Trends in Managing Medical Waste

Incineration technologies remain the primary means to dispose of infectious and noninfectious medical waste, but new technologies are emerging, in response to new regulations, public concern over health issues, and the need to control waste management costs.

By Jonathan V. L. Kiser

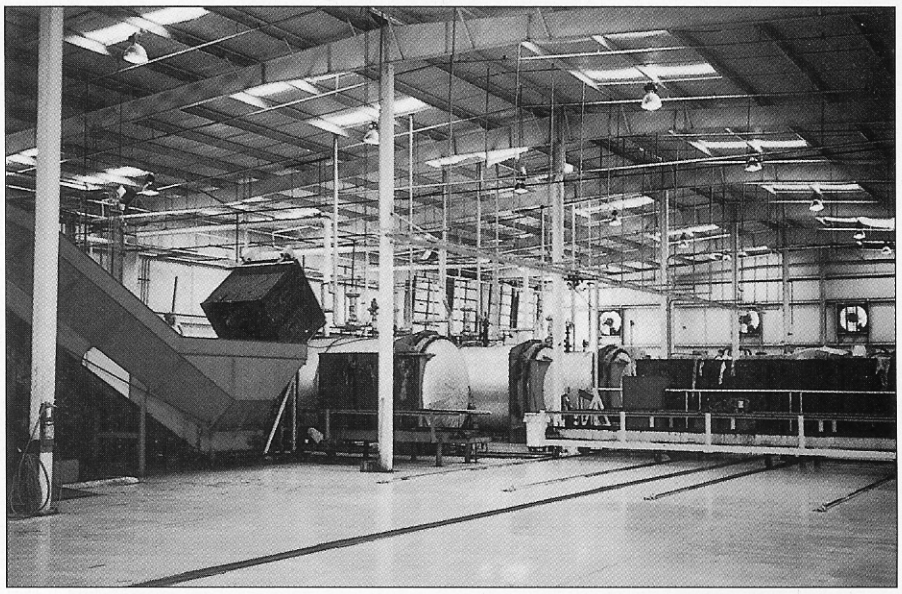
The summer of 1988 marked a clear turning point in public interest and concern regarding how medical wastes are managed. The discovery of blood vials, needles, syringes, and other medical waste washed up along beaches along the east coast, the Gulf of Mexico, and elsewhere forced beach closures and grabbed national media attention.

The resulting public outcry for swift government action led to a flurry of political activity. Congress enacted the Medical Waste Tracking Act in 1988 and called on the U.S. Environmental Protection Agency (EPA) to issue medical waste regulations within six months of enactment. States had already been busy enacting new regulations. From 1986 to 1988 the number of states lacking any infectious waste regulations dropped from 28 to 11.[1] But federal action is still incomplete.

While the EPA has the authority to regulate chemical hazardous waste and infectious waste under the Resource Conservation and Recovery Act, the agency has yet to establish any comprehensive guidelines. Congress last seriously considered reauthorizing RCRA during 1992 when bills were introduced in both the Senate and the House, but ultimately were not enacted. Provisions included in the Senate bills related to definitions of medical waste, sharps packaging requirements, medical waste storage requirements, and other issues. In the House, a medical waste proposal was withdrawn due to a lack of consensus over its provisions among key stakeholders.

In February 1995, the EPA did propose air quality regulations for medical waste incinerators, but the agency received so many comments from concerned stakeholders that it is likely to alter rules considerably before issuing a final set in April 1996. (*Solid Waste Technologies* will explore these regulatory issues in more detail in a subsequent part of this series.)

With new regulations being issued or developed on state and federal levels, the approaches taken for future medical waste management are clearly changing. Such a dynamic era presumably could have occurred at many other times, considering that medical wastes have been generated and disposed of since the beginning of hospitals. So what distinguished the beach closings of the late 1980s from previous issues regarding medical waste? According to a report produced by the Nelson A. Rockefeller Institute of Government in



Medical waste received at Applied Recovery is treated using three autoclaves that operate at 275 to 280 degrees under 48 psi of steam pressure. All waste is shredded prior to being loaded onto trailers for transport to an approved landfill.

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1989, "the increased media focus on medical waste can be traced in part to the general hysteria accompanying the rise of AIDS as a public health problem in the U.S."[2] William S. Kiser, M.D., Vice Chairman and Chief Medical Officer for Primary Health Systems based in Philadelphia, PA adds, "There is a general public concern about how medical waste is being managed, particularly during this era of AIDS." But Dr. Kiser also indicates medical waste management is on the minds of health care providers, not just the public. "The management of medical wastes has become a top priority for hospital administrators," Kiser says. "It's an important factor in the escalating cost of health care."

Heightening concern among both the public and hospital administrators is the lack of consensus regarding what materials should be included in a definition of medical wastes. One perspective is provided by the U.S. Congressional Office of Technology Assessment (OTA). In its 1990 report, *Finding the Rx for Managing Medical Wastes* report, OTA defines medical waste "to include all the types of wastes produced by hospitals, clinics, doctors' offices, and other medical and research facilities. These wastes include infectious, hazardous, radioactive, and other wastes generated at these health care and medical facilities."[6]

In terms of sources, EPA cites the major generators of biomedical waste to be: hospitals, medical laboratories, research laboratories, commercial diagnostic laboratories, animal experimentation units, and industrial laboratories. Other potential sources include: outpatient medical clinics, dental clinics, nursing homes, and veterinary hospitals and schools.[3]

The Agency for Toxic Substances and Disease Registry (ATSDR) cites the following goals as being appropriate for properly treating medical waste: 1) destroying pathogens, 2) destroying recognizability; 3) reducing volume (weight); 4) containing costs and 5) minimizing liability. To successfully accomplish these goals it is important, at a minimum, to have a system in place that provides reliable technology, that is convenient and relatively easy to use, and is redundant or provides some type of backup in the event of a shutdown.[4]

Despite some initial guidance from multiple federal and state organizations, there remains a definite lack of consensus regarding what constitutes proper regulation of medical waste treatment technologies. In the absence of standardization, hospitals and companies offering waste management technologies move forward by dealing with states and localities on a case-by-case basis.

The Baseline Technologies: Incineration and Landfilling

For decades, hospitals have preferred incineration to manage their infectious and regulated medical wastes (RMW). On-site incineration has provided efficient management of pathological and other wastes, rendering the material unrecognizable, and has allowed individual hospitals to manage their own disposal costs. Off-site incineration also has proven to be viable, particularly for

smaller hospitals that do not generate sufficient waste quantities, or perhaps can't afford to install their own on-site unit.

Regional facilities serving more than one hospital will likely be a favored approach in the future, in light of the pending stringent requirements of the Clean Air Act. A single, larger facility is more apt to be able to spread the additional air pollution control costs over more tons of waste, thus minimizing the rise in day-to-day expense burden on participating medical facilities. The AWMA Medical Waste Committee concluded at its December 1994 meeting in Chicago that "For small health care facilities, economic consideration is likely to recommend transportation to regional medical waste incinerators, or disinfection and transportation to municipal waste incinerators or landfills."

Still, incineration has generally met its share of controversy in recent years, as citizens raise concerns about air emissions and ash residue. An anticipated impact of EPA's proposed medical waste incinerator regulations, in fact, is the closure of many on-site units. This will lead to an increased reliance of off-site management options. Kathy Loving, with Arthur D. Little, Burlington, MA, notes, "Generators will enter the off-site market, however, with a new sophistication about the medical waste problem. As a result, the degree to which they resort to the off-site market will depend on assurances that they will retain some control over costs and exposure to liability."[5]

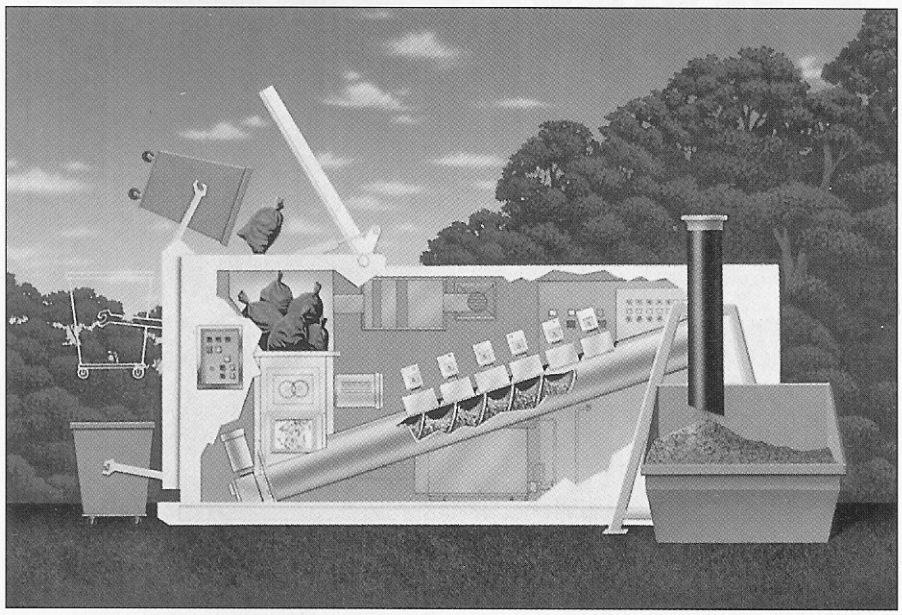
In its 1995 *Market Overview*, Consumat Systems, Inc., a Richmond, VA-based incinerator manufacturer, provides a brighter prediction regarding on-site medical waste burners: "Although the pronouncements made by EPA last summer concerning dioxins produced a chilling effect on the market, significant interest remains and sales are still being made. One reason for this is that the proposed emission limits can be met and the alternatives to incineration have not been as successful as once thought." Consumat also foresees an increase in demand "for equipment for off-site facilities and for retrofits for existing off-site facilities," in direct response to the proposed Clean Air Act regulations.

Landfills are used to dispose of most of the noninfectious medical waste generated in the U.S., including waste first treated by autoclaving or incineration.[6] This picture is gradually changing as health care providers strive to implement more reuse and recycling programs for their non-RMW. Besides saving disposal costs, there are other reasons why hospitals are looking for alternatives to landfilling of medical wastes. One problem, according to the Vesley report, has been the refusal of landfills to accept recognizable medical waste, even if it has been treated to render it noninfectious.[2] Landfill operators are concerned about infectious agents leaching into groundwater. There is also a concern about potential scavenging of medical waste items (e.g., needles by drug addicts) or of pathological materials (e.g., body parts by dogs).

Mary Ellen Lynch, Director of Environmental Planning for Browning-Ferris Industries (BFI) confirms, "Some landfill operators do indeed resist taking

'treated but recognizable' medical waste." She notes that DC General Hospital (Washington, DC), for example, cannot send recognizable treated medical waste to the Lorton Landfill in Virginia. But Gary Urbanowicz, Vice President with Doucet & Mainka, Peekskill, NY, has seen the other side of an industry without standardization. "Without standardization, you get strange things happening," says Urbanowicz. "One landfill rejected a delivery of unrecognizable medical wastes on the grounds the they wanted to see what was in the load."

Other concerns about landfilling medical wastes were raised at a December 1994 meeting of the Medical Waste Treatment Committee of the Air and Waste Management Association (AWMA). The committee, comprised of representatives from private firms, state environmental and health agencies, the American Hospital Association (AHA), Veterans Affairs, and others, concluded that a landfill produces approximately 150 pounds of methane per ton of waste disposed, and a long list of other pollutants in small quantities. The committee indicated these emissions, which occur over a period of 15 to 25 years or more, much be managed, as does the leachate that must be collected and treated to avoid contamination of surface or ground water.



In Harris County, Texas, Bentaub and LBJ hospitals are sharing a Sanitec Inc. mobile microwave disinfection system to dispose of a combined 8,000 to 9,000 pounds per day of medical waste. All surgical waste except organs and body parts (which are packaged and sent to an incinerator) are dumped by an automatic hoist into the in-feed hopper at the top of the trailer. The on-board processing system includes a shredder that can reduce sharps and syringes, gowns, towels, plastic and other waste into a uniform size for disinfection in a steam treatment chamber. Next material is carried by a screw conveyor to a series of microwave generators, and discharged only after a chart recorder substantiates that disinfection is complete. (photos courtesy Sanitec, Inc., West Caldwell, NJ)

Emergence of New Technologies

In response to concerns associated with incineration plus the restrictions associated with autoclaving and land disposal, a range of alternative technologies have emerged to take advantage of potential market opportunities. (These technologies, which include autoclaving, microwaving, plasma arc technology, pyrolytic gasification, mechanical and chemical disinfection, fluidized bed combustion, and others, will be discussed in detail in the second article of this series).

In its 1990 report, *Finding the Rx for Managing Medical Wastes*, OTA identified the following considerations associated with alternative medical waste treatment technologies: 1) Many achieve significant volume reduction; 2) Most appear to have less emissions concerns than incinerators; 3) All associated health risks are still not thoroughly investigated. Any new or additional worker exposure should be thoroughly identified and evaluated; and 4) Many are not appropriate for pathological wastes. The OTA report concluded that while the commercial viability of non-incineration treatment alternatives has increased in recent years, incineration appears still appears to be the technology of choice for these wastes.

Arthur D. Little's Loving predicts that, as on-site incineration becomes less available as a disposal option, "hospital administrators will work to reduce the amount of medical waste by any means that do not compromise the medical community's commitment to providing quality health care." She indicates that this means greater use of non-incineration technologies as well as improved waste segregation practices, which could reduce the amount of regulated waste disposed by hospitals by 30 percent. Loving also predicts move away from the use of disposable products and toward more cost effective reusable options, and an increase in the

number of cooperative arrangements among generators and commercial firms to solve waste management issues on a regional basis.[5]

Impact of Home Health Care

The rise in home health care activities has resulted in concerns about how some medical waste is being managed. For example the American Diabetes Association (Alexandria, VA) has released a brochure called "Think Sharp! Dispose Of Home Medical Waste The Right Way!," in an effort to clarify this issue for home users. The Association suggests ideally placing needles, syringes, and other sharp items in a puncture-proof, hard plastic container with a lid that screws tight. The container should not be of a clear material such as glass or plastic since glass breaks and drug abusers can spot needles through clear plastic. The Association recommends placing the container in the trash destined for disposal and never as part of a recycling program. The brochure also urges home health care users to check local medical waste disposal guidelines.

Another alternative is to have home users return used sharps back to the pharmacies where they were purchased. The key to success in preventing accidental exposures and sticks is education of health care workers, home users, and others. Organizations like the Home Health Care Association, the American Medical Association, and others can and should be instrumental in spreading this word.

Cost Savings Through The Three Rs

In their efforts to reduce the waste management costs, hospitals are applying several reuse, reduction, and recycling strategies. The first involves a reduction in packaging. Loving states, "Medical products companies are coming under increasing pressure from the medical community to develop products and systems that will make it easier for health care providers to reduce amounts of waste. One way that companies have responded is to investigate possibilities for packaging medical products more efficiently, . ."[5] An example of this is provided by the open-heart custom procedure tray, which might include 100 components in a single sterilized package. This type of package not only reduces excess packaging but facilitates inventory management.

Another waste reduction strategy is reusing medical products for continuing care with the same patient. According to Loving, "Already 60 to 70 percent of hemodialysis procedures are carried out using dialyzers that are sterilized after use and then reused when the patient returns for subsequent treatments." In another example, Minntech has announced plans to start clinical evaluation of a reusable catheter for angioplasty procedures.

Improved waste segregation efforts in hospitals have resulted in many materials being recycled. Materials such as cardboard, paper, plastic, and aluminum are being recycled. In some cases, the recovery operations are generating net revenues for the hospitals, not just disposal cost avoidance.

Management Trends & Research Needs

The drive toward new regulatory standards and protection often leads to

discovery of research needs. This is indeed the case in the medical waste management field. OTA pointed out several years ago that "Basic information on the sources, amounts, composition, and treatment/disposal of medical waste is not known in any useful detail." It suggested that there was a need for research to determine to what degree medical wastes are a public health problem, including information on occupational exposure to hazards associated with managing these wastes. OTA also identified a lack of comprehensive data on the operation of medical waste incinerators (e.g., types, comparisons of air emissions levels for a range of pollutants, ash content). The OTA called for the needed research as an essential component of any regulatory program that might be developed. The need is still here several years later, even as regulations are being developed.

Because of the lack of solid research data, especially with regard to incinerators and alternative medical waste systems, the Air & Waste Management Association has made specific "action" recommendations. AWMA's Medical Waste Treatment Committee recommends: 1) development of ASTM standards on pathogen deactivation; 2) creation of a joint emissions test program, with the results evaluated by a risk assessment approach for a range of exposure scenarios; 3) EPA should define the air quality consequences of shifting to non-incineration technology as a result of the proposed medical waste incinerator standards; 4) state and local air agencies should require performance testing, and include at least criteria pollutants, metals and speciated hydrocarbons; 5) NIOSH should investigate a range of occupational exposures of medical waste workers; and 6) Aqueous discharges should be tested to assure the absence of solids, metals, and for a neutral pH.

Notes:

[1]Renn, Ortwin and Covello, Vincent, "Risk Perception and Communication," Perspectives on Medical Waste. The Nelson A, Rockefeller Institute of Government, State University of New York, June 1989, Chapter VII, p. 2.

[2]Vesley, Donald, Croghan, Catherine, & Thompson, Kathryn, "Current and Alternative Practices: Description and Evaluation," Perspectives on Medical Waste, The Nelson A. Rockefeller Institute of Government, State University of New York, June 1989, Chapter III.

[3]Lee, C. C., Huffman, George L., and Shearer, Teri L., "A Review Of Biomedical Waste Disposal: Incineration," February 19, 1988.

[4]Rogers, Harvey W., "Medical Waste Treatment Methods—Selection Strategies," ATSDR, U. S. Public Health Service, Presented at CARS/EPA Medical Waste Workshop, Sacramento, CA, April 1990.

[5]Loving, Kathy D., "The Evolving U.S. Market for Medical Waste Management," Decision Resources, Inc., an Arthur D. Little Affiliate, June 1991.

[6]Source: Congress of The United States Office of Technology Assessment, "Issues in Medical Waste Management Background Paper," Washington, D.C., October 1988.).