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Environmental Pollution Prevention Project

CASE STUDY Chile

Pollution Prevention Implementation at a Paint Production Facility

Executive Summary

The Environmental Pollution Prevention Project (EP3) identified and assisted with the implementation of pollution prevention measures at a paint production facility in Chile.

In 1994, an EP3 assessment team, comprised of paint manufacturing experts and local pollution prevention consultants, conducted a pollution prevention diagnostic assessment. During the assessment, the team identified seven pollution prevention recommendations.

The original assessment identified many opportunities for saving water at the site through recycling and equipment changes. Recommendations included: recycling non-process cooling water; reducing wastewater discharges with high pH and biochemical oxygen demand (BOD)/chemical oxygen demand (COD); and reducing volatile organic (VOC) emissions.

EP3 provided the facility with technical assistance and guidance over the course of the following year. The project then conducted a follow up diagnostic assessment in 1995 to investigate how the facility had implemented the original recommendations and to evaluate its success in preventing waste.

The implementation assessment identified that the facility had implemented six of the recommended measures with an additional two in progress. It was also determined that, for a one-time investment of $12,200, the facility was achieving a minimum annual savings of $20,886. Much of these savings resulted from the implementation of improved housekeeping procedures.

Facility Background

The facility produces paints and other coatings for architectural coatings companies. It operates one shift per day, five days per week. There are 170 full-time employees. At the time of the original assessment, paint production was at 6,440,000 liters/year and expected to increase to 11,400,000 liters/year through expansion of the latex production facilities. Alkyd paints represent 60% of production and latex paint represents 40%.

Manufacturing Process

The commercial product of this facility is paint. However, in addition to paint production, the facility also processes raw materials into components that are used in paint production. The processes that were examined are fish oil refining, alkyd resin production, and solvent distillation (refer to Figure 1).

Fish oil refining requires neutralizing the oil with caustic soda. This process uses water, caustic soda, and sodium chloride. Three products result from the neutralization: 1) partially refined fish oil; 2) soap stock of neutralized fatty acids; and 3) water. The neutralized fish oil is blended with absorbative clay to remove the chromaphores and undesirable waxes in the partially

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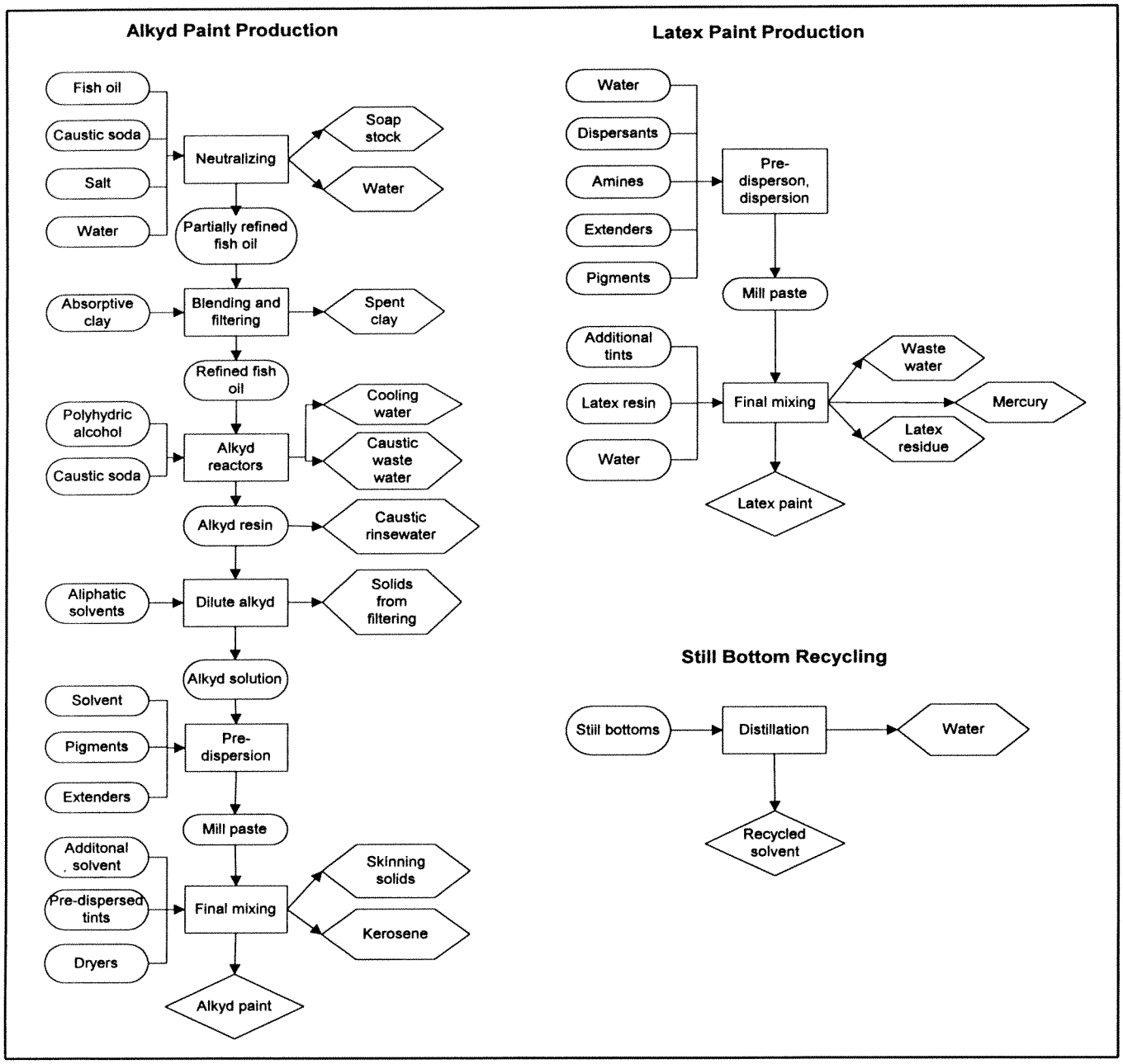
Figure I: Overview of Paint Production Process



refined oil. The mixture is pressed through a filter and is ready to be used in alkyd production.

In the alkyd resin manufacture, fish or soybean oil is co-reacted with polyhydric alcohol to extract the remaining water. After "cooking," the completed alkyd is transferred to a thin-down tank, where it is mixed with aliphatic solvents.

All still bottoms are recycled into corrosion resistant solvent-based primer. This produces 1,512 liters/month of still bottoms and 7,182 liters/month of recycled solvents.

There are two types of paints produced at this plant: alkyd resin and latex. Alkyd paint production consists of three steps. The first is pre-dispersion, which takes place in an open tank. Alkyd, solvent, pigment, and extenders are blended together into a high viscosity mill paste, using high-speed agitators known as "cowles" dispersers. The resulting paste accumulates in open tanks for final mixing. Additional alkyd resin, tint, and dryers are added in open-top blend tanks that hold the paint until final consumer packaging.

To produce latex paint, water, dispersant, amines (a stabilizer), extenders, and pigments are combined to form mill paste. Depending on the size of the paint batch, pre-dispersion and dispersion can be combined into one operation; additional ingredients are either added to the original tank or mixed with the mill paste that was transferred to let-down tanks. Finished

Table I: Summary of Pollution Prevention Opportunities

Unit Operation	Pollution Prevention Action	Implementation Status	Environmental Benefit	Implementation Cost (US$) Projected/Actual	Financial Benefit (US$) Projected/Actual	Simple Payback Period Projected/Actual
Alkyd Reactors	Recycle non-contact cooling water	*IMPLEMENTED*	Water usage reduced by 512,000 liters/year	Projected: $15,000 Actual: $2,450	Projected: $16,320 Actual: $5,079	Projected: 11 months Actual: 5 months
Alkyd Reactors	Eliminate one caustic cleaning rinse	*IMPLEMENTED*	Wastewater discharge to sewer reduced to 512,000 liters/year	Projected: $500 Actual: $1,250	Projected: $420 Actual: $747	Projected: 14 months Actual: 20 months
Alkyd Paint	Cover paint tanks	*IMPLEMENTED*	Solvent losses reduced by 34,000 liters/year; VOC emissions reduced	Projected: $350 Actual: $1,000	Projected: $3,060-4,640 Actual: $3,060	Projected: 2 months Actual: 4 months
Raw Materials	Raw material substitution	Implementation in progress	Heavy metals eliminated in product; future liability avoided	Projected: 6-8 fold increase in material costs Actual: N/A	Projected: Unknown Actual: N/A	Projected: Unknown Actual: N/A
Paint Production	Substitute organic biocide for mercury	Implementation in progress	Mercury use eliminated; future liability avoided	None	Unknown (approximately 20% savings per kilogram)	Unknown
Latex Paint - Option 1	Use high pressure spray nozzles and recirculate washwater	*IMPLEMENTED*	Washwater reduced by 381,370 liters/year	Projected: $1,200 Actual: $7,500	Projected: Unknown Actual: $12,000	Projected: Unknown Actual: 8 months
Latex Paint - Option 2	Install closed-loop recycling system	Implementation in progress	Washwater recovered and reused (100%)	Projected: $15,000 Actual: Unknown	Projected: $16,000 Actual: Unknown	Projected: 11 months Actual: Unknown
Solid Waste	Institute solid waste disposal program	*IMPLEMENTED*	Solid wastes reduced	Unknown	Projected: Unknown Actual: $900	Unknown
Spill Control	Establish spill control policy	*IMPLEMENTED*	Waste discharge reduced	Unknown	Unknown	Unknown

batches are held in the open tanks until they are put into consumer packaging.

Environmental Problems

The original assessment identified severe water, air, solid waste, and hazardous waste problems at the facility. Water was used inefficiently in the alkyd reactors and latex painting operations. VOCs were released in the alkyd reactors. Solid wastes were generated throughout the process. Hazardous materials, specifically mercury, lead and chrome compounds, emanated from paint production.

Pollution Prevention Opportunities and Implementation

This section details the pollution prevention opportunities that were identified during the original assessment and the actions that the facility has undertaken since that time.

Table 1 lists the pollution prevention opportunities, indicates the implementation status of the recommended measures, identifies the environmental benefits associated with those measures, and presents data on projected and actual implementation costs and savings.

Recycle Non-contact Cooling Water.

- *Opportunity*: A recycling system for the cooling water should be installed to eliminate the need for the facility to buy water from the water utility.
- *Implementation status*: This measure has been implemented, allowing the facility to achieve a 100% water recirculation rate.

Eliminate One Caustic Cleaning Rinse.

- *Opportunity*: The reactor vessels do not need to be cleaned when switching from soybean oil to fish

oil processes. Cleanings can be reduced by dedicating reactors to specific types of oils. In addition, the caustic cleaner solution can be re-used until it becomes ineffective for cleaning.

- *Implementation status*: This measure has been implemented with the cleaning of reactors every two-three months. The facility plans to continue extending the period between cleanings.

Cover Paint Tanks.

- *Opportunity*: The mixing, blending, and manufacture of the solvent based paints takes place in uncovered tanks. These tanks should be covered to reduce fugitive emissions and prevent product loss due to the formation of a layer of dried paint on the surface.
- *Implementation status*: This measure has been implemented. VOC emissions have been reduced by 80%, and product loss has been reduced resulting in $3,060 of annual savings.

Raw Material Substitution.

- *Opportunity*: To reduce the use of toxics, non-metal bearing pigments should be substituted for lead and chrome pigments.
- *Implementation status*: This measure will not be implemented because of cost constraints. Metal-free pigments are 6-8 times more expensive than heavy metal bearing pigments and will increase raw material costs by $0.53 to $1.59 per liter of finished paint in those colors affected. The facility will not substitute lead and chrome pigments until required by law.

Substitute Organic Biocide for Mercury.

- *Opportunity*: Isothiazoline, an organic biocide, is used in a small portion of paint production. Because mercury is so toxic, organic biocide use should be increased to the maximum possible. Further, isothiazoline is 20% cheaper than mercury.
- *Implementation status*: This measure will be implemented. Small amounts of organic biocide have already been incorporated into the paint production process; the facility is working towards full substitution.

Latex Paint Production.

- *Opportunity*: There are two options for reducing the amount of washwater generated during paint production.

Option 1 - Use Spray Nozzles and Recirculate Water: The amount of washwater generated in the latex tank washing procedure can be substantially reduced through the use of high pressure spray nozzles and recirculation of the washwater. Estimated reductions in initial wash water generation are 80%.

Option 2 - Implement On-Site Retention of Latex Washwater: A closed loop system for recycling all latex washwater can be created. This can be achieved by installing a three-phase concrete or lined latex washwater settling pond on-site. Latex paint residue could be used in subsequent paint production and the supernatant water should be suitable for reuse in subsequent latex paint production.

- *Implementation status*: A combination of Options 1 and 2 has been implemented. High pressure spray nozzles and settling tanks have been installed. The settling tanks are used for dark colors and water is reused in dilution processes.

Institute Solid Waste Disposal Program.

- *Opportunity*: A program to make employees more aware of the types and amounts of wastes generated should be developed in order to identify reduction opportunities.
- *Implementation status*: This measure has been implemented with the establishment of criteria for the classification, reuse, sale, and final disposal of wastes.

Establish Spill Control Policy.

- *Opportunity*: Management should establish a policy prohibiting spills, leaks, or other waste discharges to the ground. A cleanup procedure should be established in the event of accidental spills or leaks.
- *Implementation*: This measure will be implemented. An Environmental Hygiene Committee has been created to define internal regulations on the policy.

Benefits of Implementation

For a one-time implementation cost of $12,200, the facility has saved $20,886 per year. The typical payback period for the implemented measures has averaged seven months.

As a result of the implemented measures, the facility has reduced all releases of metal compounds and VOCs to the environment and created healthier working conditions for its employees. In addition, the facility plans to phase mercury, an extremely hazardous chemical, out of its production processes entirely. The facility intends to create new product labels advertising the benefits of non-toxic paints.

For Further Information

For further information on this assessment or other activities sponsored by EP3, call the EP3 Clearinghouse at (703) 351-4004, send a fax to (703) 351-6166, or on Internet: ep3clear@habaco.com