



Duffin Creek Water Pollution Control Plant

Odour Control





Duffin Creek Water Pollution Control Plant

Duffin Creek Water Pollution Control Plant (WPCP) is located on the northern shore of Lake Ontario in the City of Pickering, and is operated as a partnership between The Regional Municipality of York and The Regional Municipality of Durham. The Duffin Creek WPCP is capable of treating 520 million litres of wastewater each day and serves the communities of York Region and the Town of Ajax and the City of Pickering in Durham Region. The plant has a sophisticated odour management plan using tested technology to ensure air quality is protected. Regional staff work closely with the Ontario Ministry of Environment and Climate Change (MOECC) and local municipalities to discuss potential concerns.

The Duffin Creek Plant is ISO 14001 certified and a MOECC Class four conventional activated sludge treatment plant. The Duffin Creek Plant operates to ensure environmentally responsible treatment of wastewater.

Why Are Odour Control Systems Needed?

In addition to reducing the impact to nearby communities, proper odour control is also essential for pollution prevention. Odour control systems are mandated by the Ministry of Environment and Climate Change (MOECC) as part of plant approvals. Our state-of-the-art odour control systems operate to remove common wastewater gases, including Volatile Organic Compounds (VOCs), petroleum-based hydrocarbons, mercaptans, nitrogen-based compounds (ammonia) and sulphur compounds (hydrogen sulfide) that exist in wastewater.

Wastewater is the water that ends up in the sewer system after being used by homes, businesses and industries. This water comes from toilets, sinks, laundry and rinse water from various industrial and commercial processes.



View of Duffin C
tanks and final



Environmental Compliance Approvals – Air Limits

The Duffin Creek WPCP ensures protection of both human health and environment by meeting or exceeding standards set by the MOECC via the facility's Environmental Compliance Certificate. Compliance is ensured by constantly monitoring by operators and annual testing for dioxins, furans, total hydrocarbons and various heavy metals.





Thermal treatment



Biofilter equipment



Odour Control Technology

There are several types of odour control systems used at Duffin Creek. Each type has a unique process to remove the odour-causing compounds from the air. The Duffin Creek WPCP operates incinerators, biofilters and activated carbon units.

Choosing the Right Technology

Odour control technology is chosen based on an understanding of the source of the air stream that is to be treated. Some technologies are better than others at removing specific odours. For example, odours from the initial liquid phase of the treatment process tend to contain more hydrogen sulfide gas ($H_2S_{(g)}$) and need filters to deal with that odour. The solids management portion of the process contains reduced sulphur organic-based compounds such as methyl mercaptan and dimethyl disulfides that are best treated with heat or combustion to remove or reduce the smell.

Oxidation: A substance that combines chemically with oxygen.

Airflow: Proper ventilation is very important to the odour control process at the Duffin Creek WPCP. Air movement through the different odour control mechanisms help prevent the buildup of harmful gases and also minimize corrosion of pipes and equipment.

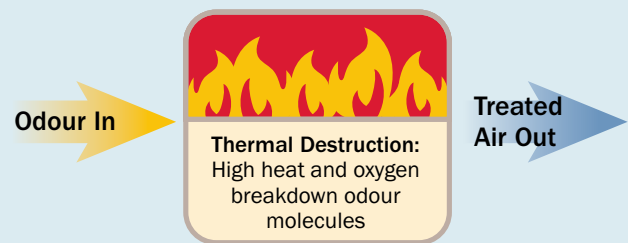
Odour Treatments at Duffin Creek

THERMAL TREATMENT

Mechanism of Removal: Thermal Destruction

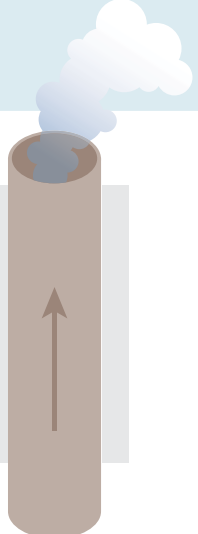
Processes Treated: Capture air from dewatering operations and digesters

Primary Odour Source: Hydrogen Sulfide Gas- $H_2S_{(g)}$



Thermal processes destroy foul odours through oxidation. Odours from the dewatering process and sludge holding tanks are ducted into the air blowers of a reactor. The combination of high heat and oxygen leads to the breakdown of odour-causing compounds. What remains is released into the atmosphere with either no smell (water vapour and carbon dioxide) or reduced smell (sulphur dioxide). Waste gas burners and boilers also use thermal treatment to destroy odour produced by digesters.

Stack Ventilation: Odours leaving the plant are *diffused* or dispersed into the atmosphere through a tall chimney or stack. Diffusion works by using pressure differences with the stack to pull in outside air.





Biofiltration



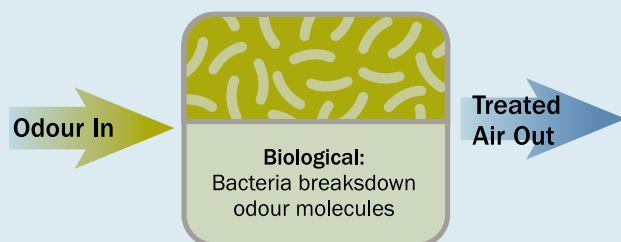
Activated carbon odour control system

BIOFILTRATION

Mechanism of Removal: Biological

Processes Treated: Headworks and Pumping Stations

Primary Odour Source: Hydrogen Sulfide Gas- $H_2S_{(g)}$



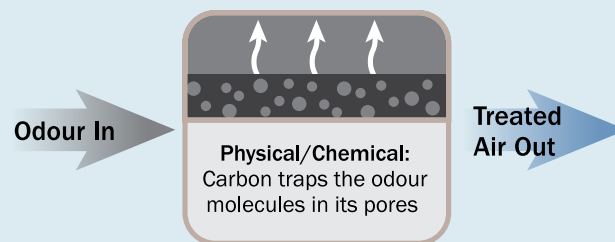
Biofiltration technology uses bacteria to break down odours. First, odorous air is pumped into a humidification system to raise the moisture content and temperature. Next, the air is moved to the biofilter cells and is evenly spread over the media bed where bacteria breaks down the odour-causing compounds. The treated air is then exhausted into a discharge stack.

ACTIVATED CARBON FILTER

Mechanism of Removal: Physical/Chemical

Processes Treated: Sludge Pumping Station

Primary Odour Source: Hydrogen Sulfide Gas- $H_2S_{(g)}$



The activated carbon unit works to take out odour by trapping odour-causing compounds in its pores. A fan located at the end of the unit draws the air through the carbon filter and the treated air is released through an exhaust stack.

Filtration Media

Media Bed

A media bed consists of stones and organic material that odours pass through in the biofiltration process.

Biofilter Media

The biofilter cells are filled with a light-weight synthetic media called BIOSORBENS® which supports bacterial growth. This material is specially designed to remove the maximum amount of odour from wastewater.

Activated Carbon Filter Media

Activated Carbon is coal that has been ground into pellets or fine pieces and is heated to increase the pores or empty spaces in the carbon. Increasing pore size allows the carbon to trap more odours. The filters can be rinsed and reused a number of times before they have to be replaced.



How is Odour Measured?

The strength of a smell or odour is measured in Odour Units (OU) by following a standard odour panel testing procedure. The testing procedure means a smell or odour is exposed to a panel of judges with average noses. The odour is diluted with odour free air and is exposed to judges. The test stops when only 50 per cent of the judges are able to accurately identify the odour, this is one Odour Unit. For that reason, if a substance has to be diluted 15 times with odour free air, this odour is said to have 15 OU. An odour with 15 OU is stronger than an odour with two OU.

Human Sense of Smell

Different odours and chemical vapours can set off your sense of smell. Humans are able to smell through what is called the *olfactory system*. Our perception of odours is related to each individual's experience and can vary from person to person.

Effects of Temperature on Odour

Fluctuations in heat and humidity can impact the volatility of gaseous odorants in the air. It is this volatility that allows humans to perceive odours. What's more, the receptors in your nose are more effective in warm and humid conditions. This is why we perceive odours to be stronger on hot summer days.

Volatility describes how easily a substance will turn into a gas or vapor.

Sources of Odour in Wastewater

Type of Compound	Example of Source
Organic compounds	Human waste
Nitrogen Based Compounds (i.e. Ammonia-NH ₃)	Cleaning Products
Mercaptans (methyl mercaptan, dimethyl disulfide)	Additive to Gasoline
Hydrogen Sulfide (H ₂ S _(g)) and other sulfur-based compounds	Petroleum and Natural Gas
Petroleum based Hydrocarbons and other Hydrocarbons (i.e. Methane-CH ₃)	Crude Oil Products



Odour-causing agents:

Mercaptans are added to substances like natural gas to give it a detectable odour resembling garlic or rotten eggs.

Volatile Organic Compounds or **VOCs** are organic compounds that can easily become vapours or gases. VOCs that contain sulphur can give off an unpleasant odour.

Compounds: A substance that results from the combination of two or more different chemical elements. Different types of odour-causing compounds are managed at the Duffin Creek Plant.

Other Sources of Odour

Algae in Lake Ontario

Algae are a group of naturally occurring organisms that can be found in almost all bodies of water. They are small, microscopic organisms that grow near the surface of the water and often build up along the shorelines. Algae give off an odour when they die and decay which can be confused with that of the wastewater treatment plant, but is in fact a naturally occurring phenomenon.



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