carbon filter media as is proposed for this facility. The test results from this facility are below 100 odour units.

4 DISPERSION MODEL

In this Report, odour emissions at this facility are modelled using the MECP approved dispersion model, AERMOD, using MECP site-specific meteorological data files for the facility (see attached letter, Appendix C).

Table 1 below contains the Dispersion Modelling Input Summary.

Table 1: Dispersion Modelling Input Summary

Relevant Section of the Regulation	Section Title	Description of How the Approved Dispersion Model was Used
Section 6	Approved Dispersion models	AERMOD (version 16216r)
Section 8	Negligible Sources of Contaminant	2 sources of odour emissions
Section 9	Same Structure Contamination	N/A
Section 10	Operating Conditions	See Section 1.4 and 3 of Report
Section 11	Source of Contaminant Emission Rates	Appendix B sample calculations
Section 12	Combined Effects of Assumptions for Operating Conditions and Emission Rates	N/A
Section 13	Meteorological Conditions	AERMET (Ministry-approved site specific data sets)
Section 14	Area of Modelling Coverage (receptor locations)	Discrete receptor points, Appendix A
Section 15	Stack Height for Certain New Sources of Contaminant	AERMAP Site Specific NED Files Available here: https://www.ontario.ca/environment-and-energy/map-regional-meteorological-and-terrain-data-air-dispersion-modelling
Section 16	Terrain Data	AERMAP Site Specific NED Files Building downwash considered for stacks located on top of buildings, Good Engineering Practice applied for stack height
Section 17	Averaging Periods	All data converted to 10-minute averages from 1-hour averages

5 ODOUR EMISSIONS SUMMARY AND INTERPRETATION OF RESULTS

Odour emissions from the odour control stacks and the biogas upgrader are based on stack characteristics and an odour emission of 1,000 ou as a worst case scenario.

The AERMOD model provides predicted ambient concentrations at each human receptor in one-hour averages. The conversion factor provided in the Regulation of 1.65 is used to convert from 1-hour to 10-minute averages.

The emission concentrations are compared to the MECP odour threshold of less than 1 ou at human receptors. The MECP Dispersion Modelling Guidelines allow for the removal of the anomalous eight hours with the highest 1-hour average predicted concentrations in each single meteorological year. The summary of all the data points that is provided in Table 2 below indicate that there are no data points above the 1 ou threshold (prior to removal of meteorological anomalies).

Table 2 below provides a summary of all of the data for five years of meteorological data at the site. In the table below you will see the number of data points (1-hour of time per data point) where data odour concentrations were within each range. This table indicates that over 96% of the resulting odour units are below 0.1 ou at all four human receptors.

Table 2: Odour Concentration at each Human Receptor

Odour Unit Range	**Receptor A** Coronation Drive		**Receptor B** Chemical Ct		**Receptor C** Railway		**Receptor D** Manufacturing Plant	
	# of data points	frequency [%]	# of data points	frequency [%]	# of data points	frequency [%]	# of data points	frequency [%]
0.9 to 1.0	0	0.00	0	0.00	0	0.00	0	0.00
0.8 to 0.9	0	0.00	0	0.00	0	0.00	0	0.00
0.7 to 0.8	0	0.00	0	0.00	1	0.00	0	0.00
0.6 to 0.7	1	0.00	31	0.07	3	0.01	0	0.00
0.5 to 0.6	4	0.01	61	0.14	20	0.05	0	0.00
0.4 to 0.5	5	0.01	139	0.32	62	0.14	16	0.04
0.3 to 0.4	42	0.10	250	0.58	234	0.54	216	0.50
0.2 to 0.3	192	0.44	551	1.27	929	2.14	606	1.40
0.1 to 0.2	685	1.58	1591	3.67	1386	3.19	3289	7.58
less than 0.1	42,454	97.86	40,760	93.95	40,775	93.99	39,283	90.55

6 CONCLUSIONS

The AERMOD dispersion model of odour emissions from the proposed facility indicate that the facility will not result in negative odours at the human receptors.

It must be reiterated that the use of 1,000 ou exiting each odour control stack is a very conservative value and it is anticipated that the outlet from the stacks will be much lower Regardless of this conservatism, the results from the dispersion model indicate that the MECP requirement of less than 1 ou at all human receptors is met using a dispersion model with site-specific meteorological data.