Chapter 5
Special Treatment Issues

A number of management issues associated with packaging, handling, and disposal practices interface with decisions regarding treatment methods for medical waste. This chapter examines management developments for a number of such treatment issues: sharps management, small generator management, sewer use, and shredding.

SHARPS MANAGEMENT

Special attention is given to the management of sharps (e.g., hypodermic needles and syringes; also scalpels, broken glass, etc.) because of both the occupational and general public risks they pose. Sharps, specifically syringes, are generated by both households (e.g., in-home health-care) and health-care facilities. They are therefore part of both the general MSW and medical waste stream. In Washington State's survey of occupational exposure of waste industry workers to infectious waste (with 438 of the 940 workers surveyed responding), 21 percent of the respondents reported having sustained a needlestick injury on the job from both medical and residential sources (139).[1] The ATSDR, based on its literature survey and study, estimates that 500 to 7,300 medical waste-related sharp injuries occur annually to solid waste workers (93). Surveys of health-care workers, including housekeeping staff, usually indicate much higher incidence of needlestick injuries.[2] Sharps cause concern not only because of their infectious potential, but also because of the direct prick or stab type of injury that can result from them (114; see also 96). It is in part for this reason that EPA included *un*used sharps in its definition of regulated waste types under MWTA.

Most of the concern over the management of sharps has focused on the packaging of used sharps, the integrity of which is critical to containing the sharps during their collection, storage, and transportation to the treatment or disposal site. Currently, puncture-resistant containers are the preferred handling package for sharps (122, 118, 120, 121). Yet, a number of new techniques for containing sharps, particularly needles and syringes, continue to emerge (e.g., encapsulation).

Education of health-care and refuse workers, as well as the general public, about the proper disposal of sharps will facilitate their safe handling and management. Segregation of sharps and their separate collection and management without compaction is key to reducing the risk of injury associated with their management. In King County, Washington (Seattle area), there is a local requirement that all sharps be segregated and disposed of in leakproof, impermeable plastic containers with tight lids for separate, uncompacted collection and transportation to a landfill. This management strategy greatly reduces the risk of human contact with the sharps and the potential of needlestick injuries (111).

Manufacturing

Some of the efforts to ensure the safer handling of sharps have been made at the manufacturing stage. The attempt by manufacturers of sharps is to incorporate into the syringe a mechanism which will render it "nonsharp" immediately after it has been used. One method for achieving this is a sheath around the barrel of the syringe that will slide up around the needle when used while the barrel part is held. This makes it impossible for a needlestick injury to occur and the end product can be disposed of in a bag with other regulated waste items (unless the facility's protocol dictates otherwise) (104). These syringes are costly, however, restricting their use to date to high-risk areas of health care. Their potential as a feasible and practical method of protection in the home health-care setting seems apparent, although this application has not yet occurred, presumably due to their higher cost (104). Tests of the performance and reliability of these syringes were not identified by OTA.

[1]Interestingly, 32 percent of the respondents reported direct contact with waste blood on their clothing or shoes and 74 percent reported having received occupational cuts and scratches (139). Needlestick injuries while prevalent are not necessarily the most common type of occupational hazard for waste workers (e.g., back strain and other types of injuries are more prevalent).

[2]One survey by a local union of the Service Employees International Union (the Nation's largest health-care union) of its hospital workers in the San Francisco area, found that 62 percent reported accidental needlestick injuries on the job (100; see also 91).

Mechanical/Chemical

Although grinding, clipping, and other practices are no longer used for sharps management, primarily due to their potential for worker injury or exposure through aerosolization of microorganisms during the procedure, new techniques have appeared, e.g., chemical treatment and shredding of sharps. The primary alternative method of sharps management of this sort is the mechanical/chemical disinfection process discussed in chapter 3. In another process the needle part of the syringe is placed in a box while holding the barrel part. The needle completes an electrical circuit that melts it and leaves only the barrel in need of disposal. This process is a bit time consuming given the individual treatment of each sharp, but it does probably meet the "treated and destroyed" criteria of MWTA (141). Again, it may be a process for which the application to small generator settings is most practical (104).

Encapsulation

Another process introduced within the last couple of years that is experiencing some success is encapsulation of sharps. This process involves use of a phenolic solution to disinfect sharps and then introduction of an oxidizing agent as a catalyst to encapsulate the waste in a polymer matrix, i.e., a solid block-like material. This material can then be disposed of as solid waste without risk to the workers handling it (114, 104). It does not, however, meet the "treated and destroyed" criteria of MWTA regulations (141).

This system is also expensive, currently four to five times higher than the cost of comparable containers for sharps (104). This factor makes its application for high-volume generators largely impractical, but the process could facilitate handling sharps for the small generators and home health care since it both disinfects and immobilizes the sharps, allowing for their disposal with other solid waste.

Some States (such as California, where small generators are required to manage their medical wastes in an approved manner) have endorsed the process and in some cases permitted its use as an alternative treatment technology. Until more States endorse this process, it is unlikely that it will gain widespread adoption (104).

Concern has been expressed over potential impacts of these blocks of encapsulated sharps to the solid waste stream, in particular over what significance (if any) incinerating them with other wastes would have. Where landfilling of the "blocks" is not allowed, the encapsulated sharps are in some cases shipped via the United Parcel Service (UPS) to a manufacturer of the process in Georgia (see below) (104).

Mail Shipment for Disposal

The mail shipment of wastes for disposal is an increasingly common practice. As noted above, encapsulated sharps are sometimes shipped by UPS. Apparently, they are one of the few types of waste that nonpostal shipping companies will accept because they are rendered noninfectious prior to shipment.

A number of companies now operating were created primarily to cater to the needs of small or rural generators for viable disposal options. They operate out of several States and accept waste shipments from generators and then transport the wastes to treatment facilities. A contractor to OTA identified such operations in four States: Indiana, New Jersey, Oklahoma, and Texas (104). One of these firms claims over 30,000 clients nationwide and transfers the material to an incinerator in yet another State (104).

Most States authorizing waste by mail mandate that their State requirements be met, even if the waste is being mailed out of the State. For example, California authorizes out-of-state shipment only if the waste is rendered noninfectious prior to disposal. International shipment is allowed also if the waste is treated first in-state (104). Under MWTA, generators in States covered by the demonstration program are allowed through an exemption in the regulations to ship medical waste sharps through the mail, provided they meet the specified packaging requirements (40 CFR 259). This exemption is intended to encourage small quantity generators (e.g., doctors' offices) to dispose of medical wastes properly (141).

For the most part, most of the medical wastes shipped are sharps. Some tissues and laboratory specimens are mailed to laboratories for diagnostic purposes. Historically, laboratory samples, etiologic agents, and other medical items have been shipped through the postal service. Some basic postal packaging requirements exist and the practices have

been the subject of congressional hearings (e.g., 54 *Federal Register* 11970).

Concerns have been raised not only about the potential hazard or at least negative perception associated with handling medical wastes and household mail through the same postal system, but also over the operation of these waste mail companies that essentially operate as transfer stations (104). The scope of current regulation does not cover such operations. These practices warrant further investigation, particularly over the adequacy of current regulations governing the shipment of wastes through the mail and the desirability of such systems for small generators and rural health-care facilities.

SMALL GENERATOR MANAGEMENT

The amount of medical wastes generated nationally from non-hospital settings is not known (although EPA will reportedly be including such estimates in its first report to Congress). These small generators include such sources of medical wastes as: home health-care patients, doctors' offices (including dental and veterinarian), and rural health-care settings. Although some States are including some small generators of medical wastes, such as doctor and dental offices, in their regulatory programs for medical wastes, most exclude households.

The equity of including some and not all generators of medical wastes under regulations is hotly debated.[3] It is widely recognized that the same types of controls are not feasible for both large and small generators. The focus of the debate is over where to draw the regulatory line between generators to be included or excluded from regulation and over how large the gulf should be between the level of scrutiny and degree of requirements for large versus small sources of medical wastes.

In the area of medical waste policy, the demand for a comprehensive scope for controls is being grappled with from the beginning of regulatory efforts. EPA issued guidelines for home health-care disposal shortly after it promulgated its standards for MWTA (130). Other guidelines are being developed and discussed in response to the increased attention to wastes from these sources and their infectious potential (102; see also 82, 83).

The need for developing feasible and economical treatment and disposal options for small generators is widely acknowledged. Few advocate including households under medical waste regulations, but concerns over solid waste worker safety are real. The need for viable disposal options for rural hospitals, small laboratories, and different types of doctors' offices are also real. Some technologies have already been adapted for nonhospital sources. For example, for a number of years a mobile sterilization system has been used in Berlin, West Germany, to collect doctor office and nursing home medical wastes. There are plans by a hospital council on Long Island, New York, to attempt to bring this technology to the United States (68).

For small generators, the most promising of the emerging treatment methods discussed in this report are the nonincineration treatment methods and the newer management methods for sharps. These options may provide safe and economically feasible on-site treatment alternatives for small generators. Off-site incineration is also an option, since some medical waste companies will contract to pick up and transport to their incinerator medical wastes from doctor and dental offices and other small generator sources.

Careful and creative management strategies will be key to ensuring effective handling and treatment of these wastes. Limited information and assistance are available to households, small and rural hospitals, and other smaller generators to help them devise effective medical waste management plans and systems. Education efforts are clearly important but to date are limited to an EPA brochure for households, to be distributed by health-care providers or others (130).

[3]Clearly, regulations are usually adopted not because they are perceived as "fair," but rather because they are necessary to achieve some social or economic goal of the greater public. That regulations be "reasonable" may be difficult to define, but a legitimate standard by which to judge them. In most areas of environmental policy, regulatory attention is first focused on the largest generators of the problem. Later, refinements are made to the regulations and their scope broadened to include other significant sources.

OTHER TREATMENT TECHNIQUES: SEWER USE AND SHREDDING

Sewer Use

Certain medical wastes can be legally discharged to sewers. These wastes include blood and blood products, ground-up solid infectious wastes (e.g., body parts and organs), and other liquid and or semi-liquid infectious wastes. Reportedly, about 23 percent of hospitals dispose of blood and body fluids to sewers and about 14 percent grind solid infectious wastes and discharge them to sewers using a grinder similar to that used for in-sink home garbage grinding (91). The State of Washington survey found that 49 percent of the hospitals surveyed reported pouring blood into the sewer system (139).

EPA (122), in its guidance manual for infectious waste management, identified sewers as an acceptable treatment option for blood and blood products if secondary treatment is available (i.e., occurs at the sewage treatment plant).[4] Secondary treatment systems, however, are designed to microbiologically breakdown and remove organic constituents in wastewater and are not designed to disinfect waste water. At a primary or secondary municipal treatment facility, wastewater disinfection occurs as the last step, usually by chlorination, prior to release to the environment (111).

While there is little concern over the ability of sewage treatment plants to handle liquid medical wastes adequately, the absence of treatment at the point of discharge (i.e., at the facility) has prompted some concern.[5] Medical staff and plumbers risk occupational exposure if there is a sewage backup (104, 91). At least one such incident reportedly occurred in 1987 at the Los Angeles County-University of Southern California Medical Center when a pipe in the basement burst and dumped possibly contaminated blood and fluids on workers (five of whom filed a lawsuit against the facility).[6] This type of incident is an example of a *plumbing* problem and concern over potential worker exposure from these types of accidents should be distinguished from the issue of health-care facilities discharging body fluids to the sewage system.

Photo credit: Vetco Sanitec Corp., Combustion Engineering, Stamford, CT

Shredded medical waste meets the nonrecognizability requirement of MWTA. Shredders can be used for untreated wastes or be incorporated into the use of various treatment technologies. Shown here are contents of microwaved and shredded medical wastes.

Another aspect of sewage disposal that is much larger than the medical waste issue and its contribution to the flow of wastes to the sewers is potential problems associated with combined sewer overflows (CSOs), i.e., where sanitary and storm sewers are combined. In these situations when it rains untreated sewage and any wastes discharged to sewers may be discharged directly to waterways, because the sewage treatment plant cannot accommodate the increased flow of waste water. In New York City, for example, there are over 500 CSO points and for some as little as a quarter of an inch of rain can lead to the release of untreated sewage (134).[7]

Shredding

The nonrecognizability requirement of MWTA regulations has focused attention on methods to destroy treated waste, notably shredding, to meet this requirement. Currently, there are no criteria (voluntary or mandatory) on the degree of shredding

[4]Steam sterilization and incineration are, however, the two recommended treatment methods (122).

[5]This is true particularly when untreated discharged liquids can bypass the treatment facility in areas with combined sewer overflows.

[6]*Quinn* v. *Court of Los Angeles*, Case No. C669760, L.A. Superior Court of the State of California.

[7]CSOs were in fact implicated as a major source responsible for the beach washups of medical wastes in the summer of 1988. Investigations concluded that syringes discharged to the sewers, primarily from I.V. drug users and diabetics, were directly discharged to waterways in heavy rains and then other weather patterns made the likelihood of washups containing these wastes high (137).

required to achieve nonrecognizability. This lack may account for the apparent reluctance to apply shredding technology to emerging treatment methods.[8] The necessity for criteria or standards for this and other treatment and destruction methods will perhaps best be evaluated after the completion of MWTA demonstration program.

Yet other factors, such as the difficulty existing shredding systems have with the heterogeneity of the medical waste stream and the high maintenance associated with shredders, may account for their limited application to date. It may be that improvements and refinements to shredding technologies will occur, particularly if the nonrecognizability criterion is more widely incorporated into medical waste regulations, and the use of shredders is increased. In any case, disinfection of infectious medical wastes *before* shredding to minimize potential aerosolization of pathogens is desirable.

[8]Interestingly, there are specific shredding standards for document destruction by the Department of Defense for confidentiality (104).