Impact of Hazardous Waste Regulations

Special report by independent microbiologist
Ian Blenkharn MSc CBiol MIBiol CSci FIBMS.

Waste is a costly and troublesome commodity. Clinical waste is foremost among waste streams in hospitals – although comprising around 40% of the total solid wastes, it is responsible for more than 60% of the disposal costs. Vast resources are devoted to its management. This is justified by clear risks of infection or other adverse health effects that demand special care in disposal and compliance with an array of legislation. Much of that legislation is about to change. The Hazardous Waste Regulations 2004 (HWR) come into force in July 2005 and look set to change considerably the approach to clinical waste management. But are these changes appropriate?

Several studies have shown that clinical wastes contain substantially fewer bacteria than domestic refuse. There are, however, more potential human pathogens in clinical waste. Wastes, from veterinary sources may be particularly heavily contaminated. The pathogens present vary widely and may reflect the patient population and clinical activities at the site of arising. Thus, broad assumptions may be drawn of the microbial burden of clinical wastes, though sweeping generalisation is inappropriate and can be misleading. Considering the biology of clinical wastes and the practicalities of clinical waste management in hospitals the new HWR, which seek to separate hazardous from non-hazardous wastes, may prove troublesome. Additionally, there may be conflict with the demands of health and safety legislation. Notwithstanding, this legislation is here to stay. It is thus important to formulate clear and unambiguous clinical waste policies that are safe and effective, and which are compatible with the demands of a busy hospital.

Categorised

Clinical wastes, categorised effectively into five distinct groups in the 1992 Health & Safety Executive publication *Safe Disposal of Clinical Waste* (Table 1), include wastes from clinical areas, diagnostic and research laboratories, pharmacy, mortuary and post-mortem facilities. Wastes will normally be disposed to yellow sacks or rigid yellow bins including sharps bins. Studies of the content of waste containers inevitably reveal a high proportion, up to 40%, of items other than clinical wastes including much innocuous packaging material, domestic-type refuse and paper waste etc. More accurate segregation at the point of disposal may reduce dramatically clinical waste volumes. However, once deposited, cross-contamination can occur and the entire container must be considered potentially hazardous and managed as clinical waste – downstream segregation

> It is important to formulate clear and unambiguous clinical waste policies that are safe and effective, and which are compatible with the demands of a busy hospital

is inappropriate and dangerous, and is at odds with the requirements of HWR.

The Hazardous Waste Regulations have much to commend them. They seek to identify wastes hazardous to health or to the environment, and ensure that care is taken in their disposal. HWR imposes a new waste classification, the European

Waste is a costly and troublesome commodity.

Down-regulation of some clinical wastes into non-hazardous EWC subcategories, at a time when we continue to record increases in hospital acquired infections and poor standards of hospital hygiene, delivers an entirely inappropriate message

Waste Catalogue (EWC), predicated on composition and hazard (Table 2). Non-hazardous wastes largely escape more stringent control in disposal, which previously had been applied blanket fashion. This permits correspondingly lower disposal costs. Classifications are clear and largely unambiguous, though application to the busy clinical unit will be fraught with difficulty. As the legislation rolls out across Europe, parallel hazardous and non-hazardous streams for clinical waste seem likely to increase the incidence of serious and potentially life-threatening infections through error or omission in classification.

As befits such legislation, there are caveats and exceptions intended to require a full and detailed risk assessment of wastes to ensure correct classification. This is especially valuable for wastes that might present an infection hazard and for which simple analytical assessment and reference to published threshold values is not possible. Though the legislation may be largely robust, the risk of infection associated with any waste will always be troublesome in interpretation. Guidance is available from the Environment Agency (*Interpretation of the definition and classification of hazardous waste technical guidance, WM2*) that includes schemata for the classification of infection risk of wastes. These schemata may be oversimplified. For example, waste from orthopaedic wards might be classified largely as non-hazardous since those patients are unlikely to be suffering any infectious disease. Although provision is made for wastes from patients known to suffer from, for example, Hepatitis B or C or HIV infection no provision can be made for those with undiagnosed or unrecognised and latent infection. Can we identify those individuals? Their carers will be unaware, as may be the individuals themselves. A codicil to such schemata, that anticipates additional clinical judgement applied to the classification of wastes is surely without merit and serves only to highlight the lack of understanding applied in the formulation of such guides, and to the realities of work in hospitals. Do we know with certainty which patients pose a risk of infection? Clearly, we do not. To propose a scheme for the further segregation of clinical wastes based on assumptions of the risk of infection is to negate totally the CDC Universal Precautions for Prevention of Transmission of HIV and other Bloodborne Infections. With the implementation of HWR, universality in the protection of patients, healthcare workers and others sadly becomes conditional.

Hazardous clinical wastes, as listed in EWC, demand additional care and control in disposal. There are constraints on the transfer, transport, storage and terminal destruction of these wastes, necessitating complete separation from non-hazardous wastes, to ensure correct processing and avoid cross-contamination or inadvertent and inappropriate co-disposal. This also entails additional administrative obligations, though these are unlikely to be onerous. The cost of disposal for hazardous wastes will carry a substantial premium.

Down-regulation of some clinical wastes into non-hazardous EWC subcategories, at a time when we continue to record increases in hospital acquired infections and poor standards of hospital hygiene, delivers an entirely inappropriate message. Although there is no evidence for any causal link, public confidence may be further weakened by down-regulation in clinical waste management at this time.

Particular concern

Conflict between HWR and health and safety legislation is of particular concern. Health and safety legislation has been used to bring successful prosecution of NHS Trusts in breach of Section 3, Sub-section 1, of the Health and Safety at Work etc Act, 1974. This Act places on employers "a duty .... to ensure, so far as is reasonably practicable, that persons not in his employment who may be affected thereby are not thereby exposed to risks to their health or safety". Prosecution has followed storage of clinical wastes in areas of hospitals accessible to the public. No mitigation was entertained on the basis of the infectious nature of the waste, or lack of it. Thus in health and safety legislation clinical wastes are deemed a potential hazard to health. Trusts must exercise an appropriate Duty of Care to ensure waste is properly managed, in such a way as to ensure the safety of their employees and others. It is questionable if this duty will be satisfactorily discharged if some wastes are managed to a lesser standard based on arbitrary and ill-defined categorisation that is itself fundamentally flawed through our inability to apply meaningful and precise definitions of infection risk for clinical wastes. What will happen when an employee, contractor, or member of the public suffers a sharps-related or other illness from exposure to clinical wastes defined as "non-hazardous" in the context of HWR? The infection risk, though possibly small, cannot be dismissed and relevant health and safety legislation may apply – additional civil liability may greatly magnify the costs. The architects of HWR may not have foreseen the difficulties these fine distinctions in waste classification may force on hospitals. More seriously, it seems likely that they have failed to foresee the risks to individuals from lax interpretation of the definitions and thereby of inadequate waste classification. This paradox may require that we apply to wastes categorised as non-hazardous similarly stringent controls in collection and disposal to comply with the demands of health and safety legislation. Having adopted the dual classification of EWC, if infection results from exposure to clinical wastes "not having special requirements in order to prevent infection" the courts may assume a breach in Duty of Care.

Table 1: Categorisation of clinical wastes.

Categorisation of clinical wastes	
Group A	Soiled surgical dressings, swabs and all other contaminated waste from treatment areas; materials other than linen from cases of infectious disease; all human tissue (whether infected or not), animal carcasses and tissues from laboratories, and all related swabs and dressings.
Group B	Discarded syringes, needles, cartridges, broken glass and any other sharp instrument.
Group C	Laboratory and post-mortem waste other than waste included in Group A.
Group D	Certain pharmaceutical and chemical wastes (those wastes falling within the definition of clinical waste).
Group E	Used disposable bed-pan liners, urine containers, incontinence pads and stoma bags.
	From: *Safe Disposal of Clinical Waste* (Health & Safety Executive, 1992)

Consequential liability may be costly since by definition the mandatory risk assessment necessary to classify those wastes was defective.

Practical issues arise. To segregate sharps and other clinical wastes based on known or presumed risk of infection, however that may be defined, is to require two waste containers at every location where currently there is only one. Marking of these containers, for hazardous and non-hazardous wastes, must be clear and unambiguous to ensure they receive only the intended wastes. Subsequent handling of wastes must ensure complete separation of waste streams. Space constraints and logistics become critical, making the additional EWC distinctions impractical.

Despite these negative comments, we must not unduly criticise HWR. There is not a priori defect in its construction though our interpretation of it, and in particular the formal guidance to its implementation, may be at fault. The solution is simple. With few exceptions, an all-embracing site-wide policy for the disposal of clinical wastes to a hazardous waste stream avoids completely the possibility of infectious wastes disposed to a lesser waste stream. Choice in disposal is removed, and the possibility of error in classification is eliminated.

Might we be able to progress still further? Moving toward a global approach to waste management in hospitals, with clinical wastes managed as a single hazardous waste stream, may escalate costs of disposal. However, significant increases in volume permit leverage of disposal costs and provide additional savings though streamlining of the broader logistics of waste management. Savings in space, reduced on-costs associated with reduction in the number and types of waste container, an opportunity for saving in staff costs though elimination of multiple waste streams, and associated savings in administration, may be significant.

Although HWR relaxes standards for the disposal of that proportion of clinical waste considered largely non-hazardous, a universal approach to clinical waste management that considers all clinical waste as hazardous ensures the widest margin of safety, and permits compliance with all relevant legislation

Table 2: European Waste Catalogue categorisation of clinical wastes.

Categorisation of clinical wastes (European Waste Catalogue, 2002)		
18	**Wastes from Human and Animal Health Care and/or Related Research (except kitchen and restaurant wastes not arising from immediate healthcare).**	
18 01	Wastes from natal care, diagnosis, treatment or prevention of disease in humans.	
18 01 01	Sharps (except 18 01 03).	
18 01 02	Body parts and organs including blood bags and blood preserves (except 18 01 03).	
18 01 03*	Wastes whose collection and disposal is subject to special requirements in order to prevent infection.	A
18 01 04	Wastes whose collection and disposal is not subject to special requirements in order to prevent infection (e.g. dressings, plaster casts, linen, disposable clothing, diapers).	
18 01 06*	Chemicals consisting of or containing dangerous substances.	M
18 01 07	Chemicals other than those mentioned in 18 01 06.	
18 01 08*	Cytotoxic and cytostatic medicines.	A
18 01 09	Medicines other than those mentioned in 18 01 08.	
18 01 10*	Amalgam waste from dental care.	A

Any waste whose six-digit code is marked with an asterisk (*) is a hazardous waste.

Classification may be Absolute (A) defining waste as hazardous regardless of the concentration of any "dangerous substance" within it, or a "mirror entry" (M) covering wastes having the potential to be hazardous or non-hazardous depending on their composition and the concentration of "dangerous substances" within them. The hazard potential is determined by reference to published threshold limits or, for infection hazards, on risk assessment.

This may be extended yet further, with co-disposal of other compatible wastes. Thus, pharmaceutical waste, confidential paper waste from clinical, laboratory and administration areas, domestic-type refuse and food wastes might be managed as a single waste stream. To achieve this, techniques for handling and end-disposal must accommodate the additional volume and complexity of waste composition, while ensuring cost-effective destruction with minimal environmental impact.

High temperature incineration is the established gold standard for the destruction of clinical wastes.

Alternative treatment

The newer alternative treatment technologies (hot oil auger, microwave, etc) generally fail to address the environmental impact, transport cost, and cost of landfill disposal for treatment residues that are markedly less for high temperature incineration. While there remains a place for alternative technologies in the management of clinical wastes, fully destructive high temperature processing provides the most effective solution to the management of these complex wastes. Further advances are possible.

Plasma technologies achieve even higher temperatures than does conventional high temperature incineration. Plasma arcs create a heat source of enormous power and versatility. Temperatures in the plasma column typically exceed 10,000˚C giving average bulk temperatures within the plasma reactor in the range 1,300-1,500˚C. Together with the intense UV light emitted from the arc, this ensures rapid destruction of all organics, reduces emission levels and creates a non-leachable non-polluting vitrified solid residue having minimal environmental impact with maximum volume reduction. Plasma arc technology is a highly flexible advanced destruction technology. It satisfactorily addresses biological, chemical and environmental issues, as well as logistic and economic concerns, and readily accommodates co-disposal of a broad range of other waste streams from healthcare establishments.

Although HWR relaxes standards for the disposal of that proportion of clinical waste considered largely non-hazardous, a universal approach to clinical waste management that considers all clinical waste as hazardous ensures the widest margin of safety, and permits compliance with all relevant legislation. Co-disposal with other waste streams, moving toward a total waste management approach supported by plasma treatment technology, can afford substantial additional benefits and may be the best way forward. ✚