ChemTRAC Pollution Prevention Case Study

➢ *Pharmaceutical & Medicine Manufacturing*

Company Overview

This facility manufactures bulk quantities of a medical chemical and derivative products. Isopropyl alcohol (IPA) and methanol are used to produce the products in the proprietary manufacturing processes. A natural gas fired boiler produces steam for the process. Currently, 20 people are employed at the facility.

Pollution Prevention Assessment Process

The principle motivator for the company in considering a P2 Plan for their facility was regulatory compliance. Additionally, the facility could expect to benefit from improvements to employee health and safety and public image as a result of adopting a P2 Plan. The facility's plan focuses on opportunities for reducing or eliminating the following priority substances: volatile organic compounds (VOCs) including IPA and methanol, nitrogen oxides (NO_x) and fine particulate matter ($PM_{2.5}$). An important objective is to find options for reducing the use and release of IPA.

Through the ChemTRAC Program they retained a pollution prevention consultant to complete a pollution prevention plan. This involved:

- assessment of priority substances
- tracking and quantification of priority substances
- assessment of P2 options
- development of an implementation plan

The detailed final report provided the findings and outlined opportunities for implementation.

Summary of Findings

The facility's P2 Plan focuses on opportunities for reducing VOCs, NO_x and $PM_{2.5}$. Significant losses of VOCs were determined to be due to inefficiency in the recovery methods for raw materials from the manufacturing processes.

The excess use of water in one production step offers an opportunity for reduction of NO_x, $PM_{2.5}$ and VOCs, as well as resource savings. Namely, using more concentrated raw materials (e.g. ferric chloride solution) could result in a reduced requirement for evaporation, which would ultimately result in lower gas consumption.

The P2 Plan made several recommendations:

- Upgrade the re-boiler to improve IPA Recovery. With normal operations, this change would reduce annual gas use for this process by 32%, with an estimated annual savings of $64,870. Expected reductions in releases to the environment from gas combustion are: 23 kg per year of VOCs, 270 kg per year of NO_x and 32 kg per year of $PM_{2.5}$. The estimated cost of the upgrade is $9,710.

- Replace methanol use with an ultrafiltration unit. The estimated annual cost for this change is $15,000, with an expected $21,640 of annual savings. This would result in an estimated 23,786 kg per year reduction in releases of VOCs.

- Upgrade the performance of the facility's boiler by installing low-NO_x burner. The estimated fuel savings from installing new efficient fuel burners is 10% - or $20,460 per year. Equivalent benefits of 10% reduced air releases, including 7 kg per year of VOCs, 85 kg per year of NO_x and 10 kg per year of $PM_{2.5}$, can also be expected.

- Annual staff training programs for P2 and Best Operating Practices. An in-house training would cost approximately $5,650. Potential annual savings would be $37,460 with a reduction of 10% in use and release of VOCs, the equivalent of 24,400 kg per year.

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Pollution Prevention Solutions, Environmental Results and Related Cost Savings

The Table below summarizes select pollution prevention recommendations outlined in the facility's report. When implementation is complete, the pollution prevention measures are

- ✓ **Projected to reduce 48,827 kg of VOCs, NO_x and $PM_{2.5}$ annually.**
- ✓ **Offer a total annual savings of $144,430 and an overall payback of less than 5 months**

Opportunity	P2 Solution	Environmental Benefits	Cost Savings and Payback
Increase recovery rate of isopropyl alcohol	Upgrade distillation re-boiler to improve rate of IPA recovery by up to 50%	Reduces releases of VOCs by 23 kg/yr, NO_x by 270 kg/yr and $PM_{2.5}$ by 32 kg/yr.	Implementation costs = $9,700. Annual savings = $64,870. **Payback < 2 months.** **Effort = Moderate**
Replace use of methanol	Replace methanol use with ultrafiltration	Eliminates one source of VOCs (methanol) and reduces releases by 23,786 kg/yr.	Annual implementation costs = $15,000. Annual savings = $21,640. **Payback < 9 months.** **Effort = Low to moderate**
Boiler upgrade	Upgrade performance of boiler by installing low-NO_x burner	Reduces releases of VOCs by 7 kg/yr, NO_x by 85 kg/yr and $PM_{2.5}$ by 10 kg/yr.	Implementation costs = > $25,000. Annual savings = $20,460. **Payback > 15 months.** **Effort = Moderate**
Staff training	Provide annual Pollution Prevention training for employees	Reduced use of substances will result in a reduction of 12,200 kg/yr of VOC releases	Implementation costs = $3,700. Annual savings = $18,730. **Payback < 3 months.** **Effort = Low**
Staff training	Provide annual refresher training on Best Operating Practices	Reduced use of substances will result in a reduction of 12,200 kg/yr of VOC releases	Annual implementation costs = $1,950. Annual savings = $18,730. **Payback < 2 months.** **Effort = Low**