Appendix C

Air Impact Assessment Study

Tribute Communities, Colgan Wastewater Treatment Plant

Air Impact Assessment Study

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Executive Summary

Tribute Communities retained EXP Services Inc. (EXP) to prepare an air impact assessment (Study) for a proposed Wastewater Treatment Plant (WWTP) in the community of Colgan. The purpose of this Study is to provide an air impact assessment, including odour, as part of the Class EA Process.

Tribute Communities is currently undertaking Phases 3 and 4 of a Schedule "C" Class EA for wastewater servicing of its Colgan Communities development. The proposed WWTP will use the state-of-the-art Membrane Bio-Reactor (MBR) technology with an ultimate capacity of about 1,050 cubic meters per day (m^3/day) of influent.

The Ontario Ministry of the Environment, Conservations and Parks (MECP) D-series guidelines provide recommended separation distances and other control measures for land use planning proposals to prevent or minimize adverse effects from the encroachment of incompatible land uses where a facility either exists or is proposed. Guideline D-2 specifically applies to all development or redevelopment applications for residential or other sensitive land uses adjacent to sewage treatment facilities. The recommended separation distance in the Guideline is 100 metres. A separation distance of less than 100 metres may be permitted with a study demonstrating the feasibility of the distance based on the degree and type of mitigation measures applied to the facility for control of odour and other contaminants of concern. This Study assesses the potential impact of the proposed WWTP on the air quality for the proposed developments.

An emission inventory and air dispersion modelling assessment were completed to conservatively assess the WWTP's potential odour impact at the property line, at the nearby existing sensitive receptors, and the proposed residential subdivision when the WWTP will be operating at its ultimate capacity. The odour emission inventory was developed based on typical emission rates of the wastewater treatment processes. The modelling assessment was completed using the MECP regulatory model, AERMOD View (Version 9.5.0).

Where applicable, this Study follows the MECP emission summary and air dispersion modelling guideline as set out in s.26 of Ontario Regulation 419/05 and MECP guidance documents Procedure for Preparing and Emission Summary and Dispersion Modelling Report (March 2009); Air Dispersion Modelling Guideline for Ontario (March 2009); and Technical Bulletin: Methodology for Modelling Assessment of Contaminants with 10-Minute Average Standards and Guidelines under O. Reg. 419/05 (April 2008).

The result of the Study showed that the potential emissions were found to be compliant with appropriate MECP point of impingement (POI) limits and hence the D-2 guideline. The maximum 10-minute average odour concentrations were below the MECP odour guideline at all offsite locations, including the surrounding existing sensitive receptors and the proposed residential subdivision to be located immediately south and east of the proposed WWTP. No air quality adverse impacts are therefore expected from the normal operation of the proposed WWTP.

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1 Introduction

1.1 Purpose and Scope of Air Impact Assessment Report

Tribute Communities retained EXP Services Inc. (EXP) to provide services for submission of an air impact assessment (Study) for the proposed Colgan Wastewater Treatment Plant (WWTP). The Study is being completed as part of a Class EA underway in support of the WWTP. The WWTP will service a proposed residential subdivision community within the Township of Adjala -Tosorontio, just northwest of the Colgan Settlement Area.

The Ontario Ministry of the Environment, Conservation and Parks (MECP) D-series guidelines recommend separation distances and other control measures for land use planning proposals to prevent or minimize adverse effects from the encroachment of incompatible land uses where a facility either exists or is proposed. These guidelines are intended to minimize or prevent, through the use of buffers, the exposure of any person, property, plant or animal life to adverse effects associated with the operation of specified facilities. If recommended distances cannot be met, a study demonstrating no adverse effects on nearby receptors is required.

As part of the municipal Class Environmental Assessment (Class EA), the WWTP's potential odour impact was also assessed at the property line, at the nearby existing sensitive receptors, and the proposed residential subdivision when the WWTP is operating at its ultimate capacity.

Guideline D-2 specifically applies to all development or redevelopment applications for residential or other sensitive land uses adjacent to sewage treatment facilities. This Study assesses the potential impact of the proposed WWTP on the air quality, including odour, for the proposed developments.

2 Description of Development and Surrounding Areas

The development consists of single residentials, bungalow townhomes, and a retirement home serviced by a WWTP. The WWTP will be located at 44°02'01.9"N, 79°51'27.8"W, north of the County Road 14, west of the Concession Road 8, in Tottenham, Ontario. The WWTP site is currently surrounded by agricultural lands to north, south, west and east, with few residential homes along Concession Road 8 and County Road 14. The proposed residential subdivision will be located immediately east and south of the proposed WWTP. A site plan showing the proposed development and WWTP location is provided in Figure 1, Appendix A.

3 Provincial Guidelines and Regulations

The Ontario Ministry of the Environment, Conservation and Parks (MECP) D-series of guidelines are meant to identify potential compatibility issues between land uses. In the case of proposed sensitive uses in proximity to the WWTP, the "D-2 Compatibility between Sewage Treatment and Sensitive Land Use" Guideline is applicable. The minimum recommended separation distance for a WWTP with capacity of greater than 500 m^3/d and less than 25,000 m^3/d is 100 meters. A separation distance of less than 100 meters may be permitted provided a study demonstrates the feasibility of the proposed facility and distances. This study assesses:

- the degree and type of odour mitigation applied to the facility; and
- other contaminants of concern which may need to be addressed.

The recommended separation distance is shown on Figure 1. Residential properties located in the east and the possible future retirement home (post 20-year planning horizon and as such not yet approved) in the south of the WWTP are within the recommended separation distance.

3.1 Air Quality Contaminants

Under Ontario Regulation 419/05 – Air Pollution – Local Air Quality (O.Reg. 419/05) of the Environmental Protection Act a facility is required to meet prescribed standards for air quality contaminants at any location off-site. The proposed development and WWTP include emission sources of air quality contaminants with nearby sensitive receptors. The proposed WWTP will require an Environmental Compliance Approval - Air and Noise (ECA) to demonstrate that no off-site adverse effects result from its operation. A developer can support compliance through design of at-source mitigation (i.e. odour and contaminant control systems).

3.2 Odour

Odour is the sensation when receptors in the nose are stimulated. Individual response to odour varies and is subjective. Whilst some contaminants are specifically regulated based on odour effects, there is no formal regulation with respect to mixed odours. The MECP apply odour-based standards to locations "where human activities regularly occur at a time when those (odour emitting) activities regularly occur," such as residences and public meeting places. Most odours do not pose a health risk, but exposure to some can lead to headaches, nausea and other symptoms. They are generally only considered and regulated by the MECP in the presence of persistent complaints. Typically, odours are assessed against the following five criteria:

- Frequency – how often a receptor is likely to be exposed to an odour;
- Intensity – strength of the odour;
- Duration – the length of time the odour is likely to be detected by a receptor;
- Offensiveness – subjective character of odour – pleasantness or unpleasantness (hedonic tone); and
- Location – where the odour is likely to occur and with respect to land use. For example, rural smells would be more accepted in rural areas versus urban areas.

4 Assessment – Potential Air Quality Impacts

The WWTP process requires the handling and processing of up to 1,050 m^3/day raw sewage to produce treated wastewater and 1,100 kg/day sludge.

4.1 Description of Process and Process Flow Diagram

The proposed WWTP will use Membrane Bio-Reactor (MBR) technology with a maximum capacity of 1,050 cubic meters of influent per day (m^3/day). The WWTP will be constructed with three parallel clarifiers, each at 350 m^3/d, and three MBR trains with having a process capacity of each 350 m^3/d.

The WWTP with the MBR system will be composed of the following processes and primary components:

- Headworks (two coarse/fine screens and one equalization tank);
- Biological treatment (three aeration and three membrane tanks and two Ultraviolet (UV) disinfection channels); and
- Sludge management (aerated sludge Storage Tank (SST) and dewatering by Rotary Drum Thickening (RDT)).

All the units described above will be enclosed within the WWTP building. Process ventilation will be provided by the installation of three (3) Odour Control Units (OCU), rated at 4 cubic meters per second (m^3/s). While the specific OCU has not been finalized at this design stage, based on a review of supplier specifications on typical odour control equipment (see Section 4.2.1), a minimum removal efficiency of 95 per cent (%) is easily achievable and conservatively assumed for the purpose of this assessment.

The MBR process represents a significant advance in the treatment of wastewater, offering greater control over treated water quality, higher reliability and simpler operation.

The WWTP will also be equipped with a stand-by diesel generator that will be installed within its own Diesel Generator Room, within the WWTP itself.

The process flow diagram is presented in Figure 3 (Appendix A). A detailed process description is presented in this section below.

4.1.1 Headworks

The headworks accomplishes the pre-treatment of the raw wastewater and consists of Grit Removal, Fine Screens, and an Aerated Equalization Tank. These are enclosed within the WWTP as part of the headworks.

Grit Removal and Fine Screen

The raw wastewater will enter the grit removal and fine screens to remove any debris that might damage the membranes. The screenings (debris) will be transferred into a storage bin, while the wastewater from the screen will be collected by the screen discharge tank, which will flow to the downstream equalization tank by gravity. The air in the screen room will also be vented through the OCU prior to release to the environment.

The screened wastewater will then proceed to the aerated equalization tank.

Aerated Equalization Tank

Pre-treatment continues with the screened wastewater entering the Aerated Equalization (AEQ) tank, which will buffer influent flow variations prior to the treatment process tanks to maintain the desired water level and biological conditions in the downstream processes. Coarse-bubble air diffusers will be used to maintain complete mixed conditions and to prevent odours associated with septicity in the AEQ tanks. Air from the AEQ tank will be vented through an OCU prior to release to the atmosphere.

4.1.2 Biological Treatment

Biological treatment of the wastewater will occur with membrane bioreactors (MBR), which consist of aerobic tanks and membrane tanks. The MBR's portion will be enclosed within the Secondary/Tertiary area of the WWTP, and air from this section will be vented through an OCU prior to release to the environment. The Secondary/Tertiary area OCU will also include moisture removal capabilities.

Membrane Bio-Reactor

a) Aerobic Tanks

The wastewater will continue from the AEQ tank and enter one of three aerobic tanks, where fresh air will be blown into the tanks to provide oxygen for biological oxidation/nitrification. Phosphorous will be precipitated in the aerobic tanks during the organics removal process. Dissolved oxygen, pH level, and temperature in these aerobic tanks will be controlled to maintain the optimum conditions in the tanks. Some secondary clarification will occur within the aerobic tanks.

b) Membrane Tanks

The effluent from the aerobic tanks will undergo solid-liquid separation through the ultrafiltration membranes in the membrane tanks. The treated water (permeate) will be filtered through the membranes on a permeate relaxations cycle. Scour air will be introduced to the bottom of the membrane unit through medium-bubble diffusers (i.e. counter-flow) to remove cake build up on the membranes. Solids, including organics, bacteria, and most viruses will be retained in the membrane tanks. Some secondary clarification will also occur within the membrane tanks.

4.1.3 Ultraviolet (UV) Disinfection Process

The treated water leaving the membrane tanks will enter the UV disinfection system prior to being discharged into the environment. Minimal odour emissions are expected from the UV process, as odorous compounds would have been removed through the biological treatment process.

4.1.4 Sludge Management

The waste mixed liquor will be pumped from the sludge storage tank to the rotary drum thickener. The rotary drum thickeners reduce sludge volume of biosolids and waste activated sludge and produce a pumpable concentrate for dewatering, transport, or further digestion. The rotary drum thickener employs a floc development tank and a rotary drum screen. The sludge mixed with polymer enters the floc development tank, and from there the flocculated sludge moves through the rotary drum screen. The liquid separates from the flocculated solids through the rotary drum screen. The solids pass through dewatering stages and are stored in the thickened sludge storage tank before removal.

Sludge to be removed from the WWTP will be transferred from the thickened sludge storage tank to a jet/vacuum truck within an enclosed truck loading bay.

The sludge storage and transfer area will be enclosed, and air from this section will be vented through an OCU prior to release to the environment.

5 Identification of Significant Odour Sources

Odour emissions from waste water systems are principally associated with Sulphur-bearing compounds. Hydrogen sulphide (H_2S) is widely assumed as the most prevalent malodourous compound and often used as a marker for sewer odour. Other contaminants include mercaptans, ammonia, amines, and Total Reduced Sulphur (TRS). The table below lists some typical odorous compounds found in wastewater and their odour detection thresholds.

Table 1. Odorous Compounds in Typical Wastewater Treatment Processes

Compound Name	Formula	Human Detection Threshold (ppmv)	Odour Description
Acetaldehyde	CH_3CHO	0.067	Pungent, fruity
Allyl Mercaptan	$CH_2=CH-CH_2-SH$	0.0001	Disagreeable, garlic
Ammonia	NH_3	17.0000	Pungent, irritating
Amyl Mercaptan	$CH_3-(CH_2)_3-CH_2-SH$	0.0003	Unpleasant, putrid
Benzyl Mercaptan	$C_6H_5CH_2-SH$	0.0002	Unpleasant, strong
n-Butyl Amine	$CH_3(CH_2)\ NH_2$	0.0002	Sour, ammonia
Crotyl Mercaptan	$CH_3-CH=CH-CH_2-SH$	0.00003	Skunk-like
Dibutyl Amine	$(C_4H_9)_2NH$	0.016	Fishy
Diisopropyl amine	$(C_3H_7)_2NH$	0.13	Fishy
Dimethyl Amine	$(CH_3)_2NH$	0.34	Putrid, fishy
Dimethyl Sulphide	$(CH_3)_2S$	0.001	Decayed Cabbage
Diphenyl Sulphide	$(C_6H_5)_2S$	0.0001	Unpleasant
Ethyl Amine	$C_2H_5NH_2$	0.27	Ammonia-like
Ethyl Mercaptan	C_2H_5SH	0.0003	Decayed Cabbage
Hydrogen Sulphide	H_2S	0.0005	Rotten Eggs
Indole	$C_6H_4\ (CH)_2NH$	0.0001	Fecal, nauseating
Methyl Amine	CH_3NH_2	4.7	Putrid, Fishy
Methyl Mercaptan	CH_3SH	0.0005	Rotten Cabbage
Phenyl Mercaptan	C_6H_5SH	0.0003	Putrid, garlic
Propyl Mercaptan	C_3H_7SH	0.0005	Unpleasant
Skatole	C_9H_9N	0.001	Fecal, nauseating
Thiocresol	$CH_3C_6H_4SH$	0.0001	Skunky, irritating
Trimethylamine	$(CH_3)_3N$	0.0004	Pungent, fishy

Source: CH2MHill and EarthTech. Prepared for Regions of York and Durham. Duffin Creek Water Pollution Control Plant Schedule C Class EA Odour Control Study. *Table 2-1. September 2006.*

The treatment process within the aerobic and membrane tanks is aerobic with bacteria that will oxidize odourous compounds (i.e. hydrogen sulphide and other Sulphur based compounds) and prevent the formation of odours. These processes are, therefore, not considered significant sources of odour.

For the purpose of this study, six (6) main contaminants were considered for odour estimation. The selection of these contaminants was based on odour assessments completed for similar studies and consultation with the MECP. The odour-related contaminants assessed included:

- Odour
- Hydrogen sulfide;
- Mercaptan (as Ethyl Mercaptan)
- Ammonia
- Total Reduced Sulphur (TRS)

exp.

- Dimethyl sulphide; and
- Dimethyl disulphide.

Based on dispersion modelling the level of treatment provided by the various odour treatment systems will provide sufficient odour removal such that the odour concentration is less than 1 Odour Unit (OU) at the Colgan WWTP property line.

5.1 Source Summary Table and Site Plan

This section provides the table required by sub paragraph 8 and the Site Plan required by sub paragraph 9 of s.26 of 419/05.

5.2 Source Summary Table

The emission rate estimates for each source of significant contaminants are documented in Source Summary Table (Table 8, Appendix B), in accordance with requirements of sub paragraph 8 of s.26 of O.Reg.419/05.

For each source of significant contaminants, the following parameters are referenced:

- Contaminant,
- Chemical Abstract Society (CAS) reference number,
- Source reference number,
- Source description,
- Stack parameters (flow rate, exhaust temperature, diameter, height above grade, height above roof),
- Location referenced to a geographic coordinate system presented on Drawing 1,
- Maximum emission rate,
- Averaging period,
- Emission estimating technique,
- Estimation data quality, and,
- Percentage of overall emission.

The following potential odour emission sources at the Colgan WWTP are considered significant:

- The headworks and sludge management facilities will be considered as potential odour sources. These facilities will be enclosed, and the air will be treated with an OCU before exhausting to the environment.
- The biological reactor tanks will be aerobic, will generate less odour emissions than headworks, is also considered as a potential odour source.

5.3 Site Plan

The locations of the emission sources are presented in Figure 1 – Site Plan (Appendix A). The location of each of the sources is specified with the source reference number. The location of the property line is indicated on the Drawing 1.

5.4 Other Contaminants of Concern

Other contaminant of concern included in the assessment is NOx. NOx is a potential contaminant that may be emitted during the running of the diesel generator standby power unit. The diesel generator will be enclosed within the WWTP to contain potential noise emissions.

The diesel generator would be used in the event of a power outage. It will also be run once per month for testing. For the purpose of this assessment, the average duration and frequency of power outage for Alectra Utilities (the local service distributor in Alliston) was used in calculating run time due to power outages, based on the Ontario Energy Board's 2017 Scorecard Management Discussion and Analysis for the utility:

- Average number of hours that power to a customer is interrupted (maximum average between 2013 to 2017): 1.03 hours.
- Average number of times that power to a customer is interrupted (maximum average between 2013 to 2017): 1.23 times per year.

For the purpose of this assessment, the estimated size of the diesel generator for the Colgan WWTP is 750 kWe. A specification sheet for a typical diesel generator of this size is attached in Appendix C.

Under O.Reg 1/17 and O.Reg. 524/98 emergency power generators are exempt from approvals, however for the purpose of this assessment, NOx emissions were assessed in accordance with

the MECP emergency generator guideline, Information for Proponents Applying for a Certificate of Approval (Air) for an Emergency Generator, August 2008 (POI 1880 µg/m3 for ½-hour).

6 Odour Emission Estimation and Maximum Emission Scenario

As defined in Section 4.2, the potential significant odour sources at the WWTP are the headworks, MBR units, and sludge management operations which are summarized in Table 2.

Table 2. Source and Contaminant Identification Summary

Source I.D.	Source Description	General Location	Expected Contaminants	Significant?	Included in Modelling
1	Screen Room	Headworks	Odour	Yes	Yes
2	Equalization Tank	Headworks	Odour	Yes	Yes
3	Membrane Bio-Reactors	Biological Treatment	Odour	Yes	Yes
4	Ultraviolet Disinfection	Biological Treatment	Odour	No	No
5	Sludge Storage Tank	Sludge Management	Odour	Yes	Yes
6	Rotary Drum Thickening	Sludge Management	Odour	Yes	Yes

6.1 Meteorology

Meteorological conditions effect odour transport and impact on receptors. High winds result in increased dispersion but also in lower concentrations. Low winds can result in impacts in the immediate surrounding area with higher concentrations and stagnation. Meteorological conditions are also required for input into air dispersion modelling. For this assessment MECC approved regional five-year meteorological data sets were used. Both a 5-year annual and seasonal wind roses are provided in Appendix A. Winds predominantly blow from the northwest, west, and southwest quadrants, with no significant seasonal variations. The nearby receptors are located east and south of the WWTP, within the predominant downwind direction. Low winds are less than 1%.

6.2 Emission Estimation Methodologies

6.2.1 Odour Assessment

As site specific odour emission data is not available for the proposed Colgan WWTP, for the purpose of this assessment emissions for potential odour sources were derived from the environmental study report for equivalent processes in the Everett WWTP Surface Water Outfall Expansion, Class Environmental Assessment, September 2014, prepared by Greenland Consulting Engineers for the Town of Adjala-Tosorontio. Odour emission data for dimethyl sulphide and dimethyl disulphide were conservatively estimated based on Total Reduced Sulphur (TRS) emissions. The TRS is defined as the total of six reduced sulphur compounds including hydrogen sulphide, carbon disulphide, carbonyl sulphide, methyl mercaptan, dimethyl sulphide, and dimethyl disulphide.

The following assumptions and steps were used to conduct the preliminary screening level air impact assessment:

- The odourous air collected from the headworks emission sources would have the characteristics as summarized in Table 3. The contaminants emission rates from other sources would be less than from the headworks, hence the headworks was selected as a conservative representation for each WWTP emission source at Colgan WWTP and prorated to an ultimate capacity of 1,050 m^3/d;
- The headworks facility would be ventilated at 12 to 15 Air Changes per Hour (ACH), which provides estimated 4 m^3/s flow rates;
- The blower performance was then used to convert the odour concentration back to an odour emission rate (OU/S);
- Control efficiencies for the odour control systems were applied to yield a controlled odour emission rate.
- Dimethyl sulphide and dimethyl disulphide emissions were estimated based on the TRS emission rate.

The emission calculation sheet detailing the assumptions and methodologies are presented in Appendix B- Supporting Calculations.

Table 3. Odourous Sulphur Compounds in Wastewater Treatment Plant Air

Substance	Contaminant Concentration from Headworks (Based on Everett WWTP)
Odour	1,124 OU/m^3
Hydrogen Sulfide	0.0064 g/m^3
Mercaptan (as Ethyl Mercaptan)[1]	9.74E-05 g/m^3
Ammonia	9.52E-06 g/m^3
Total Reduced Sulphur (TRS)[2]	6.54E-03 g/m^3
Dimethyl Sulphide	6.54E-03 g/m^3
Dimethyl Disulphide	6.54E-03 g/m^3

Notes: [1] Mercaptan includes methyl mercaptan, ethyl mercaptan, 1-propyl mercaptan. The emission rate of mercaptan is expressed as methyl mercaptan

[2] Total reduced Sulphur compounds means a mixture that includes at least one reduced Sulphur compound of reduced Sulphur compounds. As H_2S is the major component in Headworks TRS, molecular weight of H_2S is used as MW of TRS

The study assessed one maximum scenario based on the ultimate plant capacity (1,050 m^3/d) for the entire plant. The maximum emissions scenario also assumed all equipment and processes operate simultaneously at their respective maximum capacity, 24 hours per day, all year round.

As the equalization tank will provide some primary aerobic treatment prior to proceeding to the MBR, the actual odour emissions from the headworks section are expected to be much lower.

A 95% removal efficiency rate of the OCU was assumed for the purpose of this assessment. This is consistent with the odour assessment completed in the Everett WWTP Class EA. Additionally, a review of odour control unit specifications indicate a reported removal efficiency rate greater than 99%. (see Table 4). Examples of typical odour control equipment that might be considered is provided in Appendix D. The selection of the odour control units will be completed as part of detailed design.

Table 4. Examples of Odour Control Unit Technology Removal Efficiency

Technology	Manufacturer	Model	Removal Efficiency
Activate Carbon Filter	Pure Air Solutions	Actus RND2000	99.7%
Multi-Stage Scrubber (NaOH and NaOH / NaOCl)	Evoqua	LO/PRO Multi-Stage Scrubber LP-4500	99.5%
Single-stage Scrubber (NaOH/NaOCl)	Evoqua	Packed Tower Odor Control System RJP-600	>99% (using NaOH and NaOCl)

6.2.2 Stand-by Power

Emission data of a typical diesel fired emergency generator, power rated at 750 kW, that comply with US EPA Tier 2 standard used for emission assessment. The emergency diesel generator was assessed for emissions of nitrogen dioxide. The MECP emergency generator guideline, Information for Proponents Applying for a Certificate of Approval (Air) for an Emergency Generator, August 2008, states that the significant contaminants emitted to the atmosphere from an emergency generator are nitrogen oxides (NOx). Other contaminants, for these types of sources, are generally emitted in negligible amounts. Therefore, carbon monoxide and total suspended particulate matter from the generator were considered insignificant for this assessment.

The emission calculation sheet detailing the assumptions and methodologies are presented in Appendix B- Supporting Calculations.

7 Air Dispersion Modelling

7.1 Method

The preliminary screening level air impact assessment were conducted using dispersion modelling. Dispersion modelling is a mathematical simulation of emissions as they are transported throughout the atmosphere. The dispersion modeling was conducted in accordance with the publication "Air Dispersion Modelling Guideline for Ontario [Guideline A-11], Version 3.0" (ADMGO) dated September 2016. The AERMOD air dispersion modelling program has been used to predict worst-case point of impingement (POI) concentrations. The emission rates used in the dispersion model meet the requirements of s.11(1)1 of O. Reg. 419/05 which requires that the emission rates used in the dispersion model be at least as high as the maximum emission rate that the source of contaminant is reasonably capable of for the relevant contaminant.

MECP AERMOD dispersion modelling was conducted for the three stacks of headworks, biological treatment, and sludge management, and the single stack of diesel generator. POI concentration of contaminants was estimated for each significant contaminant based on conservative representation of the entire WWTP emissions at Colgan WWTP and prorated to an ultimate capacity of 1,050 m^3/d. As there are three vent stacks, emissions were calculated based on headworks emissions as a worst-case scenario. The methodology for the calculation is documented in Appendix B. The maximum 10-minute, ½-hour, one-hour, and 24-hour, where applicable, emission rates for each significant contaminant emitted, from the significant sources, were calculated. The emission rates used in the dispersion model meet the requirements of s.11 (1)1 of O.Reg.419/05 which requires that the emission rates used in the dispersion model be at least as high as the maximum emission rate that the source of contaminant is reasonably capable of for the relevant contaminant.

Process emissions are released to the atmosphere via three (3) stack exhausts equipped with three odour control units, with minimum 95% removal efficiency a volumetric flow rate of 4.0 cubic meters per second (m^3/s) having an exit diameter of 0.38 m located 1 m above the roof and 14.4 meters above the ground. Combustion emissions, from the emergency diesel generator, are released to the atmosphere via one (1) vertical stack exhaust, with a volumetric flow rate of 2.77 cubic meters per second (m^3/s) having an exit diameter of 0.38 m, located at northside sidewall, 4 meters above the ground.

7.2 Dispersion Modelling Input

Point of Impingement (POI) concentrations have been determined using AERMOD 9.5.0 (Model Version 16216r). On site buildings and immediately surrounding buildings have been input into the model. All emission points have been input as individual point sources. Source parameters are provided in the Emission Summary Table (Table 9, Appendix A). AERMOD contour maps are provided in the Appendix E.

7.3 Dispersion Modelling Input Summary Table

A description of the way in which the approved dispersion model was performed is included as Table 5– Dispersion Modelling Input Summary Table. This table meets both the requirements of s.26 and sections 8-17 of O.Reg. 419/05 and follows the format provided in the ESDM Procedure Document.

The AERMOD model was run using an MECP pre-processed 5-year dispersion meteorological data set (i.e. surface and profile files). Regional surface and upper air meteorological data for the part of Ontario in which the source of contaminant is located that was available through a website maintained by the Ministry on the Internet. The land use type used for AERMOD dispersion modeling was "rural" based on the land use within a 3 km radius around the facility sources. There are no sensitive land uses on the property, such as childcare facilities, senior citizen's residences, long-term care, or educational facilities.

Table 5. Dispersion Modelling Input Summary Table

Relevant Section of the Regulation	Section Title	Description of How the Approved Dispersion Model was Used
Section 6	Approved Dispersion Models	AERMOD 9.5.0, Version 16216r was used.
Section 8	Negligible Sources	All sources assessed
Section 9	Same Structure Contamination	Not Applicable (single-tenancy building, no on-site sensitive receptors).
Section 10	Operating Conditions	Worst case operating conditions assumed as detailed in Section 5.1 of this report
Section 11	Source of Contaminant Emission Rates	Emission rates based on engineering calculations, and emission factors. Calculation methods are detailed in Appendix B
Section 12	Combined Effect of assumptions for Operating Conditions and Emission Rates	Worst-case scenario used
Section 13	Meteorological Conditions	AERMOD Regional Meteorological Data and Terrain Data for Township of Adjala -Tosorontio, ON applied (Southwest_2_Crops).
Section 14	Area of Modelling Coverage	AERMOD nested grid receptors set at 5000 m, 2000m, 1000 m, 500 m and 200 m from Boundary Box, and 10 m spacing around property boundary.
Section 15	Stack Height for Certain New Sources of Contaminant	Stack heights provided in Appendix A Tables 10 and 11
Section 16	Terrain data	AERMOD Regional Meteorological Data and Terrain Data for Township of Adjala -Tosorontio, ON applied (tile 090)
Section 17	Averaging periods.	24- hour, 1 hour, 10 min (where necessary)

7.4 Meteorological Data

A five-year meteorological data set 1996-2000 Processed Meteorological Data Set, Southwest_2_Crops, as provided by the MECP (http://www.ontario.ca/environment-and-energy/map-regional-meteorological-and-terrain-data-air-dispersion-modelling) was used.

7.5 Terrain Data

Terrain data (tile 090), as provided by the MECP (http://www.ontario.ca/environment-and-energy/map-regional-meteorological-and-terrain-data-air-dispersion-modelling), was used. The dataset included DEM files.

7.6 Receptors

Receptors were chosen based on recommendations provided in Section 7.1 of the ADMGO, which is in accordance with s.14 of O.Reg.419/05. Specifically, a nested receptor grid, based on an area that is bounded by a rectangle that encloses every source of contaminants, and spaced out as follow:

- 10 m spacing along the property boundary;
- 20 m spacing within a distance of 200 m from the bounding rectangle;
- 50 m spacing within a distance of 500 m from the bounding rectangle;
- 100 m spacing within a distance of 1000 m from bounding rectangle;
- 200 m spacing within a distance of 2000 m from bounding rectangle;
- 500 m spacing within a distance of 5000 m from bounding rectangle.

There is no child care facility, health care facility, senior's residence, long-term care facility or an educational facility located at the Facility. As such, same structure contamination was not considered.

7.7 Building Downwash

Building downwash option was applied.

7.8 Deposition

The deposition algorithm was not implemented.

7.9 Averaging Period and Conversions

The shortest time scale that AERMOD predicts is a 1-hour average value. The 24-hour (and 1 hour where applicable) maximum point of impingement (POI) impact was determined using AERMOD. Alternate averaging period maximum POI impact was determined using the conversion factors provided in Table 4-1 of the Air Dispersion Modelling Guideline for Ontario (Version 3.0, Sept 2016, PIBs # 5165e03).

Table 6. Common Averaging Time Conversion Factors (Table 4-1) from Air Dispersion Modelling Guidelines for Ontario

To Convert From:	Convert To:	Multiply by:
1 hr	10 min	1.65
1 hr	½ hr	1.2
1 hr	24 hr	0.4
1 hr	Annual	0.08

Any additional averaging periods (i.e. 30-day) were calculated using the equation:
$C_0 = C_1 * (T_1 / T_0)^{0.28}$

7.10 Dispersion Modelling Options

The options used in the AERMOD dispersion model are summarized in the table below:

Table 7. Dispersion Modelling Options

Modelling Parameter Description Used in the Assessment?	Description	Used in the Assessment?
DFAULT	Specifies that regulatory default options will be used	Yes
CONC	Specifies that concentration values will be calculated	Yes
DDPLETE	Specifies that dry deposition will be calculated	No
WDPLETE	Specifies that wet deposition will be calculated	No
FLAT	Specifies that the non-default option of assuming flat terrain will be used	No (Elevated used)
NOSTD	Specifies that the non-default option of no stack-tip downwash will be used	No
AVERTIME	Time averaging periods calculated	1-hr, 24-hr
URBANOPT	Allows model to incorporate the effects of increased surface heating from an urban area on pollutant dispersion under stable atmospheric conditions	No
URBANROUGHNESS	Specifies the urban roughness length (m)	No
BETA	Specifies the use of capped and horizontal stack release algorithms within AERMOD	No
FLAGPOLE	Specifies that receptor heights above local ground level is allowed on the receptors	No

7.11 Sample Calculations

The technical rationale, including sample calculations, required to substantiate the emission rates presented in Appendix B – Supporting Calculations.

8 Results

8.1 Odour Emissions

The maximum 10-minute average concentrations are presented in Table 9, for the off-site sensitive receptors with highest POI.

As presented in Table 9 (Appendix A), Emission Calculation Sheet, the maximum off-site 10-minute average odour concentrations are predicted to be well below the MECP odour guideline of 1 OU/m^3 at the Colgan WWTP's property line, the surrounding existing and proposed sensitive receptors and the proposed nearby residential subdivision.

The maximum predicted 10-minute odour concentration was 0.54 OU at the property boundary, which is 0.54% of the limit, compared to the recommended 1 OU at sensitive receptors.

The maximum predicted 10-minute H_2S and TRS concentration was 9.0 µg/m^3 and 9.4 µg/m3 respectively, which is 69.8% and 72.3 of the MECP's POI limit. The maximum predicted 24-hour H_2S and TRS concentration was 3.2 µg/m^3 and 3.3 µg/m^3 respectively, which is 45.7% and 47.1 % of the limit.

The contaminant of concern with the greatest percentage of the POI limit at the 10-minute time period was TRS. Its maximum 10-minute concentration was 9.4 µg/m^3, which is 72.3% of the MECP's POI limit. The maximum predicted 24-hour concentration for TRS was 3.3 µg/m^3, which is 47.1% of the limit.

The contaminant of concern with the greatest percentage of the POI limit at the 24-hour time period was TRS. Its maximum 10-minute concentration was 9.4 µg/m^3, which is 72.3% of the MECP's POI limit.

8.2 Stand-by Power

The maximum predicted half-hour nitrogen oxide concentrations from the stand-by power unit is 940 µg/m^3 µg/m^3, which is 50% of the MECP's limit of 1880 µg/m^3 for ½-hour. The MECP limit is stipulated in the MECP emergency generator guideline, Information for Proponents Applying for a Certificate of Approval (Air) for an Emergency Generator, August 2008.

9 Conclusion

A POI concentration for each significant contaminant from the Facility was determined based on the calculated emission rates and the output from the AERMOD dispersion model.

The POI concentrations listed in Table 9 were compared against criteria listed in "*Air Contaminants Benchmarks List: standards, guidelines and screening levels for assessing point of impingement concentrations of air contaminants*", dated May 2018.

The model predicts that the maximum 10-minute average odour concentrations at the Colgan WWTP's property line, all surrounding existing sensitive receptors, and the proposed residential subdivision will be below the MECP odour guideline of 1 OU/m^3. No odour impacts are, therefore, expected from the normal operation of the proposed WWTP, at its ultimate capacity of 1,050 m^3/day.

10 Recommendations

For plants with treatment capacity greater than 500 m^3/d and less than 25,000 m^3/d, the MECP Guideline D-2 of the D-Series Guidelines recommends a minimum separation distance of 100 meters between WWTPs and sensitive receivers.

Based on the above assessment, the potential emissions, including odour, were found to be compliant with appropriate MECP point of impingement (POI) limits including the sensitive receptors surrounding the Colgan WWTP within the proposed separation distance. It is important to recognize that an important component to ensure acceptable air quality of nearby residents is obtaining and complying with Environmental Compliance Approval (Air & Noise) under section 9 of the Environmental Protection Act based on final design prior to installation and operation of equipment.

11 Limitations

The information presented in this report is based on information provided by others and visual observations designed to provide information to meet Ministry of the Environment and Climate Change guidelines regarding Environmental Assessment (Air).

Achieving the objectives of this report has required us to arrive at conclusions based upon the best information presently known to us. No investigative method can completely eliminate the possibility of obtaining partially imprecise or incomplete information; it can only reduce the possibility to an acceptable level. Professional judgment was exercised in gathering and analyzing the information obtained and in the formulation of the conclusions. Like all professional persons rendering advice, we do not act as absolute insurers of the conclusions we reach, but we commit ourselves to care and competence in reaching those conclusions.

Our undertaking at EXP, therefore, has been to perform our work within the limits prescribed by our clients. We trust this summary report is satisfactory for your purposes. If you have any questions regarding our submission, please do not hesitate to contact this office.

EXP Services Inc.

Amir Bahadori, M. Sc., P. Eng.
Senior Air Quality Scientist
Earth and Environmental

Ron Taylor, M.Sc., C. Chem., CIH
Discipline Lead, Air Quality & Industrial Hygiene
Earth and Environmental

Appendix A – Tables, Figures & Drawings

Table 8. Source Summary Table

Source Data									Emission Data						
Source ID	Source Description	Exhaust Point	Flow	Temp.	Diameter	Height above Roof	Height above Grade	Source Coordinates (N, E) UTM	Contaminant	CAS No.	Maximum Emission Rate	Averaging Period	Percent Overall Emission	Data Quality	Estimation Technique
			m^3/s	^0C	m	m	m	m			g/s	hours	%		
1	Headworks Stack	EF-1	4.0	Amb.	0.38	1	14.4	4876282 N 591503 E	**Odour**	na	2.25E+02	1	33	A	EF
									Hydrogen Sulfide	7783-06-4	3.84E-03	1	33	A	EF
									Mercaptan (as methyl mercaptan)	74-93-1	5.84E-05	1	33	A	EF
									Ammonia	7664-41-7	5.71E-06	1	33	A	EF
									Total Reduced Sulphure	na	3.92E-03	1	33	A	EF
									Dimethyl Sulphide	75-18-3	3.92E-03	1	33	A	EF
									Dimethyl Disulphide	624-92-0	3.92E-03	1	33	A	EF
2	Sludge Management Stack	EF-2	4.0	Amb.	0.38	1	14.4	4876282 N 591503 E	**Odour**	na	2.25E+02	1	33	A	EF
									Hydrogen Sulfide	7783-06-4	3.84E-03	1	33	A	EF
									Mercaptan (as methyl mercaptan)	74-93-1	5.84E-05	1	33	A	EF
									Ammonia	7664-41-7	5.71E-06	1	33	A	EF
									Total Reduced Sulphure	na	3.92E-03	1	33	A	EF
									Dimethyl Sulphide	75-18-3	3.92E-03	1	33	A	EF
									Dimethyl Disulphide	624-92-0	3.92E-03	1	33	A	EF
3	Biological Treatment Stack	EF-3	4.0		0.38	1	14.4	4876282 N 591503 E	**Odour**	na	2.25E+02	1	33	A	EF
									Hydrogen Sulfide	7783-06-4	3.84E-03	1	33	A	EF
									Mercaptan (as methyl mercaptan)	74-93-1	5.84E-05	1	33	A	EF
									Ammonia	7664-41-7	5.71E-06	1	33	A	EF
									Total Reduced Sulphure	na	3.92E-03	1	33	A	EF
									Dimethyl Sulphide	75-18-3	3.92E-03	1	33	A	EF
									Dimethyl Disulphide	624-92-0	3.92E-03	1	33	A	EF
4	Diesel Generator Stack	EF-4	2.8	556	0.38	-	4	4876282 N 591503 E	Nitrogen Oxides (NOx)	10102-44-0	9.80E-01	1/2	100	A	EF

A = Average; EF = Emission Factor
All sources emissions have been calculated using "worst-case" operating conditions.

Table 9. Emission Summary Table

Contaminant	CAS No.	Total Max Rate	Air Dispersion Model Used	Max POI Concentration	Averaging Period	MECP POI Limit	Limiting Effect	Regulation Schedule	Percentage of MECP POI Limit
		g/s		µg /m³	(hours)	µg/m³		#	%
Odour	na	2.25E+02	AERMOD	0.5 (OU/m³)	10-min.	1	Odour	3	54.0
Hydrogen Sulfide	7783-06-4	3.84E-03	AERMOD	9.1	10-min	13	Health	3	69.8
				6.6	1/2	10	Odour		66.0
				3.2	24	7	Health		45.7
Mercaptan (as methyl mercaptan)[1]	74-93-1	5.84E-05	AERMOD	0.1	10-min	13	Health		0.7
				0.1	1/2	10	Health		1.0
Ammonia	7664-41-7	5.71E-06	AERMOD	0.001	1/2	300	Health		<0.001
			AERMOD	0.005	24	100	Health		<0.001
Total Reduced Sulphure[2]	na	3.92E-03	AERMOD	9.4	10-min	13	Health		72.3
			AERMOD	6.8	1/2	10	Health		68.0
			AERMOD	3.3	24	7	Health		47.1
Dimethyl Sulphide	75-18-3	3.92E-03	AERMOD	9.4	10-min	30	Health		31.3
Dimethyl Disulphide	624-92-0	3.92E-03	AERMOD	9.4	10-min	56	Health		16.8
Nitrogen Oxides (NOx)	10102-44-0	9.80E-01	AERMOD	940	1/2	1880	Health		50.0

Note: [1] Mercaptan includes methyl mercaptan, ethyl mercaptan, 1-propyl mercaptan. The emission rate of mercaptan is expressed as methyl mercaptan.

[2] Total reduced Sulphur compounds means a mixture that includes at least one reduced Sulphur compound of reduced Sulphur compounds. As H_2S is the major component in Headworks TRS, molecular weight of H_2S is used as MW of TRS.

* Assume three (3) stacks exhaust simultaneously

Table 10. Physical Parameters of the Modelling Sources for the Process Emissions

Parameter	Measure
Source Type	Point Source (Stack)
Emission Rate (g/s)	1
Stack Height Above Ground(m)	14.4
Stack Inside Diameter (m)	0.381
Stack Exit Velocity (m/s)	35.08
Stack Exit Temperature (k)	293

Table 11: Physical Parameter of the Modelling Source for the Diesel Generator

Parameter	Measure
Source Type	Point Source (Vertical Stack)
Emission Rate (g/s)	0.98
Stack Height Above Ground(m)	4
Stack Inside Diameter (m)	0.381
Stack Exit Velocity (m/s)	24.3
Stack Exit Temperature (k)	829

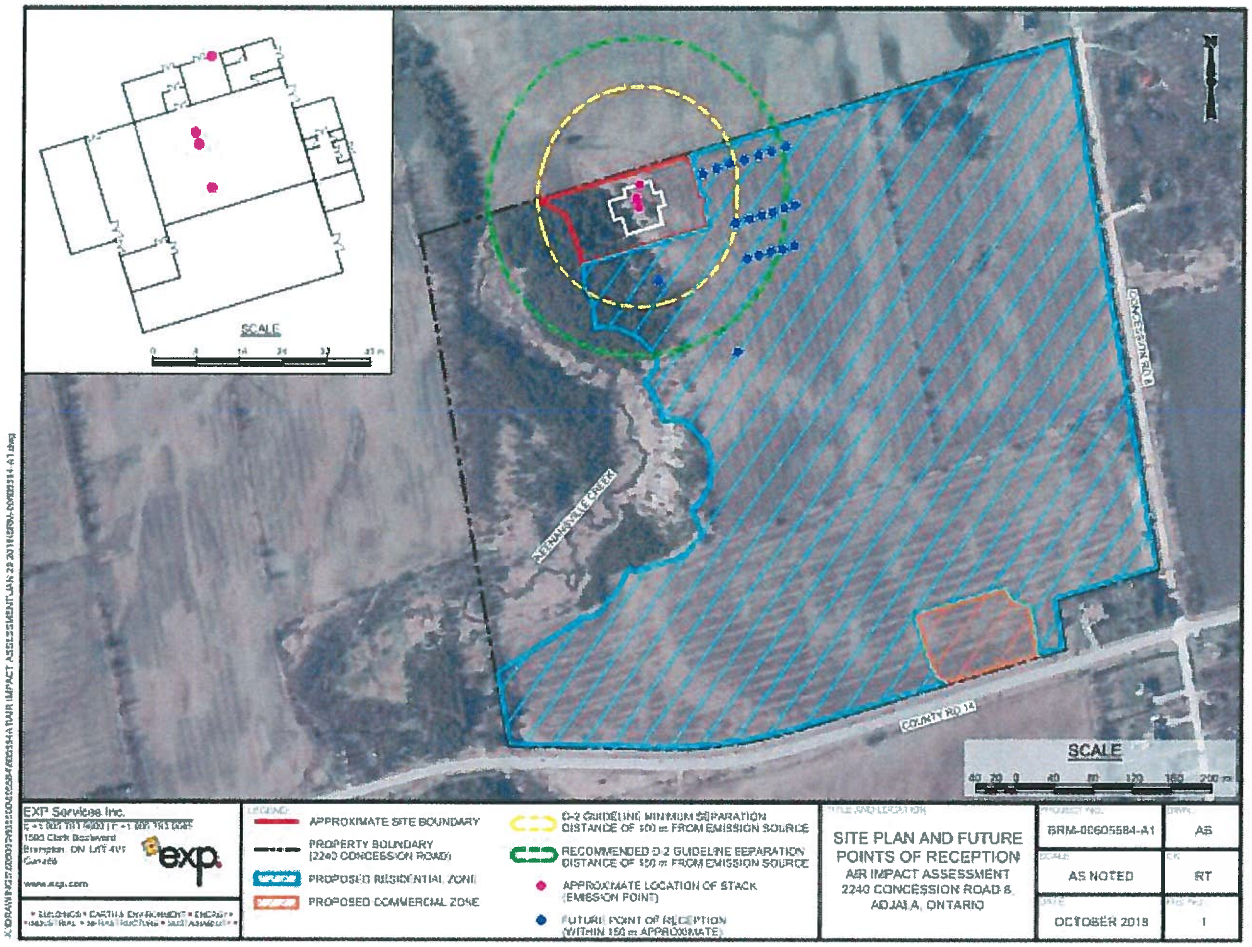


Figure 1. Site Plan, Colgan Wastewater Treatment Plant – emission source location and, existing and future receptors

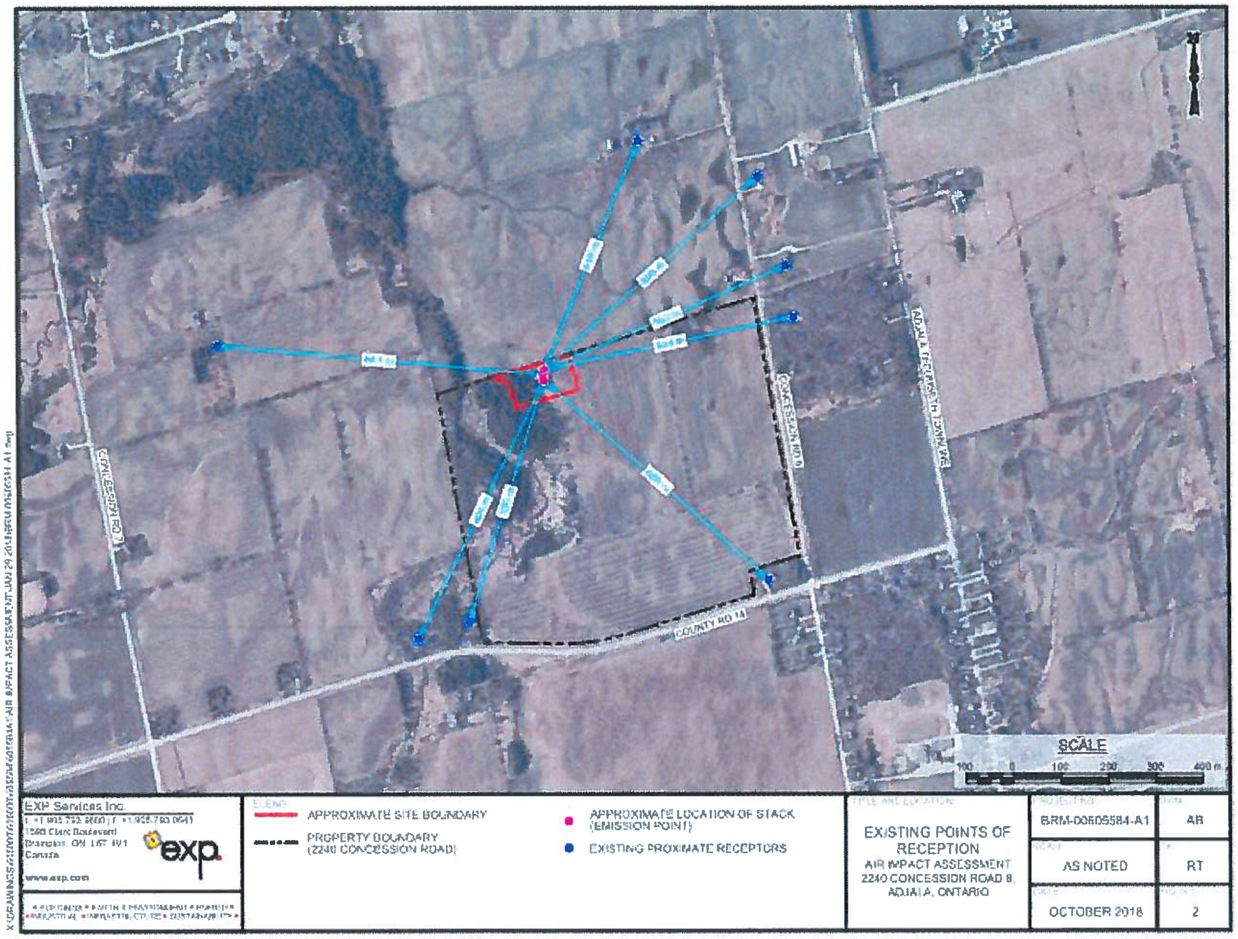


Figure 2. Existing closest receptors

Process Flow Diagram - Colgan WWTP

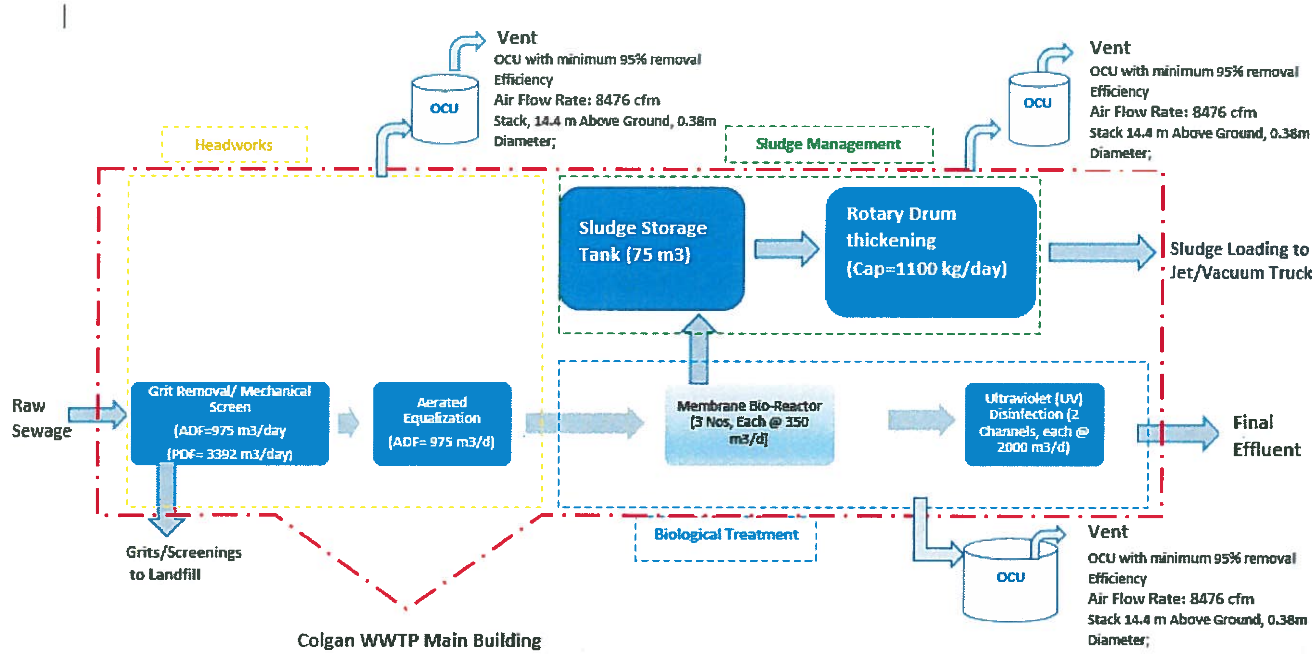
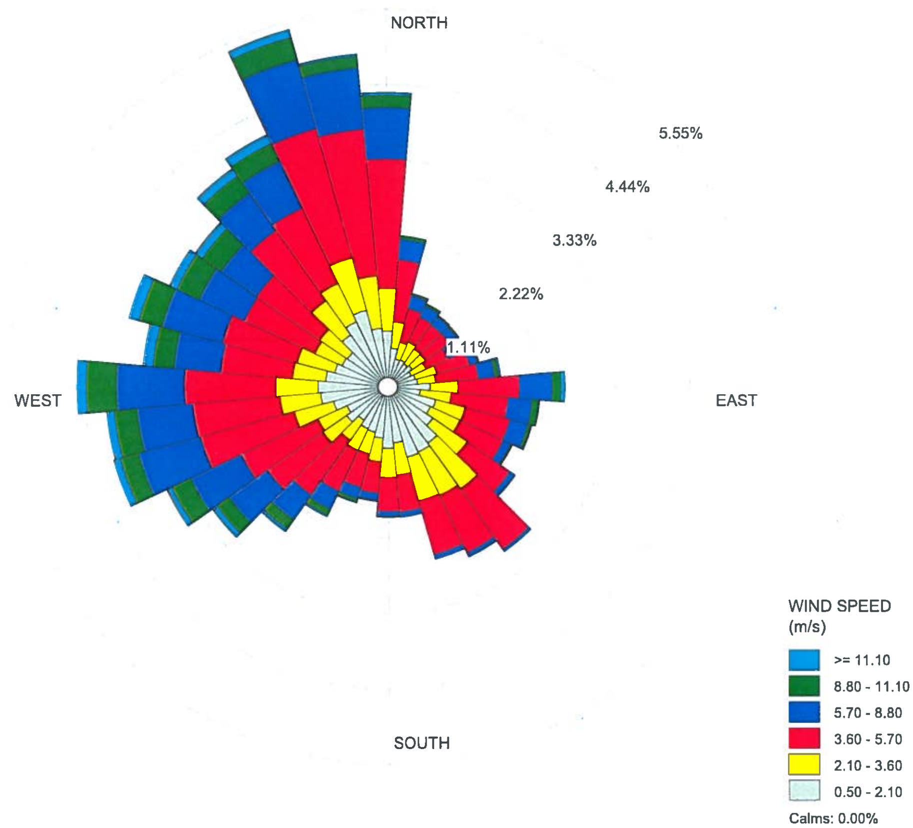


Figure 3. Process Flow Diagram, Colgan WWTP

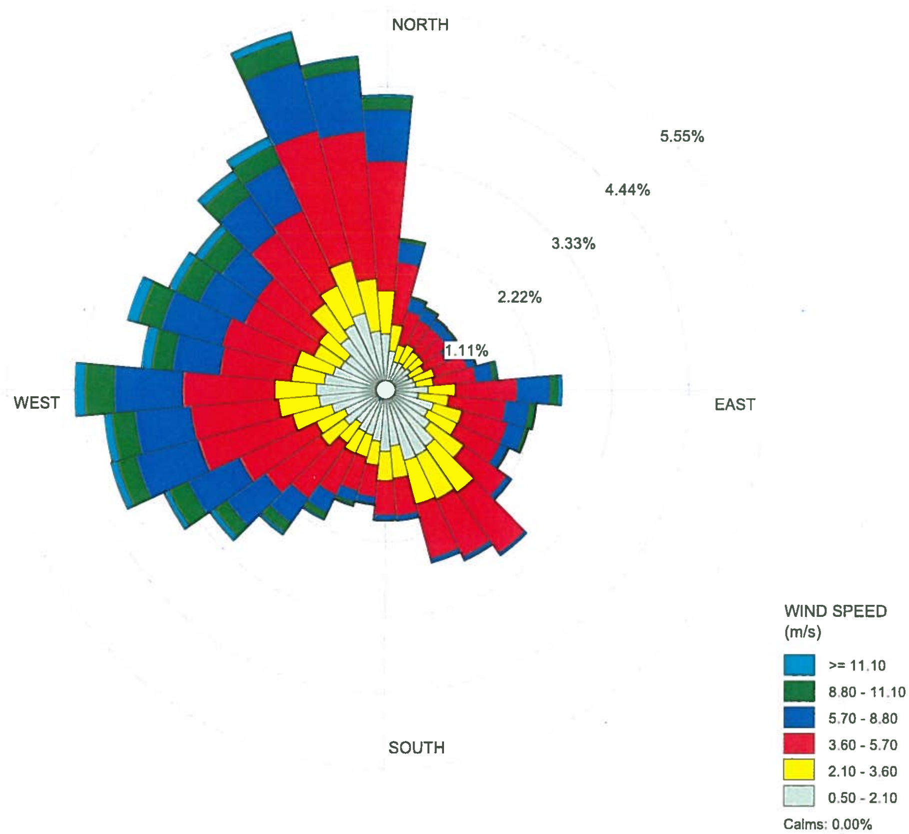
WIND ROSE PLOT:	DISPLAY:
Wind Rose (All Year) **MOECC Site Spesific Meteorological Data**	**Wind Speed** **Direction (blowing from)**



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Colgan Wastewater Treatment Plant	**Start Date: 1/1/1996 - 00:00** **End Date: 12/31/2000 - 23:59**	**EXP Services Inc.**	
		MODELER: **AB**	
	CALM WINDS: **0.00%**	TOTAL COUNT: **87516 hrs.**	
	AVG. WIND SPEED: **3.97 m/s**	DATE: **2/9/2018**	PROJECT NO.: **BRM-00605584-A0**

WRPLOT View - Lakes Environmental Software

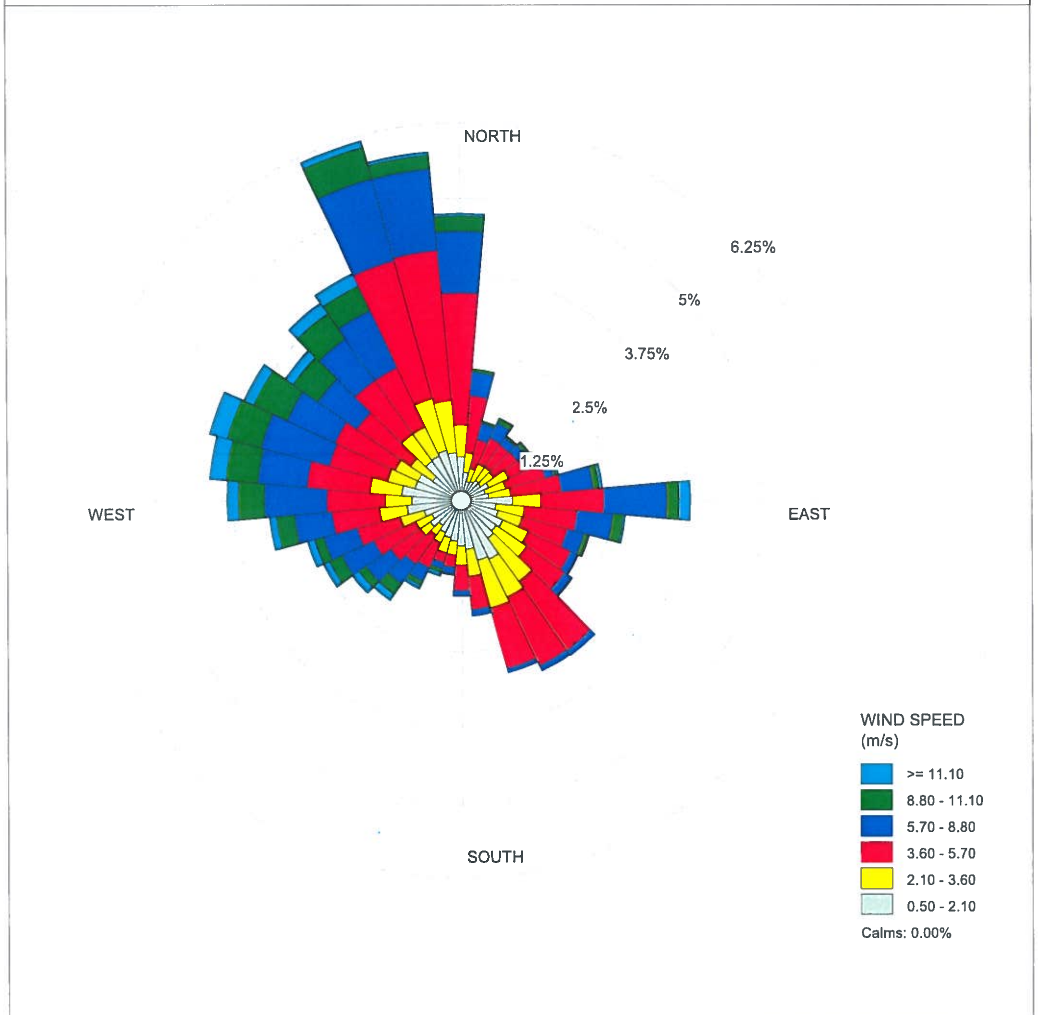
WIND ROSE PLOT:	DISPLAY:
Wind Rose (December to February) **MOECC Site Spesific Meteorological Data**	**Wind Speed** **Direction (blowing from)**



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Colgan Wastewater Treatment Plant	**Start Date: 1/1/1996 - 00:00** **End Date: 12/31/2000 - 23:59**	**EXP Services Inc.**	
		MODELER: **AB**	
	CALM WINDS: **0.00%**	TOTAL COUNT: **87516 hrs.**	
	AVG. WIND SPEED: **3.97 m/s**	DATE: **2/9/2018**	PROJECT NO.: **BRM-00605584-A0**

WRPLOT View - Lakes Environmental Software

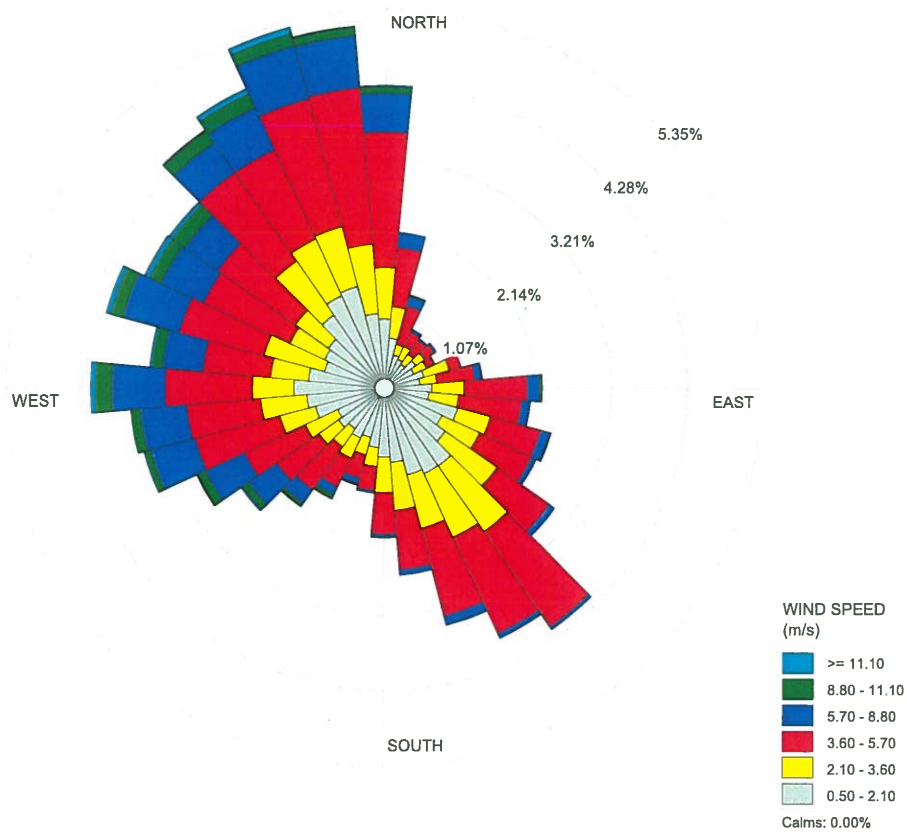
WIND ROSE PLOT:	DISPLAY:
Wind Rose (March to May) **MOECC Site Spesific Meteorological Data**	**Wind Speed** **Direction (blowing from)**



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Colgan Wastewater Treatment Plant	**Start Date: 3/1/1996 - 00:00** **End Date: 5/31/2000 - 23:59**	**EXP Services Inc.**	
		MODELER: **AB**	
	CALM WINDS: **0.00%**	TOTAL COUNT: **22066 hrs.**	
	AVG. WIND SPEED: **4.32 m/s**	DATE: **2/9/2018**	PROJECT NO.: **BRM-00605584-A0**

WRPLOT View - Lakes Environmental Software

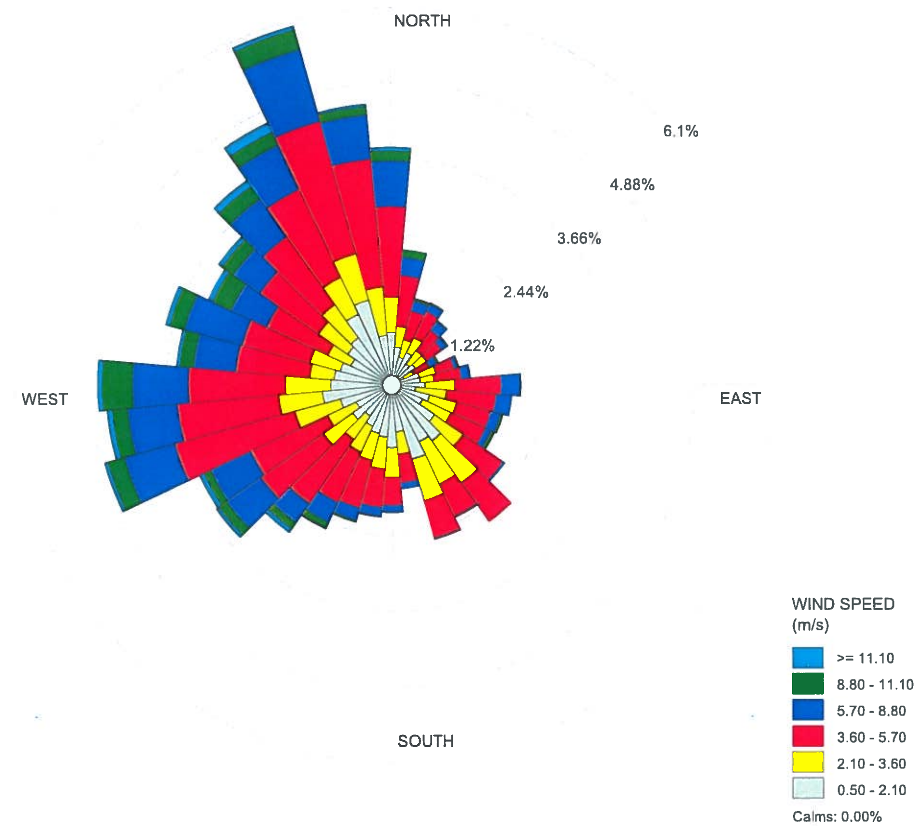
WIND ROSE PLOT:	DISPLAY:
Wind Rose (June to August) **MOECC Site Spesific Meteorological Data**	**Wind Speed** **Direction (blowing from)**



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Colgan Wastewater Treatment Plant	**Start Date: 6/1/1996 - 00:00** **End Date: 8/31/2000 - 23:59**	**EXP Services Inc.**	
		MODELER: **AB**	
	CALM WINDS: **0.00%**	TOTAL COUNT: **21990 hrs.**	
	AVG. WIND SPEED: **3.38 m/s**	DATE: **2/9/2018**	PROJECT NO.: **BRM-00605584-A0**

WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:	DISPLAY:
Wind Rose (September to November) **MOECC Site Spesific Meteorological Data**	**Wind Speed** **Direction (blowing from)**



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
Colgan Wastewater Treatment Plant	**Start Date: 9/1/1996 - 00:00** **End Date: 11/30/2000 - 23:59**	**EXP Services Inc.**	
		MODELER: **AB**	exp.
	CALM WINDS: **0.00%**	TOTAL COUNT: **21820 hrs.**	
	AVG. WIND SPEED: **3.79 m/s**	DATE: **2/9/2018**	PROJECT NO.: **BRM-00605584-A0**

WRPLOT View - Lakes Environmental Software

Appendix B – Supporting Calculations

Sample Emission Rate Calculation

A) Process Emissions

Source: Headworks
Source Type: Point Source
Description: Odour control unit vent stack

Technical Specifications:

- Stack diameter: 381 mm
- Stack height: 14.4m above ground
- Airflow rate: 8476 cfm (4m^3/s)

The total emission rate (g/s) of Hydrogen Sulphide was calculated from the following equation:
H_2S Emission Rate $E_{H2S\ vent}$ = C x Q x S

Where:
C is the maximum concentration in g/m^3
Q is the maximum flow rate of each fan in m^3/s
S is the number of emission sources - in this case 3 odour control system stacks

C = 6.4E-03 g/m^3
Q = 4 m^3/s
$E_{H2S\ vent}$ = 6.4E-03 g/m^3 x 4 m^3/s x 3 = 7.68E-02 g/s

The contaminants emission rates from the headworks was selected as conservative representation of the entire WWTP emissions at Colgan WWTP and prorated to an ultimate capacity of 1050 m3/d. As there are three vent stacks, emissions calculated for headworks is used for all three (3), for conservatism, to count for the entire facility emissions.

According to the technical specifications of the proposed odour control systems, 99.5 per cent removal efficiency is expected. However, as a conservative measure, a maximum 95 per cent removal efficiency is considered for the odour control units. Therefore, the total emission rate (g/s) of Hydrogen Sulphide with an odour control was calculated from the following equation:

$E_{H2S\ vent}$ = calculated E_{H2S} without odour control x Removal efficiency

$E_{H2S\ vent}$ = 7.68E-02 g/s x 0.05 = 3.84E -03 g/s

B) Nitrogen Oxides (NOx) Emissions:

Source: Emergency Diesel Generator
Source Type: Point Source
Description: Vertical stack through the building sidewall

Technical Specifications:

- Stack diameter: 381 mm
- Stack height: 4m above ground
- Airflow rate: 5859 cfm (2.77m^3/s)

The total emission rate (g/s) of Nitrogen Oxides was calculated from the following equation:

NOx Emission Rate, ER_{NOx} = C x P x K

Where:
C is the maximum Nox emissions per kWh in g/hp-hr
P is the maximum power in kWm (bhp)
K is the conversion factor for kW to hp, which is equal to 1.34

C = 3.5 g/hp-hr
P = 750 kWm

ER_{NOx} = 3.5 g/hp-hr x 750 kWm x 1.34 x 1-hr/3600 = 0.98 g/s

Appendix C – Typical Diesel Generator Supplier Sheet (750 kwe)

DIESEL GENERATOR SET
MTU 12V2000 DS750

750 kWe / 60 Hz / Standby
208 - 4160V

Reference MTU 12V2000 DS750 (680 kWe) for Prime Rating Technical Data

SYSTEM RATINGS

Standby

Voltage (L-L)	208V**	240V**	380V**	480V**	600V**	4160V
Phase	3	3	3	3	3	3
PF	0.8	0.8	0.8	0.8	0.8	0.8
Hz	60	60	60	60	60	60
kW	750	750	750	750	750	750
kVA	937	937	937	937	937	937
Amps	2602	2255	1424	1128	902	130
skVA@30% Voltage Dip	2440	2440	2370	2600	3340	1990
Generator Model*	LSA 49.1 L9	LSA 49.1 L9	LSA 49.1 M75	LSA 49.1 M75	LSA 49.1 L9	LS 50.2 L5
Temp Rise	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C
Connection	12 LEAD WYE	12 LEAD DELTA	6 LEAD WYE	6 LEAD WYE	6 LEAD WYE	6 LEAD WYE

* Consult the factory for alternate configuration.
** UL 2200 Offered

CERTIFICATIONS AND STANDARDS

// **Emissions –** EPA Tier 2 Certified

// **Generator set is designed and manufactured in facilities certified to standards ISO 9001:2008 and ISO 14001:2004**

// **Seismic Certification – Optional**
– IBC Certification

// **UL 2200 / CSA – Optional**
– UL 2200 Listed
– CSA Certified

// **Performance Assurance Certification (PAC)**
- Generator Set Tested to ISO 8528-5 for Transient Response
- Verified product design, quality and performance integrity
- All engine systems are prototype and factory tested

// **Power Rating**
- Accepts Rated Load in One Step Per NFPA 110
- Permissible average power output during 24 hours of operation is approved up to 85%.

STANDARD FEATURES*

- // MTU Onsite Energy is a single source supplier
- // Global Product Support
- // 2 Year Standard Warranty
- // 12V 2000 Diesel Engine
  - 23.9 Liter Displacement
  - Electronic Unit Pump Injection
  - 4-Cycle
- // Complete Range of Accessories
- // Generator
  - Brushless, Rotating Field Generator
  - 2/3 Pitch Windings
  - AREP supply to regulator
  - 300% Short Circuit Capability
- // Digital Control Panel(s)
  - UL Recognized, CSA Certified, NFPA 110
  - Complete System Metering
  - LCD Display
- // Cooling System
  - Integral Set-Mounted
  - Engine Driven Fan

STANDARD EQUIPMENT*

// Engine

Air Cleaners
Oil Pump
Oil Drain Extension & S/O Valve
Full Flow Oil Filter
Closed Crankcase Ventilation
Jacket Water Pump
Inter Cooler Water Pump
Thermostats
Blower Fan & Fan Drive
Radiator - Unit Mounted
Electric Starting Motor - 24V
Governor – Electronic Isochronous
Base - Structural Steel
SAE Flywheel & Bell Housing
Charging Alternator - 24V
Battery Box & Cables
Flexible Fuel Connectors
Flexible Exhaust Connection
EPA Certified Engine

// Generator

NEMA MG1, IEEE and ANSI standards compliance for temperature rise and motor starting
Sustained short circuit current of up to 300% of the rated current for up to 10 seconds
Self-Ventilated and Drip-Proof
Superior Voltage Waveform
Digital, Solid State, Volts-per-Hertz Regulator
No Load to Full Load Regulation
Brushless Alternator with Brushless Pilot Exciter
4 Pole, Rotating Field
130 °C Maximum Standby Temperature Rise
1 Bearing, Sealed
Flexible Coupling
Full Amortisseur Windings
125% Rotor Balancing
3-Phase Voltage Sensing
±0.25% Voltage Regulation
100% of Rated Load - One Step
5% Maximum Total Harmonic Distortion

// Digital Control Panel(s)

Digital Metering
Engine Parameters
Generator Protection Functions
Engine Protection
CANBus ECU Communications
Windows®-Based Software
Multilingual Capability
Remote Communications to RDP-110 Remote Annunciator
Programmable Input and Output Contacts
UL Recognized, CSA Certified, CE Approved
Event Recording
IP 54 Front Panel Rating with Integrated Gasket
NFPA 110 Compatible

* Represents standard product only. Consult Factory/MTU Onsite Energy Distributor for additional configurations.

APPLICATION DATA

// Engine

Manufacturer	MTU
Model	12V 2000 G85 TB
Type	4-Cycle
Arrangement	12-V
Displacement: L (in^3)	23.9 (1,457)
Bore: cm (in)	13 (5.1)
Stroke: cm (in)	15 (5.9)
Compression Ratio	16:1
Rated RPM	1,800
Engine Governor	Electronic Isochronous (ADEC)
Maximum Power: kWm (bhp)	890 (1,194)
Speed Regulation	±0.25%
Air Cleaner	Dry

// Liquid Capacity (Lubrication)

Total Oil System: L (gal)	77 (20.3)
Engine Jacket Water Capacity: L (gal)	110 (29.1)
After Cooler Water Capacity: L (gal)	20 (5.3)
System Coolant Capacity: L (gal)	372 (98.3)

// Electrical

Electric Volts DC	24
Cold Cranking Amps Under -17.8 °C (0 °F)	2,800

// Fuel System

Fuel Supply Connection Size	#12 JIC 37° Male
Fuel Return Connection Size	#12 JIC 37° Male
Maximum Fuel Lift: m (ft)	3 (10)
Recommended Fuel	Diesel #2
Total Fuel Flow: L/hr (gal/hr)	480.7 (127)

// Fuel Consumption

At 100% of Power Rating: L/hr (gal/hr)	210 (55.4)
At 75% of Power Rating: L/hr (gal/hr)	159 (42)
At 50% of Power Rating: L/hr (gal/hr)	108 (28.6)

// Cooling - Radiator System

Ambient Capacity of Radiator: °C (°F)	50 (122)
Maximum Restriction of Cooling Air, Intake, and Discharge Side of Rad.: kPa (in. H_2O)	0.12 (0.5)
Water Pump Capacity: L/min (gpm)	833 (220)
After Cooler Pump Capacity: L/min (gpm)	258 (68)
Heat Rejection to Coolant: kW (BTUM)	285 (16,222)
Heat Rejection to After Cooler: kW (BTUM)	252 (14,344)
Heat Radiated to Ambient: kW (BTUM)	82.1 (4,670)
Fan Power: kW (hp)	34.5 (46.3)

// Air Requirements

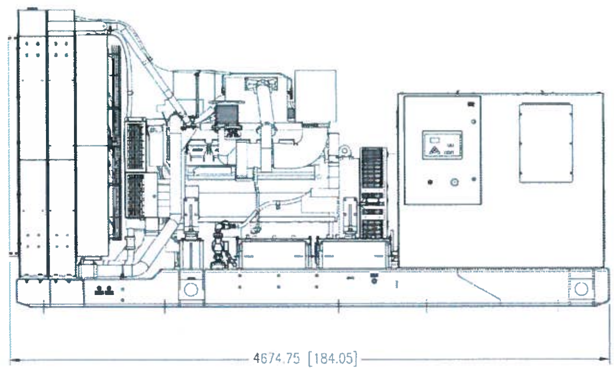
Aspirating: *m^3/min (SCFM)	63 (2,212)
Air Flow Required for Rad. Cooled Unit: *m^3/min (SCFM)	1,200 (42,400)
Remote Cooled Applications; Air Flow Required for Dissipation of Radiated Gen-set Heat for a Max of 25 °F Rise: *m^3/min (SCFM)	300 (10,532)

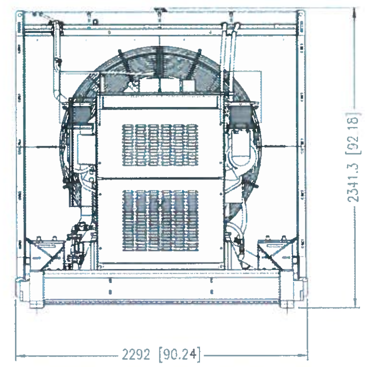
* Air density = 1.184 kg/m^3 (0.0739 lbm/ft^3)

// Exhaust System

Gas Temp. (Stack): °C (°F)	566 (1,051)
Gas Volume at Stack Temp: m^3/min (CFM)	166 (5,859)
Maximum Allowable Back Pressure: kPa (in. H_2O)	8.5 (34.1)

WEIGHTS AND DIMENSIONS





Drawing above for illustration purposes only, based on standard open power 480 volt generator set. Lengths may vary with other voltages. Do not use for installation design. See website for unit specific template drawings.

System	Dimensions (LxWxH)	Weight (less tank)
Open Power Unit (OPU)	4,674.75 x 2,292 x 2,341.3 mm (184 x 90.24 x 92.18 in)	7,883 kg (17,379 lb)

Weights and dimensions are based on open power units and are estimates only. Consult the factory for accurate weights and dimensions for your specific generator set.

SOUND DATA

Unit Type	Standby Full Load
Level 0: Open Power Unit dB(A)	92

Sound data is provided at 7 m (23 ft). Generator set tested in accordance with ISO 8528-10 and with infinite exhaust.

EMISSIONS DATA

NO_x + NMHC	CO	PM
4.66	0.45	0.01

All units are in g/hp-hr and shown at 100% load (not comparable to EPA weighted cycle values). Emission levels of the engine may vary with ambient temperature, barometric pressure, humidity, fuel type and quality, installation parameters, measuring instrumentation, etc. The data was obtained in compliance with US EPA regulations. The weighted cycle value (not shown) from each engine is guaranteed to be within the US EPA Standards.

RATING DEFINITIONS AND CONDITIONS

// Standby ratings apply to installations served by a reliable utility source. The standby rating is applicable to varying loads for the duration of a power outage. No overload capability for this rating. Ratings are in accordance with ISO 8528-1, ISO 3046-1, BS 5514, and AS 2789. Average load factor: ≤ 85%.

// Deration Factor:
Altitude: Consult your local MTU Onsite Energy Power Generation Distributor for altitude derations.
Temperature: Consult your local MTU Onsite Energy Power Generation Distributor for temperature derations.

C/F = Consult Factory/MTU Onsite Energy Distributor
N/A = Not Available

Appendix D – Odour Control Unit Supplier Sheets

evoqua
WATER TECHNOLOGIES

LO/PRO® PACKAGED ODOR CONTROL SYSTEM

Evoqua Water Technologies offers a full range of chemical scrubber odor control systems for municipal and industrial odor control.

LO/PRO Multi-Stage Scrubber

The patented LO/PRO® multi-stage scrubber system is the most efficient and versatile chemical odor control system available. By promoting different chemical reactions in each stage, the LO/PRO system can target a range of compounds in a single scrubber system.

The LO/PRO system an treat up to 24,500 cfm of odorous air in a single scrubber with very compact footprint. Higher airflows may be accommodated with special designs. Because of the low profile it may easily be installed indoors or outdoors and results in 99.5% removal of H_2S.

Standard Configuration

In the standard configuration, the first stage uses NaOH to remove 70% of the H_2S. The second and third stages use NaOH and NaOCl to remove the remaining H_2S and organic odors. This multi-chemistry system reduces chemical costs to less than half that required by conventional packed tower scrubbers.

Special Configurations

The LO/PRO system may also be configured to remove ammonia and amines in the first stage using H_2SO_4, and then remove H_2S and organic odors in the second and third stages using NaOH and NaOCl. This configuration is well suited to dewatering and solids handling operations, where lime stabilization causes ammonia and amine odors.

When operating at high ORP levels the LO/PRO system is very efficient at oxidizing mercaptans and organic sulfides. In such systems a final NaOH stage may be used to prevent any residual chlorine odors.

Standard Features

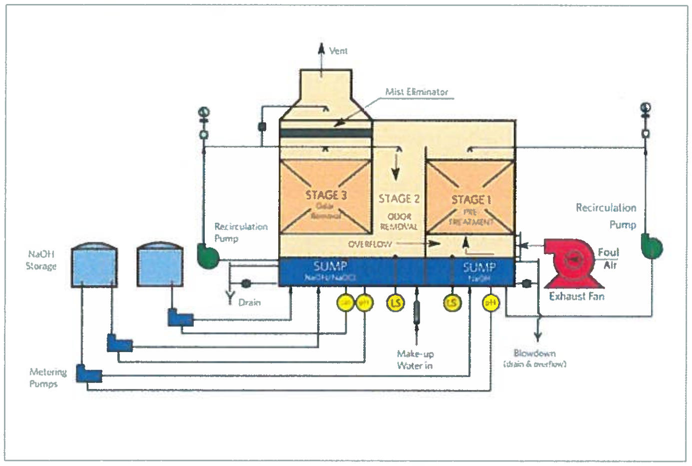
- Patented Multi-stage Odor Control Process
- Removes H_2S, Mercaptans, Organic Sulfides, Ammonia and Amines in One System
- Low Profile enables indoor installations
- Factory Assembled for near "Plug & Play" Installation
- Premium vinylester FRP construction
- Evoqua Service and Support

THE LO/PRO SYSTEM DESIGN INFORMATION

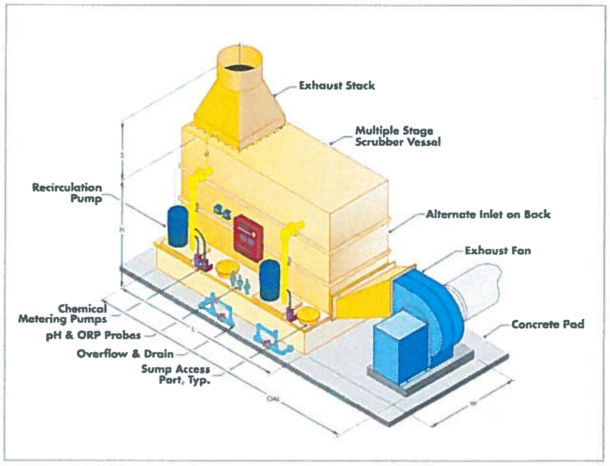
low rate of
cms=8476cfm

Model Unit	Airflow Rate* cfm	Dimensions LxWxH ft	Overall Length (OAL) ft	Shipping Wt lbs	Operating Wt lbs	Estimated System Power HP
LP-2000	1,700	6.00 x 4.50 x 9.25	11.0	2,200	6,000	13
LP-2250	2,200	6.75 x 4.75 x 9.25	12.5	2,500	7,000	17
LP-2500	2,700	7.50 x 5.00 x 9.50	13.0	1,100	8,000	18
LP-2750	3,300	8.25 x 5.25 x 9.50	15.0	3,700	9,500	20
LP-3000	4,000	9.00 x 5.50 x 10.50	15.5	4,400	11,000	25
LP-3500	5,500	8.75 x 6.00 x 11.00	16.0	5,000	12,000	30
LP-4000	7,100	10.00 x 6.50 x 11.00	17.5	5,600	14,500	35
LP-4500	9,100	11.25 x 7.00 x 11.25	19.5	6,200	17,000	45
LP-5000	11,200	12.50 x 7.50 x 11.50	20.5	6,800	19,500	50
LP-5500	13,600	13.75 x 8.00 x 11.75	22.0	7,500	22,000	50
LP-6000	16,200	15.00 x 8.50 x 12.00	24.0	8,300	22,500	60
LP-6500	20,000	16.25 x 9.00 x 12.25	26.0	9,100	28,500	70
LP-7000	24,500	17.50 x 9.50 x 12.50	27.0	10,000	32,000	90

* Standard Exhaust Stack "S" is six feet



Process Flow Diagram



Isometric Drawing

EVOQUA WATER TECHNOLOGIES

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WATER TECHNOLOGIES

PACKED TOWER ODOR CONTROL SYSTEM

Evoqua Water Technologies offers a full range of chemical scrubber odor control systems for municipal and industrial odor control.

Packed Tower Scrubbers

The packed tower scrubber has been used successfully for odor control for many years. It offers the advantage of being able to treat large air volumes, up to 56,500 cfm (96,000 m^3/h) in a single tower. Multiple towers maybe placed in series to target ammonia, H_2S and other odorous compounds.

The packed tower may use a variety of chemical processes to remove odors. Most typical are:

- NaOH for up to 95% of the H_2S only
- NaOH/NaOCl for > 99% of H_2S and organic odors
- H_2SO_4 for > 99% of ammonia and amines

Other scrubber systems using hydrogen peroxide, chlorine dioxide, potassium permanganate, or other oxidants are also available upon request.

Special Configuration

Evoqua offers a unique packed tower design incorporating an extended sump deck. This enables the use of vertical sealless recirculation pumps, and reduces the required footprint. It also facilitates removal of pH and ORP probes for maintenance and calibration.

Towers are fabricated from premium vinyl ester FRP for optimum strength and corrosion resistance.

Standard Features

- High Airflow Volume
- Multiple towers can remove H_2S, Mercaptans, Organic Sulfides, Ammonia and amines in one system train
- FRP Construction
- Evoqua Service and Support

PACKED TOWER DESIGN INFORMATION

Model	Air Flow Rate CFM *m³/h*	Diameter ft *mm*	Height ft *mm*	Shipping Weight lb *kg*	Operating Weight lb *kg*	Fan Motor Power HP *kw*	Pump Motor Power HP *kw*
RJP-600	13,500 *22950*	6.0 *1800*	21.25 *6375*	2,000 *900*	9,000 *4090*	30.0 *22*	10.0 *7.5*
RJP-700	18,500 *31450*	7.0 *2100*	21.5 *6450*	3,500 *1590*	12,000 *5455*	40.0 *30*	15.0 *11*
RJP-800	24,000 *40800*	8.0 *2400*	22.25 *6675*	4,500 *2045*	15,000 *6810*	50.0 *37.30*	15.0 *11.19*
RJP-900	30,000 *51000*	9.0 *2700*	23.5 *7050*	5,500 *2500*	18,000 *8180*	75.0 *55*	25.0 *18.5*
RJP-1000	37,000 *62900*	10.0 *3000*	24.25 *7275*	6,500 *2955*	22,000 *10000*	100.0 *75*	30.0 *22*
RJP-1100	45,000 *76500*	11.0 *3300*	24.5 *7350*	7,500 *3400*	26,000 *11800*	100.0 *75*	40.0 *30*
RJP-1200*	56,500 *96050*	12.0 *3600*	25.5 *7650*	8,500 *3850*	32,000 *14545*	150.0 *110*	50.0 *37*

Ulu Pandan STW
Singapore

Thirty-eight PT-700 Packed Tower Scrubbers in seventeen multiple tower odor control traizns.

Email odorcontrol@evoqua.com or visit
www.evoqua.com/packed-tower to connect with an expert.

EVOQUA
WATER TECHNOLOGIES

181 Thorn Hill Road, Warrendale, PA 15086

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PURE AIR SOLUTIONS

ACTUS

Activated Carbon Filter for Odour Control

ACTUS 22.08.2013/01

Pure Air Solutions P.O. Box 135 8440 AC Heerenveen The Netherlands +31(0)521 520 682 www.pureairsolutions.nl

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ACTUS 22.08.2013/01

PURE AIR SOLUTIONS

Pure Air Solutions, leader in odour and VOC Control!

Dear reader,

Pure Air Solutions is the world's leading Odour and VOC control specialist. Our customer focus, industrial know-how and technological leadership has put us at the forefront of the industry.

This trend will continue over the coming decades, as Pure Air Solutions further developes innovation solutions to improve the economic efficiency and environmental performance of air polution control systems. Subsequently we have twice been awarded, in 2011 and in 2013, by the European Union with the most prestigious Marie Curie (FP7) grant for Research & Technological Development. This extensive experience and profound knowledge is directly applied in all our products.

It is with great pleasure to present and outline the benefits of the ACTUS to you in this product brochure.

André Schoonhoven
CEO of Pure Air Solutions

PURE
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SOLUTIONS

WASTE WATER ODOUR CONTROL

EFFICIENT REMOVAL OF WASTE WATER ODOURS

Our ACTUS series of water regenerable carbon filters has been specially designed for the waste-water treatment market. The ACTUS unites the best European Activated Carbon with Dutch design, manufacturing and quality assurance to meet the highest international standards for eliminating odours from wastewater processes.

In waste water treatment processes several sources of odours are identified. Headworks, sludge treatment and pumping stations are examples of sources where waste water odours usually are recognized. Typically Hydrogen Sulphide (H2S), which gives the smell of rotten eggs, mercaptans and other organic compounds (VOC's) are produced. All these odours are removed efficiently from the gas stream by the ACTUS with a guaranteed odour removal performance.

TYPICAL APPLICATIONS

The ACTUS Activated Carbon Filter offers a solution for the elimination of:

☑ hydrogen sulfide (H2S)
☑ volatile organic compounds (VOC)
☑ mercaptans

ACTUS MODULAR SERIES AND CUSTOM MADE

We offer a complete series of ACTUS Filters ranging from skid-mounted modular systems for low air flows to custom designed systems capable of handling large air flows in excess of 20.000 m3/h.

The ACTUS as stand-alone unit is particularly useful for low air flows, low odour loads, remote locations and for the control of specific volatile organic compounds.

ACTUS RND

product type	Qty	Air flow m^3/h	H_2S ppm/avg	Diameter mm	Pressure drop Pa	Carbon Weight kg
RND 500	1	100	10	500	540	41
RND 800	1	250	10	800	529	106
RND 1000	1	500	10	1000	742	165
RND 1500	1	850	30-35	1500	967	619
RND 1800	1	1200	30-35	1800	817	891
RND 2000	1	1600	30-35	2000	863	1100

Table 1 | ACTUS Modular Series – Sizing information

STAND -ALONE OR AS WASTE WATER ODOURS

The skid-mounted, pre-assembled modular ACTUS series are ranging in flow capacity from 100 – 1.600 m3/h with a typical performance guarantee, based on the specified average H2S load, of 0,1 ppm H2S at outlet. For larger air flow rates the custom designed ACTUS unit is often installed as an extra module on top of our SULPHUS Biotrickling reactor, acting as an second 'polishing step'.

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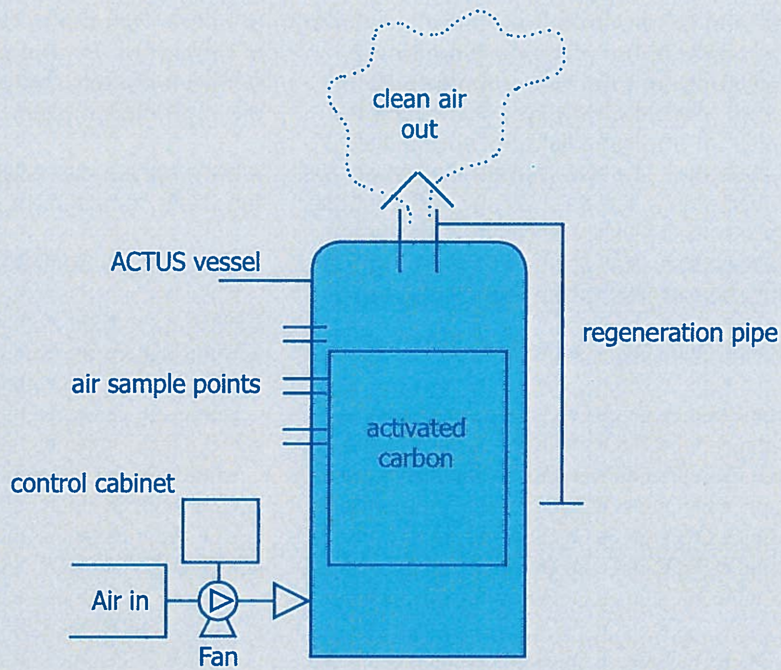
Proces flow diagram ACTUS



SIMPLE DESIGN, TO MAKE LIFE EASY

FACTORY ASSEMBLED AND SKID MOUNTED

The ACTUS vessel is fully corrosion resistance and is standard fabricated in a filament wound polyester fibre glass in accordance with relevant European standards and PS 15-69 specification. Fans are manufactured of steel and completely coated with a special corrosion resistant coating.
A local control panel mounted on the side of the vessel contains the motor starter for the fan and the power disconnect.

The ACTUS vessel, loaded with media prior to shipment, and fan are factory assembled on a skid, wired and tested at our premises in the Netherlands. The skids are manufactured from (among others) fibre reinforced polyester UNP profiles of 140mm x 6mm offering a light but strong and durable structure. The skid with the equipment will then be loaded in a standard 20ft or 40ft container. At arrival the ACTUS is ready for 'plug and play' installation on site, only the utilities (electricity and air) should be installed to start-up the system.

UNIQUE AND VALUABLE FEATURES

The carbon bed is supported by a HDPE/PP support structure which is resistant to the process condition. This also allows that the load is transferred equally over the bottom surface. To monitor the pressure drop across the carbon bed a pressure gauge is installed and mounted at the vessel, clearly visible for men standing near the vessel.

In addition the vessel is equipped with a number of air sample points to be able to monitor the air inside the carbon and just above it. The Activated Carbon is placed inside a special designed PP/PE bag with appropriate sized meshes to minimize pressure drop and keep the pelletized carbon inside. This bag can be lifted via fixed lifting lugs designed to lift the load of saturated carbon. The roof of the vessel can easily be removed for fill and re-fill of the carbon. The vessel is equipped with appropriate number of anchors.

A regeneration PVC-U pipe with flange (or other) connection is mounted alongside the vessel. The pipe is connected to a nozzle located above the carbon bed. In case regeneration is required, a simple potable water pomp system with appropriate water flow can be connected for regeneration of the carbon. In case an automatic regeneration system is chosen, this pipe is directly connected to the regeneration panel.

A drain nozzle with valve is available for removal of the water coming from humid air and regeneration.

THE ACTUS IN SUMMARY

- ☑ Pre-assembled and skid-mounted system.
- ☑ Modular for air flow rates from 100 –1600m3/h.
- ☑ Custom-made units for high air flows, stand-alone or integrated in SULPHUS Biotrickling.
- ☑ High performance, water regenerable carbon media with high adsorption capacity.
- ☑ Easy removable roof and specially designed bag for fast renewal of carbon media.
- ☑ All materials fully corrosion resistance for high-quality and sustainable operation.
- ☑ Volume control, damper, carbon sample ports, differential pressure gauge at hand.

SIMPLE DESIGN, TO MAKE LIFE EASY

THE CARBON MEDIA TYPE

The ACTUS filters are designed to work with a wide range of media, its selection is based on the specific application. Anyway, in the interest of our clients we promote cost-effective, reliable and high-quality solutions. To achieve this we select the most appropriate materials and only work with suppliers who satisfy our QA procedures and meet our high international standards. While being cost-effective with no concessions on quality, reliability and performance, we have specified the quality of Norit RST as our preferred media for waste water odours. With Norit RST inside the ACTUS we can ensure the best performance.

HIGH H2S ADSORPTION CAPACITY LEVEL

Norit RST1 is produced in The Netherlands and made of renewable material, having unique catalytic properties without the presence of an impregnant. Norit RST has an hydrogen Sulfide (H2S) adsorption capacity of 36 g/100 g when applied as fresh carbon. When the carbon is saturated on H2S, it can be regenerated by water, allowing an increased carbon life time. This grade can be operated on applications with a relative humidity from 40 – 100 %. Besides catalytic adsorption, Norit RST has a physical adsorption capacity to remove compounds like VOC and siloxanes. Low concentrations on mercaptans and ammonia are also handled by Norit RST.

REGENERATION

Since the carbon converts hydrogen sulfide predominantly into sulfuric acid, Norit RST can be regenerated with water. Results by Norit R&D showed that the H2S adsorption capacity of regenerated carbon was 60 – 80 % of the initial adsorption capacity, when regeneration was performed with 5 – 10 bed volumes water at approximately 1 bed volume per hour in upflow direction. Underneath graph illustrates the H2S adsorption capacity of Norit RST with a regeneration efficiency of 70 %. Depending on actual conditions, higher efficiencies are achievable.

DRYING

After each regeneration step it is advised to perform a drying step to remove the larger part of the retained water until a relative humidity of less than 80 % is achieved. The necessity of a drying step depends on local weather conditions. Another option could be starting the adsorption cycle with the flow of the medium to be purified. In both cases the starting flow should be low to prevent formation of an acidic mist which may corrode the downstream piping.

THE REGENERATION EFFICIENCY

The regeneration efficiency depends on the H2S inlet concentration and will be higher at low H2S concentrations. A regeneration efficiency of 60 – 80 % is achievable when applying an H2S inlet concentration of approximately 100 ppm. Sewage air typically contains 3 – 10 ppm, which allows Norit RST to be able to achieve even higher regeneration efficiencies in the field. Norit RST is especially suitable for water regeneration in applications up to 100 ppm H2S. From 100 – 1000 ppm on H2S the formation of elemental sulfur increases, which cannot be washed out during water regeneration.

CARBON LIFE TIME

The life time of Norit RST is influenced by the presence of actual concentrations of hydrogen sulfide and other (organic) compounds in the gas stream. Very high levels on H2S or compounds other than H2S, cannot be washed out with water regeneration resulting in limited service life time of the carbon.

1 Taken from Norit Digital Library, Document TB 0164, Version 11-11

ACTUS - Norit inside

Pure Air Solutions promote cost-effective solutions, with zero concessions on quality and sustainability. Therefore, we always strive for the best possible return on our installations. To achieve this we select the most appropriate materials and work with preferred suppliers who have satisfied our QA procedures and therefore meet our standards. For the Actus we have specified the quality of Norit, as they are one of the leading companies in the field of activated carbon. With Norit RST as a final polishing stage inside the ACTUS, we can ensure the optimum performance.

Norit Digital Library

taken from Norit

Summary

Why should Norit RST portfolio be chosen:

- High H_2S adsorption capacity level
- Made of renewable material
- No impregnation
- Water regenerable allowing long life times
- High siloxanes and VOC adsorption level

Properties Norit RST		
Impregnated		No
Oxygen necessary		Yes
• minimum concentration $O_2 : H_2S$	Molar basis	4 : 1
Relative humidity necessary		Yes
• working range	%	40 – 100
• optimum	%	60 – 70
H_2S adsorption capacity	g/100 g	36
Adsorbed H_2S water regenerable		Yes
• regenerability *1	%	60 – 80
• preferable H_2S range for optimal regeneration	ppm	< 10
• applicable H_2S range for regeneration	ppm	10 – 100
Empty bed contact time	s	3 – 6
Superficial velocity		
• RST 3	cm/s	5 – 30
• RST 4	cm/s	5 – 40
BTEX *2	g/100 g	22
D5 Siloxane (1 ppm, 20 °C)	g/100 g	38
Mercaptans *3	g/100 g	2
Apparent density	kg/m^3	350

Table 1: overview properties Norit RST.

*1 *Results on regenerability analyzed by Norit R&D. Testing conditions: H_2S inlet concentration 100 ppm; air temperature 20 °C; atmospheric pressure; relative humidity 80 %. Regeneration cycle: water flow approx. 1 bed volume per hour during 5 bed volumes, water temperature 20 °C.*

*2 *Benzene, toluene, ethyl benzene and xylene concentration 10 ppm each, 20 °C*

*3 *Ethyl mercaptan concentration 1 ppm*

Note: All data and suggestions regarding the use of our products are believed to be reliable and given in good faith. However, they are given without guarantee, as the use of our products is beyond our control, and are not to be construed as recommendation or instigation to violate any existing patent. Any product quality information given was valid at the time of issuance of the publication. However, we maintain a policy of continuous development and reserve the right to amend product quality aspects without notice.

Caution: For health and safety related aspects of a Norit activated carbon, please refer to the corresponding Material Safety Datasheet (MSDS), which is available on request.

This technical bulletin (issue 11-11) replaces previous issues

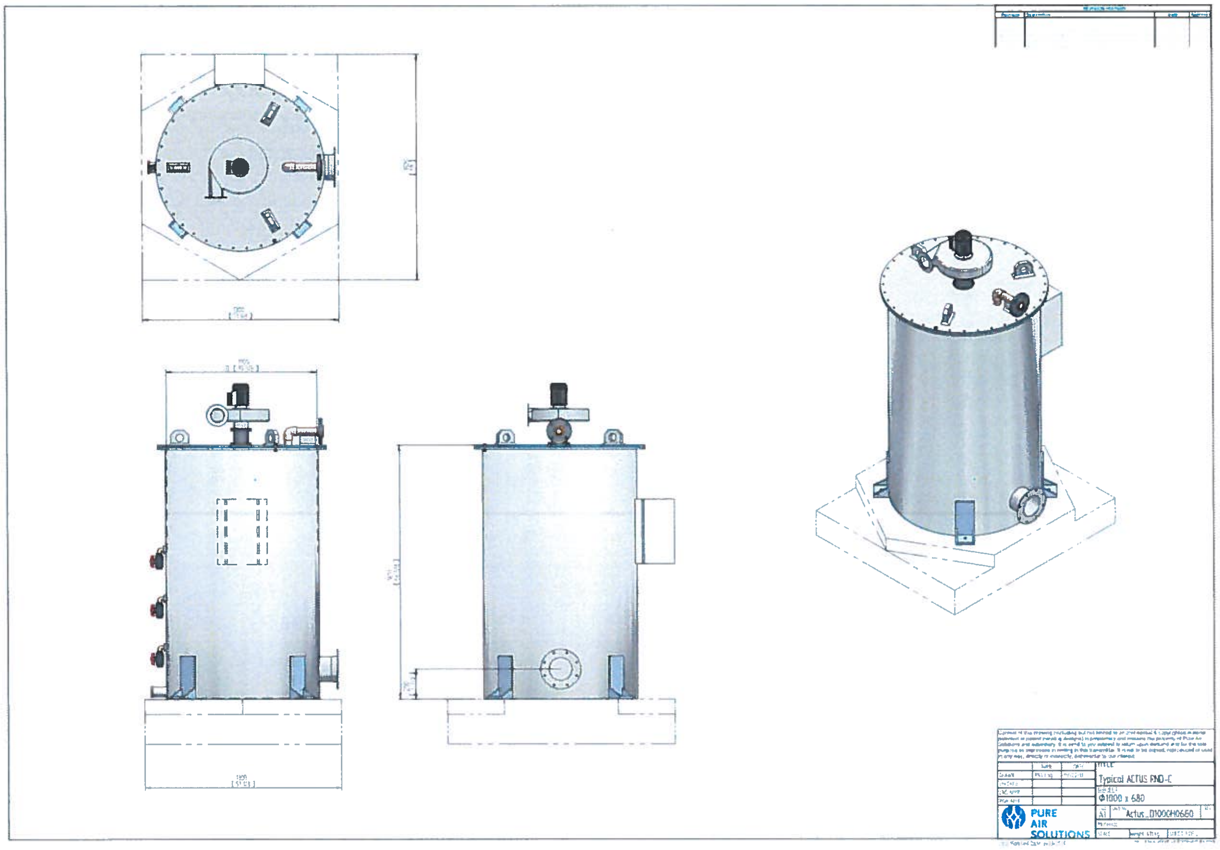
Norit **Activated Carbon**

leading in purification

ACTUS 22.08.2013/01

Sulphus 06.08.2013/05

ACTUS Technical drawing



Underneath curves show pressure drop characteristics of Norit RST 3 and 4 mm pellets.

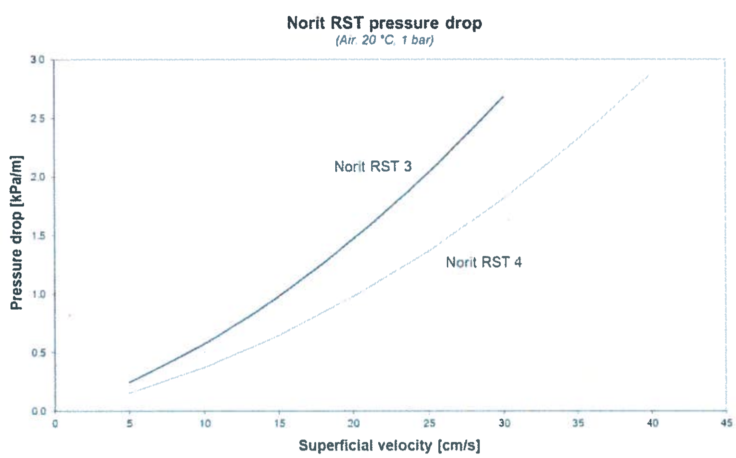
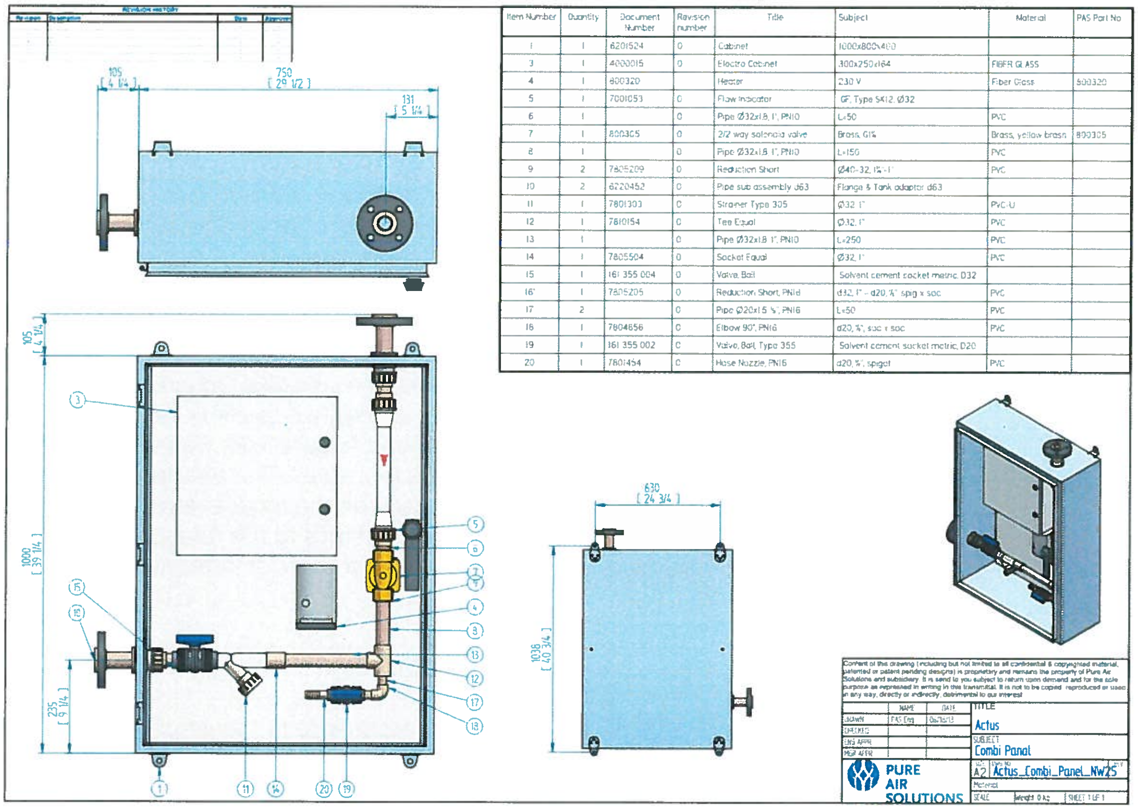


Figure 1: pressure drop curve of Norit RST grades. Operating conditions air: 20 °C; 1 bar.

ACTUS - Control panel



Item Number	Quantity	Document Number	Revision number	Title	Subject	Material	PAS Part No
1	1	6201524	0	Cabinet	1000x800x400		
3	1	4000015	0	Electro Cabinet	300x250x164	FIBER GLASS	
4	1	800320		Heater	230 V	Fiber Glass	800320
5	1	7001053	0	Flow Indicator	GF, Type SK12, Ø32		
6	1		0	Pipe Ø32x1.8, 1", PN10	L=50	PVC	
7	1	800305	0	2/2 way solenoid valve	Brass, G1¼	Brass, yellow brass	800305
8	1		0	Pipe Ø32x1.8, 1", PN10	L=150	PVC	
9	2	7805209	0	Reduction Short	Ø40-32, 1¼"-1"	PVC	
10	2	6220452	0	Pipe sub assembly d63	Flange & Tank adaptor d63		
11	1	7801303	0	Strainer Type 305	Ø32, 1"	PVC-U	
12	1	7810154	0	Tee Equal	Ø32, 1"	PVC	
13	1		0	Pipe Ø32x1.8 1", PN10	L=250	PVC	
14	1	7805504	0	Socket Equal	Ø32, 1"	PVC	
15	1	161 355 004	0	Valve, Ball	Solvent cement socket metric, D32		
16	1	7805205	0	Reduction Short, PN16	d32, 1" - d20, ½" spig x soc	PVC	
17	2		0	Pipe Ø20x1.5 ½", PN16	L=50	PVC	
18	1	7804656	0	Elbow 90°, PN16	d20, ½", soc x soc	PVC	
19	1	161 355 002	0	Valve, Ball, Type 355	Solvent cement socket metric, D20		
20	1	7801454	0	Hose Nozzle, PN16	d20, ½", spigot	PVC	

PURE
AIR
SOLUTIONS

More Pure Air Solutions

Pure Air Solutions believes that the industry as whole must advance solutions that will meet today's and tomorrow's demands of the market and the society. Through innovation and out-of-the-box thinking we endeavor every single day to make this possible. It is our purpose to improve to the global needs of a better environment and a sustainable world: no waste of money, no waste of time and no waste of energy and consumables.

SULPHUS

One of the flagships from our current product range is the SULPHUS technology, a compact bio-trickling filter with synthetic media, the so-called OdourPack. The SULPHUS is designed to eliminate organic and inorganic odours from waste water treatment processes. The principle of its design is based on the requirements of the market when it comes to the future of odour control: cheaper, greener, smarter and less stress!

ORGUS

Our experience in Industrial Odour Control is based on 30 years of practise in odour abatement at various industries. Consequently our detailed engineered ORGUS biofilters (built since the 1990's) have provided significant footprint reductions, reliable operations, low running costs and removal efficiencies of 90% and more. Small and very large airflows (> 200.000 m3/h) can be treated. Our modular ORGUS biofilters has a modular design and is available in single, dual and triple stage units

Pure Air Solutions

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Appendix E – AERMOD Files

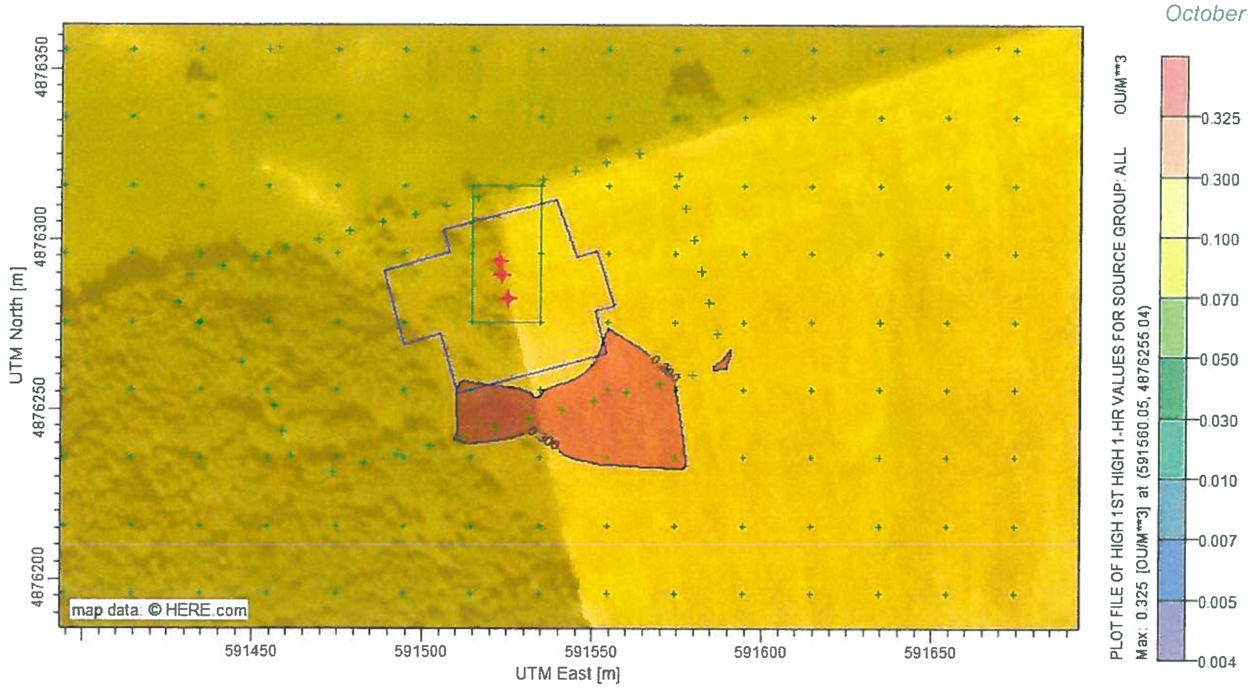

Figure 4. AERMOD modelling contours - odour emissions

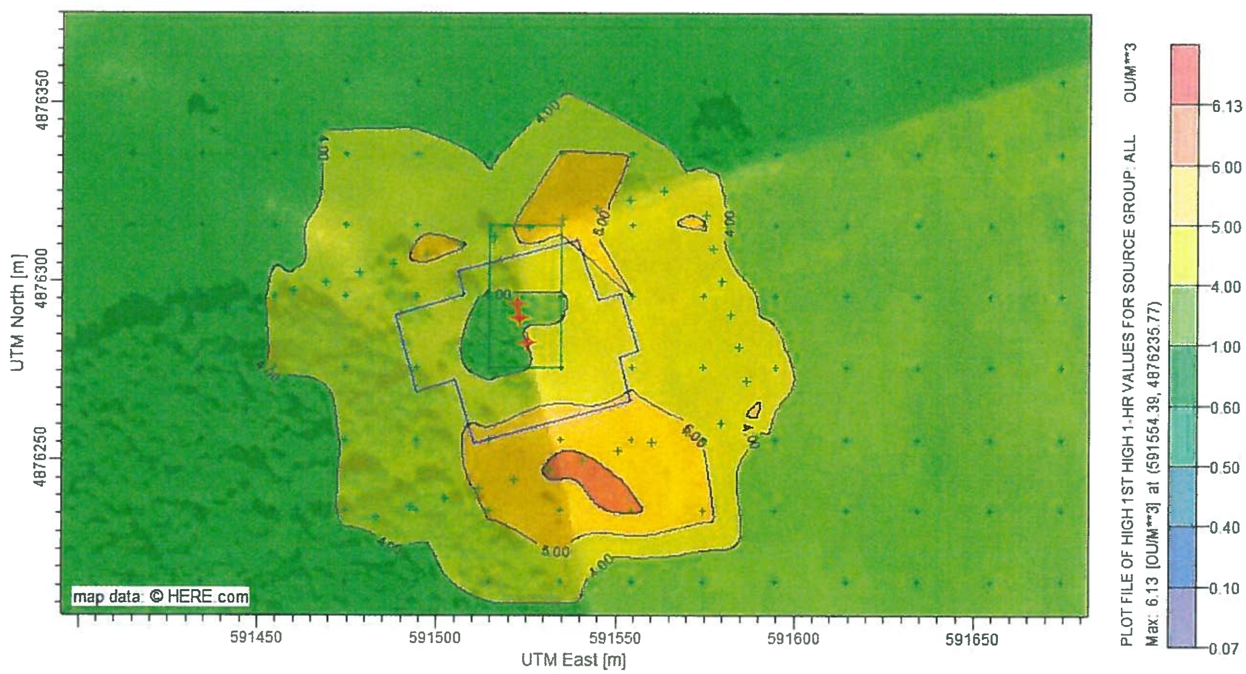

Figure 5. AERMOD modelling contours- process emissions

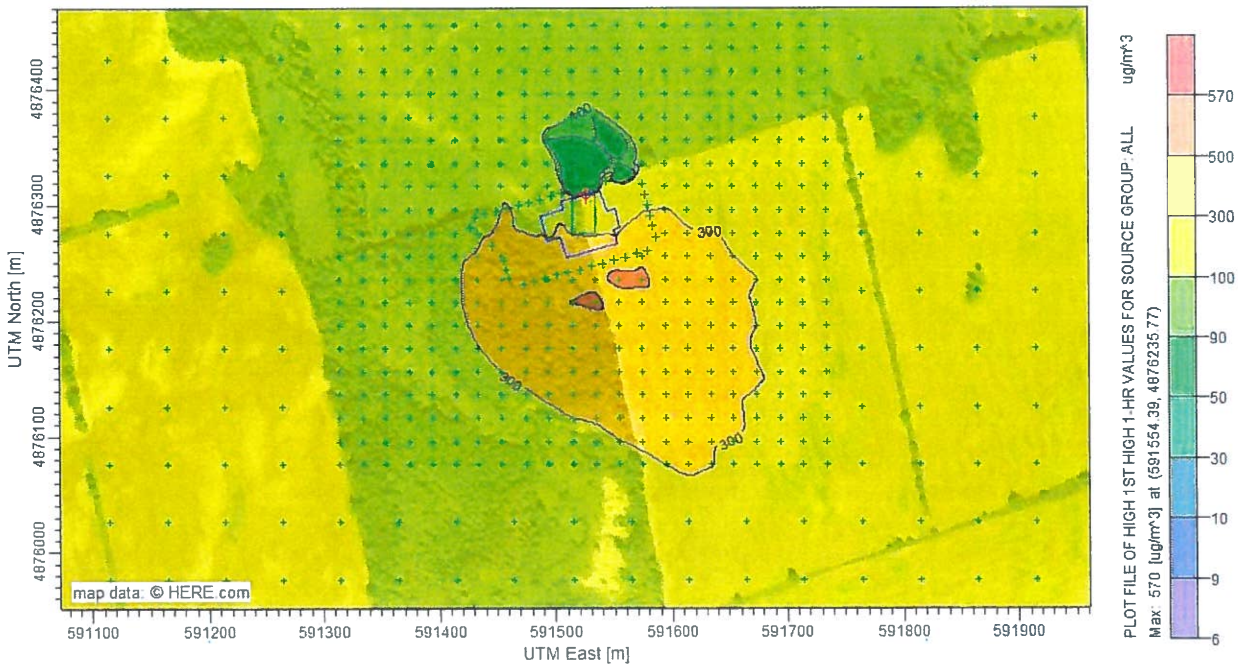

Figure 6. AERMOD modelling contours- emergency generator emissions