

# Hospitals and the environment

**Background and epidemiology:** Hospitals generate fluid, gaseous and solid waste, with solids accounting for the bulk of it. The average North American hospital produces about 9 kg of solid waste per patient-day,<sup>1</sup> and even though most of the waste is innocuous office trash or cafeteria scraps, some is potentially hazardous (e.g., radionuclide tracers, neoplastic drugs and blood products).

Compared with other industries, hospitals produce relatively small quantities of radioactive or hazardous chemical waste, but potentially infectious biomedical waste constitutes as much as 20% of a hospital's total waste output. However, much of the waste considered to be biomedical may, in fact, be misclassified. According to a 1992 audit of the waste stream at Toronto's Hospital for Sick Children, about 80% of the biomedical waste comprised items such as paper, cans, bottles and packaging that did not belong there.<sup>2</sup> This misclassification is costly, since it is about 16 times more expensive to dispose of infectious waste than it is to get rid of regular waste.<sup>3</sup>

**Hospital waste management:** Incineration has been the main method for disposing of the wide range of combustible materials that constitute biomedical waste, because it can significantly reduce the volume of waste material and it can destroy organic matter. In 1990, 44% (81) of Ontario hospitals used privately owned incinerators, and 41% (76) burned their own biomedical waste on site.<sup>3</sup>

Typically, an incinerator has a 2-chambered, controlled-air system to maximize combustion. However, 3 types of medical waste material are difficult to incinerate. Materials with low heating values, such as full urine bags and dense body parts, may burn more slowly than the surrounding material and not be completely destroyed during incineration. Toxic metals, such as the

lead, chromium and cadmium found in red plastic bags and vacutainer caps, vaporize during incineration and form fine fumes that enter the atmosphere with the flue gas. Plastics composed of polyvinyl chloride contain chlorine that converts to corrosive hydrochloric acid during incineration.

Daily variations in the composition and volume of hospital waste, when combined with inadequately maintained equipment, can upset the stoichiometric balance and cause toxic emissions.<sup>4</sup> Bio-medical waste incinerators are the second largest source of dioxin emissions in Canada and account for about 9% of the country's total mercury emissions each year.<sup>5</sup> Polycyclic aromatics, such as the carcinogen benzopyrene, and respiratory irritants, such as the oxides of nitrogen and sulfur, are also recognized by-products of inefficient incineration that pose public health concerns.<sup>6</sup>

Over the past 2 decades, incineration has become increasingly controversial because of growing concerns over the inability of the technology to process safely the current increased volumes of plastics, metals and pathogens in hospital waste. In 1985, 62% of the 137 hospital incinerators operating in Ontario were reported to be ill-equipped to handle the various components of the biomedical waste stream; the report recommended that about 38% be replaced and 24% upgraded.<sup>3</sup> As of 2000, 56 hospital incinerators were still operating in Ontario.<sup>5</sup>

**Prevention:** The Canadian Council of Ministers of the Environment has recently proposed new incinerator emission standards that will reduce current dioxin and mercury emissions by 80%.<sup>5</sup> To comply with them, operating incinerators may need to be retrofitted with a scrubber, a wet system that injects a washing liquid to agglomerate flue gas particulates or a spray-dryer/fabric-filter system.<sup>4</sup> Alternatives to incineration in-

clude steam sterilization (autoclaving), microwaving or chemical (hydropulping) disinfection.<sup>1</sup> Although these technologies are designed to disinfect biomedical waste, they are not suitable for pathological waste and they do not reduce the weight, so the landfill costs can be high.<sup>1</sup>

Propelled by rising waste-disposal costs and public disfavor toward incineration, several Canadian hospitals have recently implemented programs to reduce the amount of misclassified biomedical waste entering the waste stream. Over 18 months, a Toronto hospital reduced the volume of biomedical waste produced each month from 14 800 kg to 6300 kg, which resulted in monthly savings of \$5599.<sup>7</sup> The program's success was attributed to the support and leadership of infection-control personnel, a clearer definition of biomedical waste, hospital-wide awareness and education programs about biomedical waste, and regular audits and direct feedback to staff members.

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