WASTE MANAGEMENT AND ENVIRONMENTAL REGULATIONS

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Abstract: Fortunately, cutting fluid life may be extended significantly by implementing an effective fluid management program. The primary objective of fluid management is to maintain fluid quality and performance through administration, monitoring, maintenance and recycling practices. This allows machine shops to make the most cost-effective use of their fluid. It is also the best pollution prevention technology available.

Keywords: metalworking waste disposal, waste management, metalworking fluids environmental regulations

1. INTRODUCTION

Metalworking cutting fluids play a significant role in machining operations and impact shop productivity, tool life and quality of work. With time and use, fluids degrade in quality and eventually require disposal once their efficiency is lost. Waste management and disposal have become increasingly more complex and expensive. Environmental liability is also a major concern with waste disposal. Many companies are now paying for environmental cleanups or have been fined by regulatory agencies as the result of poor waste disposal practices.

Fortunately, metalworking cutting fluid life may be extended significantly by implementing an effective fluid management program. The primary objective of fluid management is to maintain fluid quality and performance through administration, monitoring, maintenance and recycling practices. This allows machine shops to make the most cost-effective use of their fluid. It is also the best pollution prevention technology available.

2. HAZARDOUS WASTE

Currently, many environmental regulations at the federal, state, and local levels regulate waste materials. Breaking these regulations could result in expensive fines.

Hazardous waste can be defined as a solid waste, or combination of solid wastes which, because of its quantity, concentration, or physical, chemical, or infectious characteristics may:

• Cause or significantly contribute to an increase in mortality or an increase in
serious irreversible, or incapacitating reversible illness
• Pose a substantial present or potential hazard to human health or the environment
  when improperly treated, stored, transported, disposed of, or otherwise managed

A solid waste need not be always a solid, it can also be a liquid, semisolid, or a
contained-gaseous material. To correctly manage wastes, facilities must first determine if
wastes generated by their operations are hazardous or non-hazardous. A solid waste is
hazardous if it meets one of three conditions:

• Exhibits one or more characteristics (ignitability, corrosivity, reactivity, or
toxicity) of a hazardous waste.
• Has been identified and listed as a hazardous waste
• The waste consists of a mixture containing a hazardous waste and a non-hazardous
  solid waste

**Characteristic Wastes**

Characteristic hazardous wastes exhibit one or more of the following four characteristics:

IGNITABILITY. A solid waste exhibits the characteristic of ignitability if a representative
sample of the waste has any of the following properties:

• Normally unstable and readily undergoes violent change without detonating
• Reacts violently with water
• Forms a potentially explosive mixture with water
• Generates toxic gases, vapors, or fumes when mixed with water
• Contains cyanide or sulfide and generates toxic gases, vapors, or fumes at a pH
  between 2 and 12.5;
• Listed as a forbidden explosive

National environmental agency included ignitability as a characteristic of wastes that
could cause fires during transport, storage, or disposal. Examples of ignitable wastes include
many waste solvents such as mineral spirits or naphtha.

REACTIVITY. A solid waste exhibits the characteristic of reactivity if a representative
sample of the waste has any of the following properties:

• Normally unstable and readily undergoes violent change without detonating
• Reacts violently with water
• Forms a potentially explosive mixture with water
• Generates toxic gases, vapors, or fumes when mixed with water
• Contains cyanide or sulfide and generates toxic gases, vapors, or fumes at a pH
  between 2 and 12.5;
• Listed as a forbidden explosive

Reactivity is a characteristic that identifies unstable wastes that can pose a problem,
such as an explosion, at any stage of the waste-management cycle.
TOXICITY. A solid waste exhibits the characteristic of toxicity if, by using designated test methods, the liquid waste or extract from a representative sample contains any of the following contaminants at concentrations equal to or greater than the corresponding regulatory limit. Many small businesses such as machine shops generate fluids that may contain heavy metals. Heavy metals refers to metals such as arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver. These metals are hazardous due to their toxic effects on human health and the environment.

Listed Wastes

The National Environmental agency has specifically listed over 400 wastes which are considered hazardous because they exhibit a hazardous waste characteristic or contain toxic constituents that are harmful to human health and the environment. These include wastes generated from manufacturing processes and discarded commercial chemical products.

3. METALWORKING CUTTING FLUID DISPOSAL

Even with the best fluid management program, metalworking cutting fluid will not last indefinitely and will eventually require disposal. Environmental regulations are making disposal increasingly difficult. Generators are responsible for determining if a particular waste generated at their facility is hazardous or non-hazardous. The waste material must be tested using standard methods or the generator must have sufficient knowledge about the waste to assess whether it is a hazardous waste.

Disposal of Non-hazardous Fluid

Non-hazardous fluid may be pretreated on site prior to disposal. Treating or condensing water-miscible fluids on site prior to disposal may reduce a shop's disposal costs and environmental liability. Techniques for on-site treatment include chemical treatment, ultrafiltration, and evaporation. Each process involves the removal of metal fines and other solid contaminants, concentrating the oil phase, and discharging the water phase to either the sanitary sewer or the atmosphere. The concentrated oil phase can be managed as a used oil and the solids may be disposed or reclaimed.

Contract Hauling and Disposal Services

Sometimes it may be cheaper to have small volumes of waste fluid hauled away by a waste management company for chemical treatment or incineration.

Chemical Treatment

Chemical treatment is the addition of chemicals which change the nature of the liquid waste. Simple chemical-treatment methods work well on some wastewater. Metalworking wastes are too complex for most treatment processes. Chemical treatment beyond pH control is generally not an option for small facilities.
Ultrafiltration Systems

Ultrafiltration systems were created for the metalworking industry to treat such wastes as used metalworking cutting fluids, detergents, parts-washing solutions, and other oily wastewaters. Ultrafiltration systems provide effective treatment of this wastewater by separating the water from the oily waste. The quality of water is then ready for sewer disposal. The oily concentrate generated from ultrafiltration may be processed for oil recovery or incinerated. Ultrafiltration systems are usually better than chemical treatment, less expensive than incineration and contract hauling, are easily operated and space efficient.

Centrifugation

Centrifuges can be used to remove particulates and tramp oil from waste fluid prior to disposal. However, centrifuges are expensive and other contaminant removal methods such as oil skimmers are more economical for small volumes of fluids.

Evaporators

As water-miscible fluids are normally 90-95% water, evaporators can be used to remove the water from waste fluid, reducing the volume of waste requiring disposal. The advantages of evaporators include:

- Simple to operate
- Use very little space
- Type of fluid used (synthetic, semisynthetic, or soluble oil) is not critical

Evaporators are generally suitable for low volumes of waste due to the amount of energy required to evaporate even a small volume of material. Evaporators are also labor intensive when it comes to cleaning the units. Evaporators may be a consideration when other treatment systems do not meet a shop's needs.

4. ALTERNATIVES TO CUTTING FLUIDS

In the pursuit of profit, safety, and convenience, a number of alternatives to traditional machining are currently under development.

Dry Machining

Machining without the use of cutting fluids has become a popular option for eliminating the problems associated with cutting fluid management. One of the greatest obstacles to acceptance of dry machining is the false belief that cutting fluids are needed to produce a high-quality finish.

Minimum Quantity Lubricant

Minimum quantity lubricant, also known as Near dry machining or semi-dry machining, is another alternative to traditional use of cutting fluids. There are many
similarities between dry machining and minimum quantity lubricant, in fact, many research papers treat true dry machining and minimum quantity lubricant as the same technology. As the name implies, minimum quantity lubricant uses a very small quantity of lubricant delivered precisely to the cutting surface.

5. CONCLUSION

Fluid management has become an even more attractive pollution prevention alternative since increased automation in the metalworking industry allows costs to be kept at an acceptable level. These combined factors have resulted in the replacement of dispose and replenish routines with in-house fluid management programs.

6. REFERENCES

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