

»» Pollution Prevention Case Study

Chemical Processing

Company Overview

The following describes a specialty chemical manufacturing facility in the Greater Toronto Area that supplies intermediate products to the pharmaceutical, cosmetic, paint and ink compounding industries.

Senior management is committed to compliance with all applicable laws and regulations and to provide a safe and healthy working environment for employees.

P2 Assessment Process



An example of a chemical processing facility

Through the Toronto Region Sustainability Program (TRSP), this chemical manufacturer retained the services of an environmental consulting firm to complete a Pollution Prevention (P2) assessment of its facility. The primary purpose of the review was to assist the company in meeting the P2 regulatory requirements of the

municipal Sewer Use By-Law. The firm's management was also keen on hazardous waste reduction, as well as improving overall process efficiency.

The scope of the P2 assessment consisted of an onsite P2 training seminar for plant staff, assessment of historical data, fieldwork, engineering assessment of P2 alternatives, and reporting. The consultant provided the company with a detailed P2 Assessment Report, which summarized the findings of the assessment along with recommendations on P2 options for key processes.

Summary of Findings

The facility consumed about 355,000 m³ per year of water at an annual cost of \$630,000/yr. The wastewater effluent was high in Biochemical Oxygen Demand (BOD₅) -- likely associated with water soluble organics such as glycerin, acetone and fatty acids which are not removed in physical/chemical wastewater treatment facilities. Thus, the company was paying a sewer surcharge of \$20,000 to \$40,000/yr for exceeding the discharge limit for BOD.

In addition, the in-plant assessment identified use of subject pollutants - nickel, zinc oxide, nonylphenol ethoxylate (NPE) bearing cleaners - targeted by the municipal Sewer Use By-Law. Although the company was already substituting away from NPE and had heavy metal discharges lower than the discharge limits set in the By-Law, there were opportunities for further reductions as continuous improvement measures.

The facility generated 163 tonnes/yr of process wastes, of which half was recycled (nickel, waste oil, chloroform, and varsol). Other hazardous nickel wastes accounted for more than 99% of the non-recycled hazardous wastes. A steam or natural gas-fired wastewater evaporator was identified as one option to remove 96% of this waste as a nickel-free water product, which would result in a 3.8 year payback potential based on avoided hazardous waste disposal. Further investigation by plant staff led to a process improvement based on precipitation of nickel wastes that resulted in a payback of less than one month while achieving a reduction of 120 tonnes of hazardous wastes.

P2 Solutions, Environmental Results and Related Cost Savings

The table below summarizes P2 projects being undertaken by the chemical manufacturer from the list of P2 recommendations outlined in the assessment report. When implementation is complete, the P2 measures are projected to reduce annually:

- 17 kg toxics
- 6.7 kg metals
- 120 tonnes hazardous wastes
- 68.2 tonnes process wastes
- 39 kilotonnes water

With annual savings of **\$200,000** and an overall payback of **5 months**.

Process	P2 Solutions	Environmental Reductions	Cost Savings & Payback
Fatty Acid and Glycerine Production Subject Pollutants: Zinc, Nickel and Hazardous waste	Precipitation of two nickel waste streams Improved process efficiencies	Precipitation of two nickel waste streams reduced 120 tonnes/yr of nickel wastes (hazardous) Process efficiencies will reduce 1.5 kg/yr nickel and 5.2 kg/yr nickel in wastewater to meet the sewer-use by law requirements	Total capital cost: \$7K Estimated savings of \$140 K annually in disposal costs with payback of less than one month
Material Transfer Between Vessels Subject Pollutants: Oleic Acid, Stearic Acid and Glycerine Wastes	Retrofit of transfer lines and installation of line pigging system	This option reduced 15% losses of stearic and oleic acids and glycerine to sewer = 68.2 tonnes/yr of process wastes	Capital Cost: \$84.7 K Estimated annual savings of \$42.7 K (in product losses) with a payback of 2 years
Building Services Subject Pollutants: Nonlyphenol Ethoxylates (NPEs) and Water consumption	Reuse air compressor cooling water Installation of temperature regulating valve for ammonia compressors Use of alternative cleaning products (material substitution)	The re-use option will reduce 29.8 Kilotonnes/yr of water consumed The temperature regulating valve will reduce water consumption by 9.4 kilotonnes/yr By substituting cleaning products the facility will meet the Sewer Use By-Law requirements and reduce 17 kg/yr in wastewater	The first option will lead to savings of \$59.7 K with a capital investment of \$0 The second option will bear annual savings of \$18.7 K with payback of 1 month (capital cost: \$1.5 K)
Environmental Protection, Energy Consumption and Workers time	Installation of automated scrap recovery system (belt skimmer, oil skimmer, storage tote)	The scrap recovery system will improve operational efficiency	Capital Cost: \$23.4 K Annual savings of \$11.6 K in labour and scrap recovery cost reduction with payback of 2 years

Funding and Program Support:



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