



**PENNSYLVANIA  
Source Reduction  
PROGRAM**

**SOURCE REDUCTION  
OPPORTUNITIES  
FOR SMALL MACHINE SHOPS**

A Department of Environmental Resources Program

**Machining processes profile**

Machining processes involve metal-cutting operations, with tools traveling along the surface of a metal workpiece and shearing away the metal ahead of it. This produces heat between the tool and the workpiece. Metalworking fluids are applied to the workpiece and tool to make the cutting process easier and provide a good finish.

**Source reduction**

Source reduction is the elimination and/or reduction of the amount and/or toxicity of waste produced within the manufacturing process.

**Benefits of source reduction**

Source reduction allows industry to:

- ◆ save money through reduced energy, water and raw material costs
- ◆ reduce risk of spills and emergencies
- ◆ reduce liability and improve public image
- ◆ generate income from wastes that can be sold
- ◆ protect employees, the public and the environment
- ◆ prevent growth of bacteria and resultant change of pH balance in fluids which may, as a consequence, become hazardous

Using source reduction, many firms have saved thousands of dollars by eliminating pollution-control devices and disposal costs.

**Effective coolant management**

Many companies are using coolant management programs to control the increasing costs of purchasing coolant concentrate. Maintaining coolant quality lengthens tool life, improves finishes on workpieces, reduces discard rates and provides a cleaner, odorless work area.

Coolants are discarded most often because of buildup of solids that results in offensive odors due to bacterial growth and excessive tramp oil. Usage can be reduced if coolants are removed regularly from machine sumps, treated to remove contaminants, and brought back to specification by adding fresh concentrate. About 10 percent of their volume is lost to dragout and evaporation. Replenishing coolants with new makeup solution usually restores biocide levels. Other additives may be needed, such as rust inhibitors.

**Qualities of effective coolants**

- ◆ good cooling capability
- ◆ good lubricating features
- ◆ rust resistance
- ◆ stability for long fluid life
- ◆ resistance to becoming rancid
- ◆ nontoxicity
- ◆ good transparency to allow the operator to see the workpiece clearly during machining
- ◆ low viscosity to allow chips and dirt to settle quickly
- ◆ nonflammability to avoid burning easily
- ◆ ability to minimize smoke during cutting
- ◆ ability to minimize gummy deposits that clog machinery

**Source reduction in machining**

**Reduce tramp oils.** Tramp oils such as lube and hydraulic oils are major causes of coolant breakdown and rancidity due to the formation of hydrogen sulfide. A preventive maintenance schedule to repair all hydraulic leaks and inspect and replace gaskets, wipers and seals should reduce rancidity.

**Select quality.** Check coolants for corrosion protection, hazardous additives, resistance to bacterial



growth, recyclability and whether use results in residues on workpieces.

**Limit variety.** Using limited numbers of coolants may reduce inventory costs and simplify recycling. Sometimes changes in coolant concentration will work for a variety of applications.

**Use coolant makeup bath water.** Tap water often has a high mineral content which can affect coolants and, in turn, affect tool life, degrade emulsions, increase concentrations of solids, and promote bacterial growth. Demineralized makeup water often can aid coolant performance.

**Adjust concentration and chemistry.** Measuring and adjusting active ingredients for optimum concentrations can control costs by lengthening tool life, reducing bacterial growth, reducing risk of rust on newly machined workpieces and eliminating the need for fresh coolant. Adding biocides may help control bacterial growth. With operator training, relatively low-cost refractometers and pH supplies may aid in coolant chemistry management.

**Maintain sumps.** Clean sumps and machines frequently and thoroughly. After discarding dirty coolant, remove metal shavings then clean sumps with alkaline cleaner. Metal shavings tend to harbor bacteria which may regrow and foul the clean coolant. Sump design may need to be modified to eliminate blind corners or other areas where stagnant coolant may collect and cause bacterial growth. When bacteria change coolant chemistry, the reaction with metal cuttings may produce hazardous wastes. Oil skimming devices will help extend the usefulness of coolant water by removing tramp oil, a food source for bacteria. The skimmed oil could be collected and managed as waste oil.

## Coolant recycling equipment

Many types of equipment are available for managing and recycling coolants, from simple filtration and oil skimmers to multiple-stage equipment with filters, centrifuges and pasteurization units.

- ◆ **Centrifuges** rotate the coolants at high speeds to separate tramp oil, emulsified oil and free-floating oils as well as solids from coolant water.
- ◆ **Coalescing separators** float oil to the surface where it may be skimmed off. The use of coalescers is limited, however, since they are not effective for emulsified oils.

- ◆ **Hydrocyclones** use rotation to remove solids from the coolant fluid. This process is limited for removing tramp oil, but it can remove very small particles (down to five microns) which other processes cannot.

## Other methods

**Adjust equipment scheduling.** When possible, schedule grinding or cutting workpieces of one specific metal before change out of coolant for a second type of metal. If there are several metal-working lines, assign certain equipment to be used for specific types of metal.

**Practice good housekeeping.** Covers or screens over sumps reduce contamination from trash such as food, napkins, food wrappers, cigarette butts or chewing tobacco.

**Assign coolant management to one person.** Train one person (per shift if the business operates 24 hours each day) to manage the coolant chemistry. Consistent management often reduces waste production.

**Innovate.** Some equipment may be added as part of the processing line in some facilities. Solicit input from line employees. They often have good suggestions for improved application of new equipment or better housekeeping.

**Maintain inventory control.** Buying in bulk is not always the best approach. Use inventory control to avoid unnecessary purchases and avoid unnecessary disposal costs for wasted raw materials. Use substitutes for hazardous inputs to avoid expensive hazardous waste disposal fees. If spilled, non-hazardous raw materials do not produce hazardous waste cleanup problems.

**For more information** about source reduction and pollution prevention approaches, contact:

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