5.0 WASTE MANAGEMENT AND ENVIRONMENTAL REGULATIONS

Numerous environmental regulations at the federal, state, and local levels regulate waste materials. Failure to comply with these regulations could result in expensive penalties. This section presents an overview of the existing regulations that may affect metalworking facilities.

5.1 Hazardous Waste

Congress defined the term "hazardous waste" in the Resource Conservation and Recovery Act (RCRA) 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;

Hazardous wastes are defined in terms of properties of a solid waste. It should be stressed that a solid waste need not be 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 nonhazardous. 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 by the Environmental Protection Agency (EPA).
- ✔ The waste consists of a mixture containing a hazardous waste and a nonhazardous solid waste.

5.11 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:

- ✔ Liquid with a flash point less than 140° F (60° C);
- ✔ Non-liquid and is capable, under normal conditions, of spontaneous and sustained combustion;
- ✔ Ignitable compressed gas per Department of Transportation (DOT) regulations; or
- ✔ Oxidizer per DOT regulations.

EPA 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. Ignitable hazardous wastes have the EPA hazardous waste number D001.

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

- ✔ Liquid with a pH less than or equal to 2 or greater than or equal to 12.5; or
- ✔ Liquid and corrodes steel at a rate greater than 1/4 inch per year at a test temperature of 130° F (55° C).

EPA selected pH as an indicator of corrosivity because wastes with high or low pH can directly affect human health, the environment, react dangerously with other wastes, or cause toxic contaminants to migrate from certain wastes. Examples of corrosive wastes include acidic wastes and spent pickling liquor (used to clean steel during manufacture). Corrosive hazardous wastes have the EPA hazardous waste number D002.

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 by the DOT as a forbidden explosive or as a Class A explosive or a Class B 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. An example of a reactive wastes is used cyanide solution. Reactive wastes have the EPA hazardous waste number D003.

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. A specific laboratory analytical procedure, identified as the Toxicity Characteristic Leaching Procedure (TCLP), is used to determine the toxicity of a waste. A waste that exhibits the characteristic of toxicity has an EPA hazardous waste number that corresponds to the toxic contaminant(s) which cause it to be hazardous.

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. Metalworking fluids and other wastes that may contain these metals are potential hazardous wastes and must undergo TCLP analyses in order to make a hazardous/nonhazardous determination prior to disposal.

5.12 Listed Wastes

The EPA 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. Examples of some common listed hazardous wastes include toluene, methyl ethyl ketone, methylene chloride and xylene.

5.2 CUTTING FLUID DISPOSAL

Even with the best fluid management program, 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 nonhazardous. 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.

TCLP TESTING PARAMETERS

TCLP Contaminant	Regulatory Concentration (mg/l)	EPA Hazardous Waste Number
Arsenic	5.0	D004
Barium	100.0	D005
Benzene	0.5	D018
Cadmium	1.0	D006
Carbon tetrachloride	0.5	D019
Chlordane	0.03	D020
Chlorobenzene	100.0	D021
Chloroform	6.0	D022
Chromium	5.0	D007
o-Cresol	200.0	D023
m-Cresol	200.0	D024
p-Cresol	200.0	D025
Cresols (total)	200.0	D026
1,4-Dichlorobenzene	7.5	D027
1,2-Dichloroethane	0.5	D028
1,1-Dichloroethylene	0.7	D029
2,4-Dinitrotoluene	0.13	D030
Endrin	0.02m/l	D012
Heptachlor	0.008	D031
Hexachlorobenzene	0.13	D032
Hexachloro-1,3-butadiene	0.5	D033
Hexachloroethane	3.0	D034
Lead	5.0	D008
Lindane	0.4	D013
Mercury	0.2	D009
Methoxychlor	10.0	D014
Methyl ethyl ketone	200.0	D035
Nitrobenzene	2.0	D036
Pentachlorophenol	100.0	D037
Pyridine	5.0	D038
Selenium	1.0	D010
Silver	5.0	D011
Tetrachloroethylene	0.7	D039
Toxaphene	0.5	D015
Trichlorethylene	0.5	D040
2,4-D	10.0	D01
2,4,5-TP	1.0	D017
2,4,5-Trichlorophenol	400.0	D041
2,4,6-Trichlorophenol	2.0	D042
Vinyl chloride	0.2	D043

Following a hazardous/nonhazardous determination for the waste, an appropriate disposal alternative may be selected. Disposal costs may range anywhere from 25 to 50 cents per gallon for nonhazardous waste up to several hundred dollars per drum for hazardous waste [6]. Spent cutting fluid that is determined to be hazardous must be disposed by an EPA-permitted hazardous waste management company in accordance with applicable federal and state regulations. Selecting a certified hauler and treatment facility registered with the EPA is critical.

5.21 Disposal of Nonhazardous Fluid

If the waste fluid is determined to be nonhazardous, it may be hauled to a treatment facility or, following permission from local wastewater treatment plant authorities, discharged to a municipal sanitary sewer system for disposal. Spent fluid should never be discharged to a septic tank system or dumped on the ground.

Nonhazardous fluid may also 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.

Following are disposal and pretreatment alternatives available for nonhazardous water- miscible cutting fluid.

Contract Hauling and Disposal Services

Studies have shown that it may be cheaper to have small volumes of waste fluid (less than 200 gallons) hauled away by a waste management company for chemical treatment or incineration. Many large machine shops opt for in-plant waste treatment since contract hauling and disposal services become cost prohibitive with larger quantities of waste fluid.

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 cutting fluids, detergents, parts-washing solutions, and other oily wastewaters. Strict environmental laws require proper treatment prior to discharge. 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. Units process from 100 to 300 gallons per day and cost from $5,000 to $13,000.

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; and
✔ 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.

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.

Disposal as Wastewater

Following approval by local wastewater treatment authorities, it may be possible to dispose of small amounts of nonhazardous, spent cutting fluid to the municipal sanitary sewer system. Spent cutting fluids with the following characteristics are generally acceptable for discharge to municipal sanitary sewer systems.

✔ Water soluble
✔ Regular biocide additions were applied
✔ Fluid has not become septic
✔ Chips and fines have been removed
✔ Tramp oil concentrations do not exceed 100 mg/l
✔ Fluid's pH is between 6.0 and 9.0
✔ Spent fluid does not contain toxic concentrations of heavy metals

Wastewater regulations are based on state and federal guidelines but vary from city to city depending on the municipality's wastewater treatment capabilities and local ordinances. Local wastewater treatment plant authorities may require analytical data beyond that identified above (such as biological oxygen demand [BOD] and chemical oxygen demand [COD]) before discharge approval can be obtained. Local wastewater treatment plant authorities should be contacted to determine what sampling and analytical requirements must be met in order to discharge fluid to the sanitary sewer.

If the city will not allow sewer discharge, off-site commercial disposal or in-house chemical/physical treatment (with subsequent sewer disposal of treated water and off-site disposal of treatment sludge) will be necessary.

5.3 Disposal of Metal Cuttings

The EPA specifically exempts recycled metal from hazardous waste management requirements. Therefore, it is both economically and environmentally wise to recycle all metal scrap. Scrap metal dealers may require the removal of any residual fluid on chips and cuttings prior to accepting them for recycling.

5.4 Disposal of Sump Sludge

All waste streams generated at a facility must be classified as hazardous or nonhazardous and disposed of accordingly. Machine sump sludge must be analyzed using the TCLP or evaluated by thorough knowledge to determine whether it is hazardous or nonhazardous. If the sump sludge is found nonhazardous, it may be possible to dispose of it at a landfill following approval from local landfill authorities. Otherwise, it may be shipped off-site for disposal as a nonhazardous waste using a reputable waste management company. If the sump sludge is hazardous, it must be managed and disposed as a hazardous waste.

5.5 Disposal of Used Oil

Used oil includes spent metalworking fluid, tramp oil, hydraulic fluid and other lubricating oils. Generators of used oil should be familiar with both state and federal regulations on used oil management. Used oil is not regulated as a hazardous waste by the federal EPA (provided it is not mixed with a hazardous waste) if recycled or burned for energy recovery. However, some state regulatory agencies are more stringent and consider used oil a hazardous waste [8]. Used oil management requirements that must be met to comply with federal regulations include:

- ✔ Used oil may be provided to a marketer. The used oil marketer is responsible for testing the used oil for specification parameters.
- ✔ The used oil may be provided directly to a burner. In this case, the generator is also the used oil marketer. Used oil marketers must test the used oil for specification parameters and obtain an EPA identification number.
- ✔ Used oil may be burned on site by the generator in a oil-fired furnace without testing for specification parameters.
- ✔ The generator may transport less than 55 gallons of used oil to a public collection facility or an aggregation point owned or operated by the generator in a vehicle owned by the generator or by an employee of the generator.
- ✔ Used oil in quantities greater than 55 gallons can be picked up only by transporters that have an EPA identification number.
- ✔ Generators must store used oil in containers that are in good condition and clearly labeled with the words “Used Oil”.