

## **4.11.3 Common Operations: Metal Cleaning**

### *Case Study #1*

**BUSINESS:** Northern Precision Casting; Lake Geneva, Wisconsin

**WASTE ORIGIN:** Investment Casting Process

**WASTE TYPES:** Solvent Cleaner, 1,1,1-Trichlorethane (TCA)

#### **COMPANY BACKGROUND**

Northern Precision Casting (NPC) is an investment casting operation over 150 employees. NPC casts more than 200,000 pounds of metal each month. Casting is done by pouring molten metal into ceramic molds. These molds are made by coating a wax pattern assembly with ceramic material. The wax surfaces must be clean for the ceramic coatings to adhere to the wax material. TCA solvent was used to clean the wax assemblies and would then evaporate, creating fugitive emissions of TCA while leaving a clean wax surface for the ceramic coating process.

#### **MOTIVATION**

The fugitive TCA air emissions caused concern for environmental regulations.

#### **STRATEGIES**

Replaced 1,1,1-TCA with citrus-based non-hazardous solvents.

#### **ORIGINAL PROCESS**

NPC released TCA air emissions of 18,000 pounds from the plant. TCA liquid solvent handling and storage created the potential for leaks or spills.

#### **NEW PROCESS**

NPC tried CFC-111 as a substitute solvent, which lowered but did not eliminate emission levels. Its solvent manufacturer eventually found Latrex citrus-based solvent. This non-hazardous cleaning alternative created a water-soluble liquid waste that could be discharged to the local publicly-owned treatment works (POTW).

#### **RESULTS**

##### **Waste Reduction**

Eliminated annual use of 18,000 pounds of TCA solvent feedstock.

Eliminated 18,000 pounds of annual fugitive TCA air emissions.

##### **Economics**

**Capital Costs:** None.

**Operating/Maintenance Costs:** No significant change.

**Payback Period:** Information not available.

**PROBLEMS**

Solvent substitution raised concerns over potential impact on product quality, but no change resulted. Initially, the citrus-based solvent had an offensive odor to workers, but this was resolved.

## **4.11.3 Common Operations: Metal Cleaning**

*Case Study #2*

**BUSINESS:** Briggs & Stratton; Milwaukee, Wisconsin  
**WASTE ORIGIN:** Small Engine Manufacturing  
**WASTE TYPES:** Chlorinated Metal Cleaning Solvents, Trichloroethylene (TCE), and 1,1,1-Trichloroethane

### **COMPANY BACKGROUND**

Briggs & Stratton manufactures small engines.

### **MOTIVATION**

Fugitive chlorinated solvent air emissions presented serious concerns over worker safety and environmental regulatory compliance. Using chlorinated solvents increased potential liability and costs associated with storage, transportation, and disposal of these hazardous wastes.

### **STRATEGIES**

Replace chlorinated solvents with aqueous detergent for metal parts cleaning.

### **ORIGINAL PROCESS**

The company used a vapor degreasing process to clean metal parts. This process suspended dirty parts above boiling chlorinated solvent to allow solvent vapors to perform cleaning. This process wasted a significant amount of solvent through air emissions and spent cleaning solvent.

### **NEW PROCESS**

The company converted their solvent degreasing unit to an aqueous cleaning system, which substituted a heated water-detergent solution (with rust inhibitor) for chlorinated solvents. Oily residue from parts cleaning is removed from the dirty wash and rinse stream and reused as part of a fuel program. The remaining wastewater was disposed to the local publicly-owned treatment works (POTW).

### **RESULTS**

#### **Waste Reduction**

Eliminated chlorinated solvents and solvent-contaminated machining oils and metal fragments from operations.

Eliminated fugitive air emissions and solvent recycling costs.

#### **Economics**

**Savings:** Information not available.

**Capital Cost:** \$10,000

**Operating/Maintenance Cost:** Information not available.

**Payback Period:** Three months.

**HEALTH & SAFETY BENEFITS**

Worker environment was improved by eliminating chlorinated solvents from operations, since TCE is a suspected carcinogen, mildly toxic by ingestion or inhalation, is an eye and severe skin irritant, and chronic exposure can damage the liver and other organs. Methyl chloroform also is a questionable carcinogen, an eye and skin irritant, and is moderately toxic when ingested or inhaled.

**TECHNOLOGY TRANSFER**

Briggs & Stratton has shared their cleaning technology with other companies, particularly suppliers.

**PROBLEMS**

Metal parts cleaned by aqueous methods are susceptible to rust and corrosion. This required additional installation of an air drying system. The company also had to modify a lower solvent storage tank and heating unit to provide the heat required by the aqueous cleaning process.