

Attachment B

Attachment B

ALTERNATIVES TO MEDICAL WASTE INCINERATION

Although there are over 23 alternative treatments available for medical waste, the following section briefly summarizes the most common alternatives currently in use.

Steam Sterilization (autoclaving)

Steam sterilization or autoclaving is the most common alternative to incineration. Steam sterilization can be either conducted on-site or sent to an off-site facility and is capable of treating a wide range of medical wastes. Steam sterilization employs steam under pressure (15 psi) to attain a temperature of 121 degrees Celsius, which is needed to effectively kill pathogens. Following steam treatment and cooldown, many autoclaves have a shredder or compactor which the waste will enter prior to being landfilled. This will reduce the volume of waste and render it unrecognizable.

The Medical Waste Management Act (MWMA) allows autoclaving as an alternative to incineration. The most common types of medical waste typically autoclaved include: sharps, laboratory and emergency room wastes, cultures, surgery waste, gauze, bandages, gowns, bedding, etc. Chemotherapeutic, pharmaceutical, and pathological waste cannot be treated by autoclave.

Advantages to autoclaves are that they are available in a wide range of sizes, can treat a few pounds to several tons per hour, and are relatively straightforward to operate. Capital costs are lower than many other non-incineration technologies. A small autoclave can be purchased for approximately \$30,000. Annual operating costs for autoclaving are about five to 15 cents per pound, depending on the volume of waste to be treated. There are currently nine permitted off-site autoclave treatment facilities in California.

In general, air emissions are not a concern from autoclaving. However, if inappropriate medical waste, like chemotherapeutic waste, or hazardous chemicals, such as formaldehyde enter the waste stream, then toxic air contaminants or volatile organic compounds (VOCs) can be emitted into the air. Additionally, there may be small amounts of pollutants entering the water effluent from autoclaving; however, discussions with manufacturers indicate that this amount is insignificant if facilities properly segregate their waste to ensure hazardous materials do not enter the autoclave. Staff at the Los Angeles County Sanitation District indicated that there were no adverse water discharge issues from autoclaves.

Microwaves

Microwave systems use a steam-based process to disinfect medical waste. Red bags are typically loaded into the unit while high-temperature steam is injected into the feed hopper. The red bags are then shredded or grinded to render the waste unrecognizable. The waste is passed through a series of microwaves, exposed to steam, then heated to 95 to 100 degrees Celcius. The waste is treated for at least 30 minutes to ensure disinfection. The waste is then placed in a container for disposal to a landfill. One disadvantage to microwave technology is that there are often high capital costs associated with these units. There are currently two off-site microwave treatment facilities in California.

Chemical/enzyme Treatment

Chemical treatments include disinfection through the use of agents such as sodium hypochlorite, chlorine dioxide, peracetic acid, and other compounds. Prior to chemical disinfection, and to eliminate the large surface area, the waste must be shredded and grinded to ensure that the pathogens will be rendered non-infectious. One disadvantage is that high fluid effluents can be produced from this technology. This effluent must be tested for hazardous substances prior to discharge to the sewer.

Thermal Treatments – Pyrolysis

Pyrolysis is a thermal treatment process which takes place in the presence of little or no oxygen. Shredding and grinding usually take place while heat continues until an internal temperature of 1800 degrees Fahrenheit is reached. During treatment of the waste, organic compounds become gasified in the absence of oxygen. Once gasified, these compounds become VOCs and are transferred to another chamber where they are completely oxidized. This is different from incineration, where the VOCs are combusted by heat. One disadvantage to pyrolysis is that it has a long completion cycle, typically from 12 to 20 hours.

Interest in this technology has recently surfaced in California. Pyrolysis has just recently been approved by DHS for the treatment of pathological waste and there has been much debate as to whether these units should be considered “incinerators” and treated accordingly. Proponents of this technology claim that pyrolysis units do not generate hazardous by-products such as dioxins. However, several studies have shown the contrary, that dioxins and furans can be formed under pyrolysis conditions. Further investigation and testing is needed to more fully understand the nature and extent of any potential dioxin emissions from this technology.

U.S. EPA originally considered pyrolysis units in the development of their NSPS and guidelines for medical waste incinerators; however, they concluded that because of variations in the operating conditions it would not be appropriate to apply the same

regulations to the pyrolysis units. U.S. EPA also indicated there was insufficient data to promulgate separate standards for these units; however, they may consider these units in the future for possible regulatory development.

Mail-back Programs

Several different types of mail-back programs are available for medical waste generators. Some mail-back programs accept sharps only and are a convenient low-cost way to dispose of sharps. Other types of mail-back programs accept a wide range of medical waste, such as empty chemotherapeutic containers, out-dated pharmaceuticals, gowns, gloves, used gauze and tape, and suction canisters. Mail-back containers come in a variety of sizes and include instructions, mailing cartons, pre-paid postage, and all tracking documents. Pathological waste cannot be accepted by mail-back services. In addition, there are limits to the total weight and amount of loose moisture that can be mailed back. Costs vary depending on size and frequency of mail-back. The MWMA limits the amount of time that medical waste can be held at the facility before the waste is sent off-site.

Pollution Prevention

The primary goal of pollution prevention in the medical waste industry is to minimize the amount of plastics and other products with chlorine and heavy metals from entering the waste stream. Waste minimization activities include preventing and/or reducing waste generation, reusing generated waste, and recycling waste. Many hospitals throughout California actively participate in pollution prevention programs. Examples of pollution prevention activities include reusable sharps containers, using non-mercury thermometers, and using red bags (which hold medical waste) made out of recyclable waste. DHS has just recently published a document called *Hospital Pollution Prevention (P-2) Strategies*. This document was prepared to help assist medical waste generators in developing and implementing a pollution prevention program.