



Redefining possible.

SUDBURY WWTP / BIOSOLIDS

INNOVATIVE AND ECO-FRIENDLY FACILITY

First Canadian Odour Conference (COC) 2018
Calgary, Alberta

Special Acknowledgements



Overview of Presentation

- 1. History of Project**
- 2. Regulatory Standards**
- 3. Project Constraints**
- 4. Odour Control**
- 5. Validation**
- 6. Outcome**

History of Project

Background

Drivers:

- New standards
- Impact on community



Background

- Decided to manage wastewater biosolids in a new way, using the patented process called N-Viro®.
- Followed the P3 model:
 - City of Greater Sudbury owns biosolids facility;
 - N-Viro Systems Canada LP, now part of Walker Environmental, would:
 - Design, Build, Finance, Operate and Maintain (DBFOM); and
 - Provide financing over the full 20-year contract term.
- RWDI joined team in 2013 to contribute analysis, helping the key actors design, build and operate the new facility to meet the City's criteria.

Four main components



Septage Receiving



Biosolids Facility



Sludge Thickening



Headhouse Building

Design Criteria

- Permanent and sustainable method of sludge disposal and treatment.
- A centralized wastewater sludge dewatering and stabilization facility, capable of managing nearly 160,000 m³ of wastewater daily (or over 20,000 wet tonnes/yr).
- Designed in a fashion to allow for other WWTP's in Sudbury to utilize the system and truck their septage to the site for processing.

The City of Greater Sudbury Environmental Criteria

- 
- Must be designed in order to comply with air quality/noise standards and guidelines.
 - Must be approved by the regulatory agency (Ministry).
 - Minimize the risk that residents would be bothered by the facility's operations (odour).

RWDI's Involvement

- To help the facility meet those criteria:
 - worked with the facility's design teams to evaluate and assess noise and air quality risks;
 - explored a range of potential mitigation solutions to achieve the greatest possible reductions in noise and odour; and
 - met with the Approvals Branch of Ontario's Ministry of the Environment and Climate Change (now Ministry of Environment, Conservation and Parks), to communicate the results of our analysis and demonstrating the effectiveness of the P3 team's odour-control measures.

RWDI's Involvement

Post construction:

- Carried out performance testing for all the facility's control systems to ensure they were working as the designers intended;
- Assessed and fine-tuned the indoor ventilation system; and
- Executed the Environmental Compliance Approval validation testing.



Summary of Emission Standards

Ontario Regulation 419/05

There are 3 compliance approaches for industry to demonstrate environmental performance:

- Comply with the air standards (O.Reg. 419/05);
- Apply for a site-specific standard; or
- Register to use a Technical Standard if one exists.

All three approaches are allowable under the regulation.

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Air Quality Standards, Guidelines and Screening Levels

What are Air Standards?

Legal concentration limits for contaminants in air

- Concentrations are set to protect public against adverse effects;
- Can also be based on nuisance effects, such as odour and dust; and
- Limits outlined in Air Contaminants Benchmark (ACB) List, Ontario's Ambient Air Quality Criteria (AAQC) and Jurisdictional Screening Level (JSL) List.

In recent years there has been significant progress to update or set new more stringent air standards.

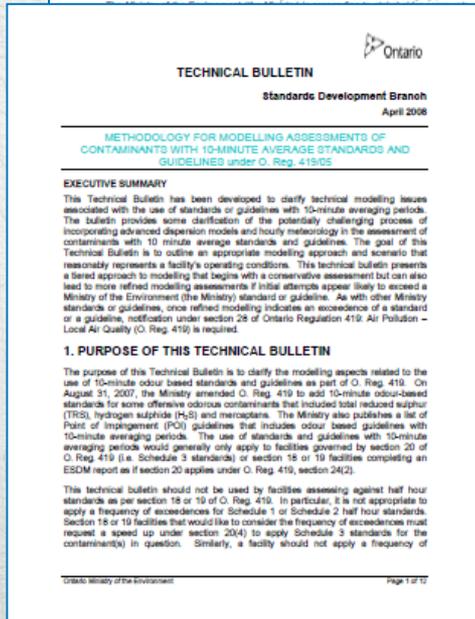
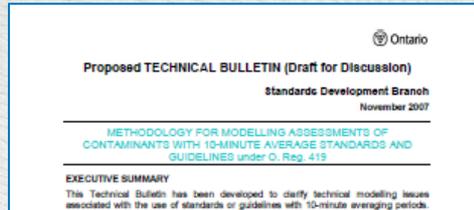
When a facility can demonstrate they meet the air standards by the phase-in dates, no additional requirements are triggered.

What is an Odour Unit?

One odour unit is the concentration at which 50% of a population will detect an odour.

- Detection = 1 Odour Unit (by definition)
- Recognition = 3-10 OU (typically)
- Annoyance = ??? OU (odour specific)
- Health Effect = ??? OU (nausea, headache)

Odour in Ontario



Technical Bulletins from the Standards Development Branch

Define:

1. Odour performance levels (1ou)
2. Modelling protocols
3. Averaging periods (10 minute)
4. Odour sensitive receptors
5. Meteorological assumptions and meteorological anomaly screening
6. Acceptable frequencies for exceeding odour (0.5% of time)

Environmental Compliance Approval (ECA) Odour Performance Contract

- Odour performance levels (1ou)
- Modelling approach
- Averaging periods (10 minute)
- Odour sensitive receptors
- Source testing requirements
- Odour event reporting
- Operation and maintenance requirements

44 "Sensitive Receptor" means any location where routine or normal activities occurring at reasonably expected times would experience adverse effect(s) from odour discharges from the Facility, including one or a combination of:

- (a) private residences or public facilities where people sleep (eg: single and multi-unit dwellings, nursing homes, hospitals, trailer parks, camping grounds, etc.),**
- (b) institutional facilities (eg: schools, churches, community centres, day care centres, recreational centres, etc.),**
- (c) outdoor public recreational areas (eg: trailer parks, play grounds, picnic areas, etc.), and**
- (d) commercial areas where there are continuous outdoor public activities (eg: commercial plazas and office buildings), where such outdoor public areas are deemed " sensitive receptors" only for the periods when there are such activities.**

DRAFT

Section titled Reporting Requirements of this Certificate.

40 "Point of Impingement" means any point in the natural environment. The point of impingement for the purposes of verifying compliance with the Act shall be chosen as the point located outside the Company's property boundaries at which the highest concentration is expected to occur, when that concentration is calculated in accordance with Schedule "E" or any other method accepted by the Director.

41 "Pre-Test Information" means the information outlined in Section 1.1 of the Source Testing Code.

42 "AERMOD" means the dispersion model developed by the American Meteorological Society ("A.S. Environmental Protection Agency Regulatory Model Improvement Committee (AERMOD) including the PM2.5 (Particulate Matter Fine Mode Enhancement) Algorithm, used to calculate one-hour average concentrations of a contaminant at the Point of Impingement.

43 "Source Testing Code" means the Source Testing Code, Version 2, Report No. ARB-06-00, dated November 1990, prepared by the Ministry, as amended.

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(a) private residences or public facilities where people sleep (eg: single and multi-unit dwellings, nursing homes, hospitals, trailer parks, camping grounds, etc.),

(b) institutional facilities (eg: schools, churches, community centres, day care centres, recreational centres, etc.),

(c) outdoor public recreational areas (eg: trailer parks, play grounds, picnic areas, etc.), and

(d) commercial areas where there are continuous outdoor public activities (eg: commercial plazas and office buildings), where such outdoor public areas are deemed " sensitive receptors" only for the periods when there are such activities.

45 "Source Testing" means sampling and testing to measure emissions resulting from operating the equipment at a level of typical maximum production within the approved operating range of the Equipment.

You are hereby notified that this approval is issued to you subject to the terms and conditions outlined below:

TERMS AND CONDITIONS

1. GENERAL

1.1 Except as otherwise provided by this Certificate, the Facility shall be designed, developed, built, operated and maintained in accordance with the terms and conditions of this Certificate and in accordance with the application, the EIDM Report, the Access Agreement Report, plans, specifications and Supporting Documentation submitted and the following Schedule attached hereto:

Schedule A - Supporting Documentation;
Schedule B - Procedures for the Calculation of 10-minute Average Concentration of Odour;
Schedule C - Procedures for Source Testing.

2. OPERATIONAL FLEXIBILITY

2.1 The Company may make Modifications to the Facility in accordance with this Certificate.

2.2 Despite Condition 2.1, all Modifications made by the Company shall be within the Operating Envelope of the Facility as defined by conditions 2.3 to 2.7.

2.3 Despite Condition 2.1, the Company shall not make Modifications to the Facility that are outside the scope of the intended operations of the Facility as described in the Description Section.

Facility that result in an increase of the

Facility that would add any Equipment with

Detailed Assessment: NPC-300

- Must comply with NPC-300
- Must minimize noise at public walking trail





Project Constraints

Project Constraints

- Very small footprint;
- Effective handling of spikes;
- Temperature and humidity never an issue;
- Input data – City's design criteria was very conservative; and
- Criteria Stricter than MECP with respect to noise (walking trail).

Inlet Conditions for Control Equipment

SLUDGE THICKENING FACILITY	
Contaminant:	
Hydrogen Sulphide (H ₂ S)	7-12 ppm
Methyl Mercaptan (CH ₃ SH)	1.0 ppm
Dimethyl Sulphide (CH ₃ SCH ₃)	1.0 ppm
Odour Concentration	120,000-200,000 ou

SLUDGE/SEPTAGE RECEIVING FACILITY	
Contaminant:	
Hydrogen Sulphide (H ₂ S)	7-12 ppm
Methyl Mercaptan (CH ₃ SH)	0.5 ppm
Dimethyl Sulphide (CH ₃ SCH ₃)	0.5 ppm
Odour Concentration	120,000-200,000 ou

RAW SEWAGE PUMPING STATION AND HEAD HOUSE	
Contaminant:	
Hydrogen Sulphide (H ₂ S)	5-7 ppm
Methyl Mercaptan (CH ₃ SH)	0.5 ppm
Dimethyl Sulphide (CH ₃ SCH ₃)	0.01 ppm
Odour Concentration	80,000-120,000 ou

Outlet Criteria for Control Equipment

Table 3.1a: Summary of Maximum Outlet Concentration after OCS (Headhouse)

Compound	Maximum Outlet Concentrations after OCS
Odour	300 OU
Hydrogen Sulphide	0.1 ppm
Methyl Mercaptan	0.05 ppm
Dimethyl Sulphide	0.2 ppm
Dimethyl Disulphide	0.1 ppm

Table 3.1b: Summary of Maximum Outlet Concentration after OCS (Sludge Thickening and Sludge and Septage Receiving Station)

Compound	Maximum Outlet Concentrations after OCS
Odour	500 OU
Hydrogen Sulphide	0.1 ppm
Methyl Mercaptan	0.05 ppm
Dimethyl Sulphide	0.2 ppm
Dimethyl Disulphide	0.1 ppm

Control Technology



Control Technologies Options Considered

- Carbon filtration;
- Biofiltration; and
- Photoionization.

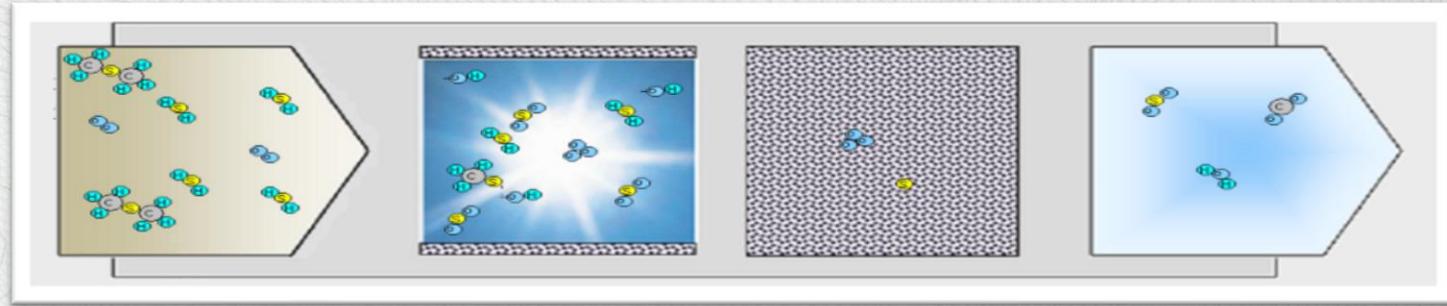
Photoionization was selected based on the following:

- WWTP located on a small rocky ridge in mostly low swampy area; i.e. limited space;
- Close proximity to high-end residential neighborhood, recreational facilities and retail outlets;
- Must operate during cold climate with winter temperatures often below -30°C ; and

The smaller footprint was major contributing factor in choosing photoionization, but also performance and temperature variations.

What is Photoionization?

Two well-known underlying principles:
UV Light and Catalysis



raw gas

UV section

catalyst

clean gas

Advantages

4

- Superior performance - very efficient odour removal even at high concentrations;
- Reasonable capital and operating costs;
- Can be turned on and off; works immediately;
- Very stable physical-chemical process;
- No chemicals or water required;
- Minimal, and predictable, maintenance requirements and operator time;
- Actually breaks down odorous compounds; and
- Low energy requirements – possibility of heat recovery.

Sudbury Biosolids Photoionization Unit (20,000 cfm)

4



Sudbury Thickenener Photoionization Unit (6,000 cfm)

4



Sudbury Septage Receiving Photoionization Unit (1,500 cfm)

4



Summary of Results

4

- Met and substantially exceeded minimum performance specification for outlet odour;
- Accomplished while effectively making use of available space, and with minimal ducting;
- Demonstrated photoionization is an effective odour removal technology in odour-sensitive locations and in locations with space limitations; and
- Confirmed cold climates not an issue for outdoor installation. When combined with outdoor installation in hot desert climates elsewhere, photoionization units can be installed outdoors in any climatic zone.



Validating Performance

How Did We Validate?

City:

- Two (2) performance guarantee tests for PI units were required: ~5 days from commissioning and ~12 days from commissioning.

MECP

- Compliance testing program to validate outlet concentrations:
 - Ontario Source Testing Code, Method 6
 - Point Sources - Lung samplers, Eductor sampling

Point Source Measurements



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Performance Results

Summary of Performance Results April 9 and 10, 2015 (Day 4 and 5)

Tested Parameters	Units	Sludge & Septage Receiving Station		Sludge Thickening Building		Biosolids Facility	
		Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
Stack Flow	(m ³ /sec)	N/A	1.11	N/A	1.52 ^[1]	9.23 ^[2]	8.38 ^[2]
Odour	(OU/m ³)	862	56	2127	433	342	74
Odour Emission Rate	(OU/sec)	957	62	3233	658	3154	617
Total Reduced Sulphurs	(ppm)	0.25	0.004	2.28	0.120	0.17	0.008
Ammonia	(ppm)	N/A	N/A	N/A	N/A	0.05	<0.04
Hydrogen Sulphide	(ppm)	0.51	<0.01	<0.01	<0.01	<0.01	<0.01
Methyl Mercaptans	(ppm)	0.19	<0.01	0.55	<0.01	<0.01	<0.01
Dimethyl Sulphide	(ppm)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dimethyl Disulphide	(ppm)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005

Notes: [1] Flows taken when only one fan was in operation.
 [2] Flows taken during second round of testing (Day 11 and 12).
 [NA] Not applicable - no performance guarantee values

Performance Results

Summary of Performance Results April 16 and 17, 2015 (Day 11 and 12)

Tested Parameters	Units	Sludge & Septage Receiving Station		Sludge Thickening Building		Biosolids Facility	
		Inlet	Outlet	Inlet	Outlet	Inlet	Outlet
Stack Flow	(m ³ /sec)	N/A	1.01	N/A	3.04	9.23	8.38
Odour	(OU/m ³)	1403	191	2426	113	865	137
Odour Emission Rate	(OU/sec)	1445	197	7504	357	7987	1184
Total Reduced Sulphurs	(ppm)	0.18	0.004	0.69	0.097	0.05	0.005
Ammonia	(ppm)	N/A	N/A	N/A	N/A	5.20	<0.07
Hydrogen Sulphide	(ppm)	0.06	<0.01	<1.33	<0.01	<0.01	<0.01
Methyl Mercaptans	(ppm)	0.24	<0.01	2.29	<0.01	<0.01	<0.01
Dimethyl Sulphide	(ppm)	<0.01	<0.01	0.11	<0.01	<0.01	<0.01
Dimethyl Disulphide	(ppm)	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
CEM TRS	(ppm)	0.672	0.004	0.554	0.106	0.047	0.005

Notes: [NA] Not applicable - no performance guarantee values

Performance Results

Comparison of Results to Outlet Performance Values April 16 and 17, 2015 (Day 11 and 12)

Tested Parameters	Units	Sludge & Septage Receiving Station		Sludge Thickening Building		Biosolids Facility	
		Outlet	Met Performance Value	Outlet	Met Performance Value	Outlet	Met Performance Value
Stack Flow	(m ³ /sec)	1.03	N/A	3.08	N/A	8.62 ^[2]	N/A
Odour	(OU/m ³)	191	Yes (<500 OU)	113	Yes (<500 OU)	137	Yes (<500 OU)
Total Reduced Sulphurs	(ppm)	0.004	N/A	0.097	N/A	0.005	N/A
Ammonia	(ppm)	N/A	N/A	N/A	N/A	<0.07	Yes (<6 ppm)
Hydrogen Sulphide	(ppm)	<0.01	Yes (<0.1 ppm)	<0.01	Yes (<0.1 ppm)	<0.01	Yes (<0.1 ppm)
Methyl Mercaptans	(ppm)	<0.01	Yes (<0.05 ppm)	<0.01	Yes (<0.05 ppm)	<0.01	Yes (<0.05 ppm)
Dimethyl Sulphide	(ppm)	<0.01	Yes (<0.2 ppm)	<0.01	Yes (<0.2 ppm)	<0.01	Yes (<0.2 ppm)
Dimethyl Disulphide	(ppm)	<0.005	Yes (<0.1 ppm)	<0.005	Yes (<0.1 ppm)	<0.005	Yes (<0.1 ppm)

Outcome



Outcome

The Sudbury Wastewater Treatment Plant and Biosolids Management Facility:

- Substantially completed in May, 2015 and is fully operational today;
- Earned the Chuck Willis Award for Innovation and Excellence in a Municipal-Private Partnership by the Canadian Council for Public-Private Partnerships; and
- Recognized in part for its commitment to environmental sustainability, and also for the health, environmental, and economic benefits it brings to Sudbury residents.

First of its kind in northern Ontario, making Greater Sudbury a leader in environmentally sound water/wastewater processing.

Contact Information



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THANK YOU

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