



Lesson Plan: Energy from Waste, Grade 12 Chemistry (SCH4U)

Introduction

The protection of the environment and the community is a vital aspect of Durham York Energy Centre (DYEC) operations. The Ministry of the Environment, Conservation and Parks (MECP) has imposed strict limits on the air emissions for the DYEC. Our air emissions limits are some of the most stringent in the world. To meet these limits, we use advanced air pollution equipment to cool, collect, and clean combustion gases. This equipment operates under stringent regulatory standards.

In this lesson, students will investigate DYEC pollutant control devices and target pollutants, analyze the potential effects of compounds on air quality, and discuss ways to help reduce and/or eliminate waste in their own communities.

Learning Objectives

1. Demonstrate an understanding of residential (household) garbage is managed in the Region of Durham
2. Analyze the potential effects of compounds on air quality, such as NOX, SO₂, CO, NH₃, and other pollutants
3. Identify how waste management activities can potentially cause adverse environmental impacts if they are not managed responsibly
4. Investigate systems that are in place at the DYEC to reduce potential adverse environmental impacts

Resources Provided

- Grade 12 Chemistry (SCH4U) Worksheet
- [Durham York Energy Centre Website](#)
- [Energy from Waste Process Overview](#)
- [Durham York Energy Centre Virtual Tour](#)

Activity

1. Where does our household waste go in Durham? Students will use the DYEC Virtual tour to learn how the residential waste in Durham is processed to manage waste and create energy.
2. The DYEC utilizes specialized air pollution control equipment to cool, collect and clean the combustion gases before they are released into the atmosphere. This equipment operates under stringent environmental regulatory standards. In small groups, students will investigate the target pollutants.
 - a. Students will draw out the atomic structure of the compounds using VSEPR Theory or Orbital Theories

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- b. Students will identify known properties of the compound (i.e., inter/intramolecular forces, type of compound, chemical or physical properties, toxicities, polarity etc.)
 - c. Students will investigate the procedures taken by DYEC to reduce and/or eliminate the release of these potential pollutants into the environment
3. Students will discuss and compare their findings on DYECs procedures to reduce and/or eliminate the release of potential pollutants into the environment.
4. Students will discuss ways to help reduce and/or eliminate waste and how this may impact the ecosystem, climate change's status, and its effects on the atmosphere.

Summary

The DYEC operates under some of the most stringent air emission guidelines in the world. Human health and the environment are primary concerns for the Region. The Region has undertaken a series of detailed studies on air emissions, health, traffic, noise, ground and surface water to assess any potential effects from the DYEC to ensure that residents and the environment are protected. Results of the Human Health and Ecological Risk Assessment studies in the Environmental Assessment concluded that the DYEC would not lead to any adverse health risks to the public or environment.

Curriculum Connections Expanded

The Ontario Curriculum, Grades 11 and 12: Science, 2008 (revised)

Chemistry, Grade 12, University Preparation (SCH4U)

A. Scientific Investigation Skills and Career Exploration

- A1. Scientific Investigation Skills: demonstrate scientific investigation skills (related to both inquiry and research) in the four areas of skills (initiating and planning, performing and recording, analysing and interpreting, and communicating)

B. Organic Chemistry

- B1. Relating Science to Technology, Society, and the Environment: assess the social and environmental impact of organic compounds used in everyday life, and propose a course of action to reduce the use of compounds that are harmful to human health and the environment
- B2: Developing Skills of Investigation and Communication: investigate organic compounds and organic chemical reactions, and use various methods to represent the compounds

C. Structures and Properties of Matter

- C2. Developing Skills of Investigation and Communication: investigate the molecular shapes and physical properties of various types of matter

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Worksheet: Grade 12 Chemistry (SCH4U) - Air Quality

The Durham York Energy Centre's (DYEC) Continuous Emission Monitoring (CEM) System is used to continuously monitor flue gas emissions for environmental compliance. Air emissions from the facility are also tested twice per year by a stack test (source test) carried out by a qualified independent consultant.

Complete the following table:

Parameter	NOx	SO ₂	CO	HCl	HF	NH ₃
VSPER Model						
Known Properties						