Comptroller and Auditor General
Report on Value for Money Examination

Department of Health and Children

Waste Management in Hospitals

March 2005

This report was prepared on the basis of information, documentation and explanations obtained from the public bodies referred to in the report. The draft report was sent to the Department of Health and Children and the Health Services Executive. Where appropriate, the comments received from the Department and the Executive were incorporated in the final version of the report.

Report of the Comptroller and Auditor General

Waste Management in Hospitals

I have, in accordance with the provisions of Section 9 of the Comptroller and Auditor General (Amendment) Act, 1993, carried out a value for money examination of hospital waste management.

I hereby submit my report on the above examination for presentation to Dáil Éireann pursuant to Section 11 of the said Act.

John Purcell
Comptroller and Auditor General

16 March 2005

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Potentially hazardous waste materials arising from healthcare-related activities — usually referred to as **healthcare risk waste** — requires special management and the use of costly handling and disposal arrangements to avoid causing infection or injury to those who come in contact with it, and to minimise negative impacts on the environment. Because of the scale and nature of the services they provide, hospitals also produce large volumes of **non-risk waste**.

Historically, small incinerators located on hospital grounds were used to dispose of both risk and non-risk waste. In that context, waste was generally not seen as a significant cost issue or an activity that needed to be monitored closely. Because the hospital incinerators failed to meet increasing environmental standards, they were closed in the late 1980s and early 1990s, and attention was given to finding alternative cost-effective ways to treat and dispose of risk waste. Since then, increasing costs and tighter regulations governing waste disposal provide a growing incentive for hospitals to improve the management of all forms of waste.

This examination was carried out to identify

- the level of output of waste in publicly-funded hospitals in Ireland, and the type of waste produced
- the costs associated with the collection, handling, treatment and disposal of such waste
- good practice in the management of waste in publicly-funded hospitals.

A survey of publicly-funded hospitals was undertaken to inform the examination.

Output of Waste

The total quantity of waste produced by publicly-funded hospitals in 2002 is estimated at around 27,500 tonnes. Risk waste accounted for almost one fifth of the total — just under 5,300 tonnes. Nearly all of the healthcare risk waste was produced in acute and maternity hospitals.

Acute and maternity hospitals produce a higher rate of both types of waste per bed day than community and psychiatric hospitals. In general, they provide significant levels of services that do not involve in-patient bed use, including day-case treatment, outpatient clinics and accident and emergency department treatment. They tend also to have higher levels of visiting to patients.

A comparison with waste output levels for hospitals in other jurisdictions showed that output levels were similar for large hospitals but that many small and medium-sized Irish hospitals had significantly higher waste output levels than their equivalents. This suggests there is scope for such hospitals to reduce the amounts of waste they produce.

Some hospitals have adopted strategies designed to prevent waste being produced, such as trying to persuade suppliers to reduce packaging on goods delivered, or to undertake to take back bulky packaging materials.

Although it appears that a high proportion of the materials in non-risk hospital waste could be recycled, the level of recycling by hospitals in 2002 was low. Hospitals reported having had difficulties in finding contractors willing to take recyclable materials, but a number stated that they have more recently started to recycle or increased the level of recycling. While recycling is

usually not cost free, it is generally cheaper than disposing of waste at landfill, and some hospitals reported recycling initiatives that resulted in worthwhile savings.

Costs of Waste Handling and Disposal

The direct costs incurred by hospitals in handling and disposing of waste in 2002 is estimated at €13.2 million (or €15.5 million in 2004 prices). While this is small in the context of the overall public provision for hospital services, it still represents a significant cost element for hospitals, and one that may escalate rapidly if not properly managed.

Overall, the direct unit costs incurred by hospitals in connection with the handling and disposal of risk waste were almost six times greater than the costs incurred in connection with the handling and disposal of non-risk waste — an average of €1,430 per tonne for risk waste, compared to an average of around €250 per tonne for non-risk waste. The wide difference in cost underlines the importance of ensuring there is good segregation of waste, so that only waste that needs to be treated as risk waste gets into that disposal stream.

Special colour-coded containers are used in hospitals to collect and transport risk waste, so as to minimise the risks of injury or infection. The containers are not re-used, and are destroyed along with the waste they contain.

On the basis of a comparison of costs across the hospital sector, there appears to be scope for savings in the procurement and use of containers and refuse bags. Even allowing for differences in the nature of the waste being produced, the scale of the variations suggests a need for review in some hospitals.

Following the closure of individual hospital incinerators, the Department of Health and Children and the Department of Health and Social Services in Northern Ireland jointly negotiated a contract with a service provider for the removal, treatment and final disposal of risk waste produced by publicly-funded hospitals on the island of Ireland. Almost all of the hospitals that responded to the survey avail of this service, and pay the same prices per tonne of waste, irrespective of location. In 2002, the average payment by hospitals was around €870 per tonne of risk waste.

Almost all the risk waste from publicly-funded hospitals in 2002 was treated by disinfection at the service provider's plant, and subsequently sent for landfill. Only around 2% of the risk waste produced was considered to require incineration — this is carried out in Belgium, and costs more than twice the price for disinfection treatment.

Individual hospitals reported payments to the waste contractors that collect their non-risk waste ranging from around €140 to just over €450 per tonne. (Some of the smaller community hospitals had their non-risk waste removed by local authority waste collection services, usually at a considerably lower cost.) The wide variation in the payments to waste contractors reflects the combined influence of a number of factors, including the prices charged at the landfill sites used by the waste contractors, the distances waste had to be transported, and the level of competition that existed between contractors locally.

Good Waste Management Practice

Active management of waste in all hospitals, but particularly in those that deal with large numbers of patients and procedures, will help to ensure that costs and environmental damage related to

healthcare waste are minimised, and that patients, staff and local communities are protected from harm. Some good practice ideas already in use in individual hospitals are highlighted in this report to assist hospital and other health sector managers in developing and improving their strategies for dealing with waste.

None of the hospitals or health boards visited during this examination had adopted a clear set of relevant and comprehensive targets for waste management performance. In general, their waste management plans contain little information about hospitals' and health boards' performance in managing waste e.g. the incidence of waste-related health and safety incidents, the amount of waste produced, the costs incurred, the proportion of waste recycled, etc.

A set of about twelve key measures could be used by larger hospitals in assessing, monitoring and setting targets for waste management performance. Developing plans that focus primarily on performance objectives and targets to be achieved by stated dates would provide hospital managers with a much stronger focus and incentive for improving waste management in hospitals.

The Health Services Executive has stated that waste management as it relates to environmental protection and value for money is a priority area for 2005. Plans are to be drawn up for putting a robust strategy in place.

1 Introduction

1.1 Waste arising from healthcare-related activities requires special management and handling because it may include solid or liquid waste material that is potentially hazardous to those who come in contact with it. Such material — referred to as **healthcare risk waste** — may have infectious, biological, chemical or radioactive content, or may include sharp items liable to lead to injury. Some waste materials may involve a number of risks e.g. used hypodermic needles.

1.2 Hospitals also produce large volumes of **non-risk waste**. This includes waste from domestic, cleaning and catering operations within hospitals, packaging from medical supplies and equipment, material that must be treated as confidential (such as copies of old patient medical records), and non-infectious medical and other equipment. There are also categories of healthcare waste that, in most cases, do not represent health or safety risks, but which may be regarded as offensive e.g. nappies and incontinence pads. [1]

1.3 Different procedures need to be followed to deal with the different kinds of waste. Typically, waste is segregated into appropriate streams for handling and disposal — risk waste is sent for disinfection or incineration; non-risk waste is usually disposed of in landfill sites, or where suitable, may be recycled. Care has to be taken to avoid mixing risk and non-risk waste — this could result in risk waste being handled inappropriately, possibly leading to injury or infection, or to non-risk waste material having to be handled as if it were risk waste, at greater cost than is necessary.

Responsibility for Hospital Waste Management

1.4 The Waste Management Act, 1996 enshrined the 'polluter pays' principle in Irish law. This places an onus on all producers of waste to ensure that the waste they produce is segregated, stored, transported and disposed of appropriately. The Act imposes a general duty upon every holder of waste to avoid environmental damage and prohibits a person holding waste from transferring control of the waste to a person who is not authorised to deal with it. Producers of waste therefore have a 'cradle to grave' responsibility for waste, from the point at which waste is generated until it is finally disposed of. The Act allows for penalties of up to €12.7 million and/or up to ten years imprisonment for breaches of the Act, plus potential liability for clean-up costs.

1.5 Hospital managements have a direct responsibility to ensure that all waste generated within their facilities is properly managed and disposed of so as to ensure the safety of staff, patients and members of the public, and to ensure that damage to the environment resulting from waste generating activities is kept to the minimum level achievable. Where hospitals were owned and run by health boards, responsibility for proper management of healthcare waste extended to the health boards.

1.6 The Department of Health and Children (the Department) has had a policy-setting and strategic management role in relation to healthcare waste management. The Department issued a policy statement for healthcare waste management in 1994, and since then has issued guidelines about the segregation, storage and packaging of healthcare waste on a number of occasions. In addition, the Department has joined with the Northern Ireland Department of Health and Social

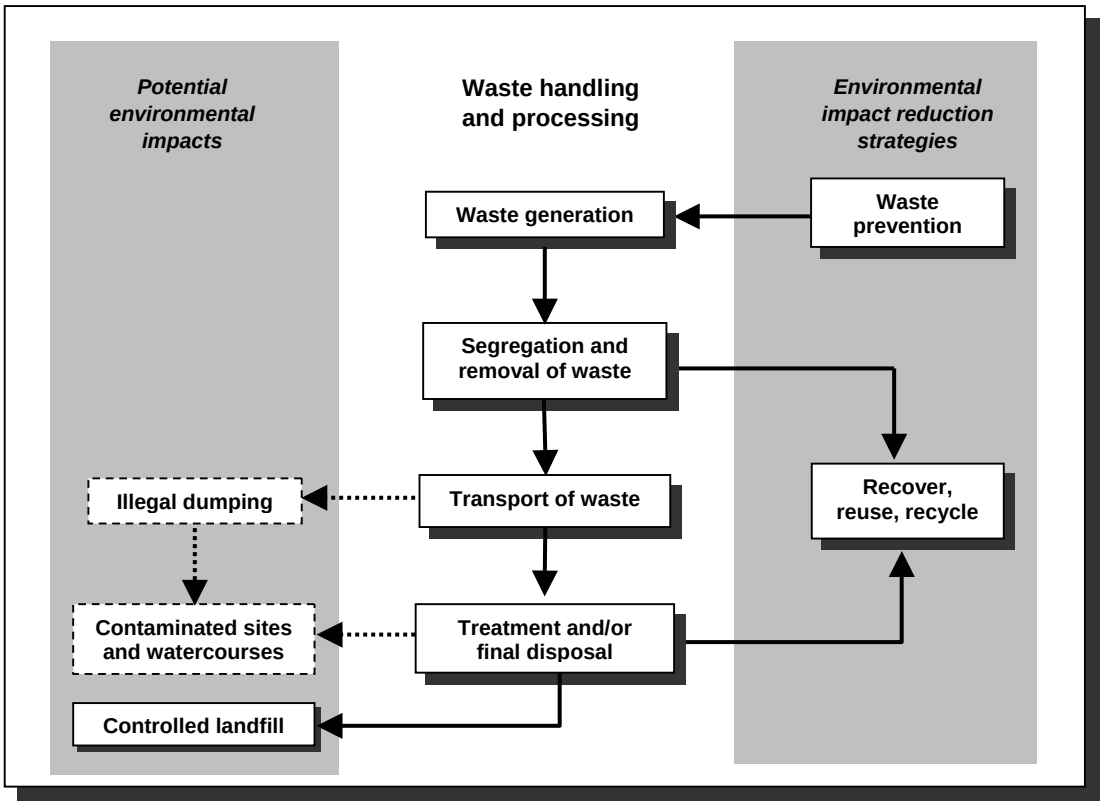
1 The types of waste included in the risk and non-risk categories are outlined in Appendix A

Services to organise procurement of a service for the collection, treatment and disposal of healthcare risk waste from publicly-funded hospitals and health agencies in the island of Ireland.

The Waste Management Cycle

1.7 The primary objectives of waste management are to ensure that all waste materials produced are handled, treated and disposed of safely, cost-effectively and in ways that impact least on the environment. The key stages and processes in the operational management and handling of waste are indicated in Figure 1.1.

Figure 1.1 The waste management cycle



Source: Adapted from *Towards Auditing Waste Management*, INTOSAI (2004)

1.8 A number of strategies may potentially be applied at different stages to minimise the quantities of waste for disposal. These include strategies to prevent the production of waste in the first place, and measures to reuse and recycle waste products and materials.

1.9 Completely eliminating waste for disposal is not feasible in most situations, so waste-generating activities are likely to lead to some environmental impacts. These are best managed in controlled treatment facilities and landfill sites. Failure to manage the waste cycle properly may result in the dumping of waste illegally and, in uncontrolled circumstances, this may in turn lead to contamination of dump sites and watercourses. Substantial illegal dumps have been discovered in a number of locations in recent years.

1.10 The capacity of licensed landfill sites in Ireland is rapidly being used up, and there is limited potential to create new landfill facilities. As a result, the charges being levied for dumping

of waste have increased significantly, and may be increased further as the available capacity decreases.

Objectives of the Examination

1.11 Despite the increasing costs and the challenges involved in the proper management of hospital waste, very little information was readily available about the volumes of waste generated in Irish hospitals, or about the costs to the health service of handling and disposal of waste. Some useful information was available about risk waste, but much less was known about the management of non-risk waste in Irish hospitals.

1.12 This examination was carried out to establish

- the quantity and type of waste produced in publicly-funded hospitals
- the costs associated with the collection, handling, treatment and disposal of such waste
- good practice in the management of waste in publicly-funded hospitals.

Scope of Examination

1.13 The examination set out to look at waste management in publicly-funded hospitals. Waste management practice in private hospitals was not examined.

1.14 The primary focus was waste management at individual hospital level, but the role of the health boards in relation to the planning and co-ordination of waste management at regional level was also examined. The strategic management role of the Department in relation to waste management in hospitals was also included within the scope of the examination.

1.15 The examination did not look at how radioactive waste is managed. Only a limited number of hospitals use radioactive material, and the quantity of radioactive material used is low. Furthermore, all locations using such materials are licensed and monitored by the Radiological Protection Institute of Ireland, which has responsibility nationally for regulation and monitoring in relation to ionising radiation.

Methodology

1.16 The examination was largely based on responses to a survey questionnaire provided by managers of 111 publicly-funded hospitals, including all of the large Dublin voluntary hospitals. Appendix B outlines how the survey was administered and presents the main survey results for individual hospitals.

1.17 Recognising that different types of hospitals are likely to have different requirements in relation to waste management, results of the survey were generally analysed by reference to four hospital types — acute hospitals, maternity hospitals, community hospitals and psychiatric hospitals.

1.18 We sought to examine trends in hospital waste management by looking at the experience in hospitals in the years 2000, 2001 and 2002. In practice, lack of detailed records at hospital level meant that it was feasible to estimate the level of output of waste and the costs of waste handling only for 2002.

1.19 The examination was carried out by staff of the Office of the Comptroller and Auditor General. In administering the survey questionnaire, the examination team was assisted by technical staff members nominated by the health boards and the Eastern Regional Health Authority (ERHA).

1.20 In addition to the survey, the examination team met with relevant officials of the Department, the health boards and the ERHA to discuss the policies, practices and systems in place for waste management in publicly-funded hospitals. Visits were also made to ten hospitals (listed in Appendix C) to see how waste is managed in practice, and to hear the views and experiences of personnel dealing with the handling and disposal of waste in hospitals.

1.21 The assistance and co-operation of hospital, health board and Department staff in carrying out this examination is appreciated.

Structure of the Report

1.22 The structure of the report reflects the objectives of the examination. Chapter 2 examines the quantity of waste produced by hospitals, analysed by type of waste and type of hospital. Chapter 3 looks at the costs involved in the handling of waste. Chapter 4 looks at waste management processes to identify examples of good practice that might be adopted by hospitals generally, so as to improve performance in relation to the safety of staff, patients and communities, the minimisation of environmental impacts and the cost of handling and disposal of waste.

2 Production of Waste in Hospitals

2.1 Historically, both risk waste and non-risk waste produced within hospitals were usually disposed of on-site in hospital incinerators. In that context, waste was generally not seen as a significant cost issue, and there was little interest, at either local or central levels, in compiling data about waste output. Following the closure of hospital incinerators in the late 1980s and early 1990s, disposal of risk waste became a particular problem. In the process of developing a strategy for dealing with such waste, the Department began centrally to compile data about the quantities of hospital risk waste being generated, but little attention was given to monitoring the amount of hospital non-risk waste being generated.

2.2 This chapter examines the quantity and types of waste generated by Irish hospitals. It also explores some of the factors that influence the amount of waste produced in hospitals, and compares hospitals in terms of the volumes of waste produced. Some international comparisons are also made.

2.3 The extent to which hospitals recycle waste material was also examined. This influences the quantity of waste that has to be disposed of.

Overall Quantity of Hospital Waste

2.4 It is estimated that publicly-funded hospitals produced a total of around 27,500 tonnes of waste for disposal in 2002 (see Figure 2.1). It is estimated that around 5,300 tonnes of the waste produced was categorised as risk waste and that four times that amount of non-risk waste was generated.

Figure 2.1 Estimated quantity of waste generated by publicly-funded hospitals, 2002

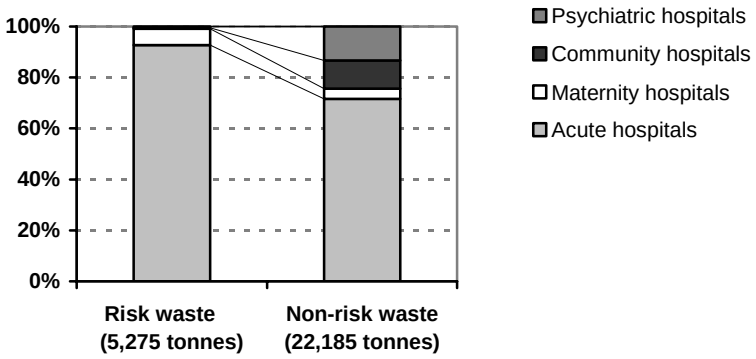
Type of hospital	Risk waste	Non-risk waste	Total
	Tonnes	Tonnes	Tonnes
Acute	4,890	15,870	20,760
Maternity	335	900	1,235
Community	25	2,470	2,495
Psychiatric	25	2,945	2,970
All hospitals	**5,275**	**22,185**	**27,460**
	19%	**81%**	**100%**

Source: Analysis by Office of the Comptroller and Auditor General

2.5 Risk waste from publicly-funded hospitals accounted for an estimated 1.6% of the total national output of hazardous waste. Hospital non-risk waste accounted for an estimated 2% of the commercial waste produced nationally.[2]

2.6 Acute and maternity hospitals generated almost all of the risk waste produced by publicly-funded hospitals. Community and psychiatric hospitals generated less than 1% of the risk waste produced, reflecting the nature of the services and treatment provided in those hospitals. By contrast, community and psychiatric hospitals are estimated to account for more than a quarter of the non-risk waste produced (see Figure 2.2.)

Figure 2.2 Distribution of hospital waste, by type of waste and by hospital sector, 2002



Source: Analysis by Office of the Comptroller and Auditor General

Output of Waste per Bed Day

2.7 Hospitals of similar type vary considerably in size and in scale of activity. This influences significantly the volume of waste produced and therefore has to be taken into account in making comparisons between hospitals in the amount of waste generated.

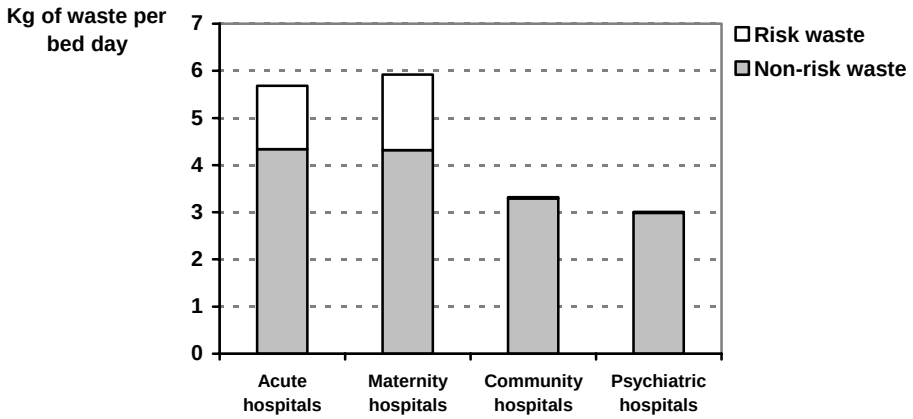
2.8 Measuring the overall scale of activity of an individual hospital is complex. The number of in-patient beds is a simple indicator of hospital size, but this does not reflect differences in bed utilisation rates, which vary significantly. The number of 'bed days used' (BDU) each year is a better indicator of activity levels in individual hospitals.

2.9 In the acute sector, the range of activities in a hospital typically includes the treatment of patients admitted overnight (in-patients) or as day-patients, and outpatient treatments and consultations. The volume of waste likely to be associated with each kind of treatment varies, so the mix of hospital services may influence the output of waste. However, since the volumes of in-patient and non in-patient services provided in individual acute hospitals tend to be broadly related, it seems reasonable to use the number of in-patient 'bed days used' as an indicator of the relative overall scale of activity in hospitals when analysing variations in waste output between hospitals.

2 The Environmental Protection Agency has estimated that a total of 323,000 tonnes of hazardous waste was produced in Ireland in 2001 (***National Waste Database Report 2001***), and that the total volume of commercial waste in 2002 was 1.13 million tonnes (***National Waste Database Interim Report 2002***).

2.10 Figure 2.3 shows the average amount of waste generated per BDU in 2002 for each hospital sector. Total waste produced was highest for the maternity hospitals, at an estimated 5.9 kg per BDU. Acute hospitals produced an estimated average of 5.7 kg per BDU in 2002. The average output of waste in community and psychiatric hospitals was significantly lower, at around 3 kg per BDU.

Figure 2.3 Average waste output per bed day used, by type of waste and by type of hospital, 2002



Source: Analysis by Office of the Comptroller and Auditor General

2.11 About half of the difference in the average output of waste per BDU between hospital sectors is related to the production of a significant amount of risk waste in acute and maternity hospitals, and almost negligible outputs in the community and psychiatric sectors.

2.12 When average non-risk waste output levels are compared, the differences between sectors are less marked — the estimated average output of non-risk waste per BDU varied from 3 kg in psychiatric hospitals to around 4.3 kg in maternity hospitals. The variation in average output of non-risk waste per BDU reflects differences in the type of patient served and the treatment typically provided. For example

- Many acute hospitals have busy outpatient and accident and emergency departments, generating extra waste not related to in-patient bed occupancy. By comparison, community and psychiatric hospitals tend to have fewer patients attending on an out-patient basis.

- The average number of visits per patient in acute and maternity hospitals is higher than in community and psychiatric hospitals, and visits may often be longer when patient conditions are acute. Gifts brought by visitors, and use by visitors of hospital facilities such as restaurants, shops, vending machines and toilets, can contribute to higher levels of non-risk waste per BDU.

International Comparisons of Waste Output Levels

2.13 Two studies carried out in other jurisdictions provide comparable data about the levels of output of waste in hospitals.

- A study[3] was carried out in 1993/1994 in Germany to identify the hospital that was performing best in managing waste. Hospitals were invited to answer a voluntary postal survey questionnaire. A total of 168 replies were received, but hospitals that were confident they were good performers may have been more likely to reply than hospitals that were less confident they were managing waste well. As a result, the data presented in the study probably provides a 'best performance' benchmark for what was achievable at that time in waste management in German hospitals, rather than the average performance of all German hospitals. How the performance of German hospitals has changed in the intervening years is not known.
- The New South Wales Audit Office carried out an audit in 2002 of the management of hospital waste in four general hospitals. The hospitals included in the study were selected on the basis that they were broadly representative of the different sizes of general hospitals in the state.[4]

2.14 Both the German and New South Wales results focused on general hospitals, providing a mix of kinds of treatment. Consequently, data for Irish hospitals used in the comparison was restricted to hospitals that also provide a mix of treatments — specialist acute hospitals (e.g. orthopaedic, paediatric and cancer treatment hospitals) were excluded. The hospitals included in the comparison also had to have provided data for both risk and non-risk waste output. On that basis, results were available for 24 acute hospitals and 2 community hospitals.

2.15 Figure 2.4 compares the results for the German and the New South Wales studies with the data reported by Irish hospitals. The main findings are

- The patterns in the Irish data suggest that there was considerable variation between small and medium-sized hospitals (up to around 150,000 BDU per year) in the average output of waste generated. Larger hospitals tended to be more similar in the amount of waste produced — between 5 and 7 kg per BDU.
- The German and New South Wales studies both indicate a positive relationship between the output of waste per BDU and the size of hospitals i.e. bigger hospitals tend to produce more waste per BDU than smaller hospitals. A similar pattern is evident for Irish hospitals, based on those that produced least waste in each size category.
- The New South Wales hospitals matched the 'best performance' levels of German hospitals of a similar size.
- Some Irish hospitals also matched the performance of similar-sized German and New South Wales hospitals, but many produced significantly higher levels of waste per BDU.

In general, the analysis suggests that there is scope for many Irish hospitals — particularly small and medium-sized acute hospitals — to reduce the amount of waste they generate.

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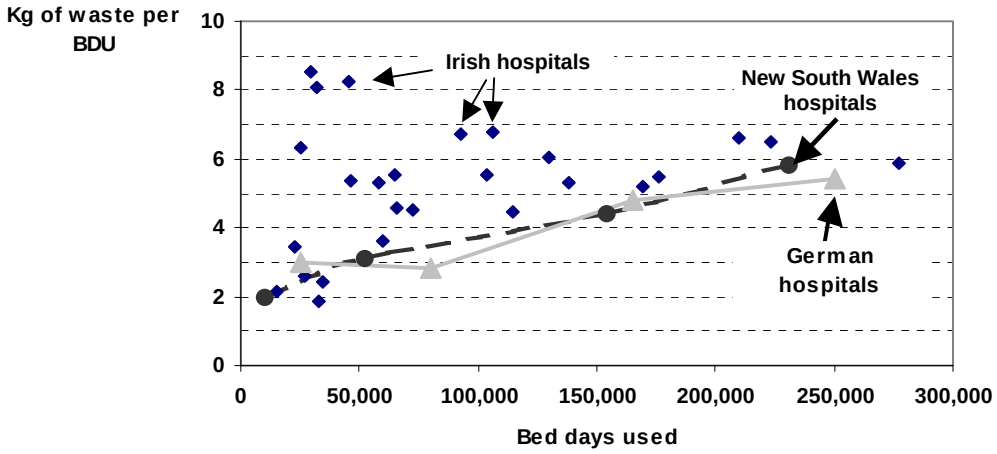
3 Hartlieb and others (1994), *Environmental Protection in German Hospitals*, **Hospital Surveys**, vol 63, pp 760-763.

4 New South Wales Audit Office (2002), ***Managing Hospital Waste***

Figure 2.4 Average waste per bed day used in Irish hospitals (2002), German hospitals (1993) and New South Wales hospitals (2002), by size of hospital



Source: Analysis by Office of the Comptroller and Auditor General

Reducing the Output of Waste

2.16 A range of strategies are available to hospital managements seeking to reduce the amount of waste they produce for disposal. These include strategies designed to prevent the generation of waste, and strategies for segregating materials suitable for recycling from the waste stream.

Waste Prevention

2.17 Waste prevention measures in hospitals aim to reduce the amount of waste being generated within the hospital precincts. Some examples of the kind of measures that have been implemented in Irish hospitals are mentioned in good practice note 1.

Good practice note 1

Cutting down the amount of waste produced

Some hospitals have tried to cut down the amount of waste material they generate by

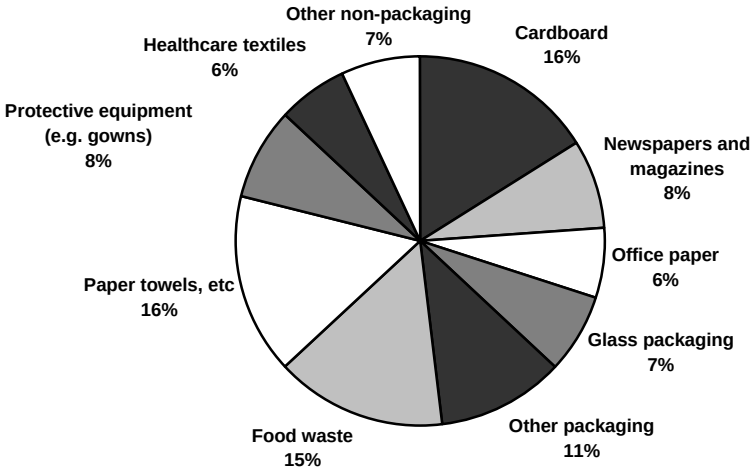
- ensuring that all purchasing contracts include clauses covering how packaging will be dealt with
- asking their suppliers to cut down on the amount of packaging they use when delivering goods e.g. supplying medical and laboratory equipment, drugs and some food items without individual cardboard packaging, but retaining inner plastic wrapping
- requiring suppliers to take back bulky packaging materials, such as pallets, cardboard and plastic outer wrapping, as a condition of purchasing agreements
- placing notices asking visitors, when bringing gifts to patients, not to include items that result in bulky or heavy waste
- installing equipment in hospital kitchens to filter cooking oil, thereby doubling its useful life, and saving both on the cost of purchasing cooking oil and on paying for its disposal

2.18 For waste prevention strategies to achieve their full potential, they need to be adopted by everyone in the hospital community e.g. they may require liaison between various sections of hospital administration such as procurement, stores, materials management and hospital services personnel. Furthermore, joint procurement initiatives across a number of health agencies may be required to generate sufficient buying power to persuade some suppliers to change their packaging policies. Even then, the quantities being purchased may be insufficient to influence international suppliers of some products.

Recycling of Non-Risk Waste

2.19 The Environmental Protection Agency has reported the findings of a 2001 study of the composition of non-risk waste produced in a large acute hospital. The waste was physically divided into different categories and each type of waste was then weighed. Figure 2.5 presents a percentage distribution of the waste by type of material.

Figure 2.5 Composition of non-risk waste in one acute hospital, 2001



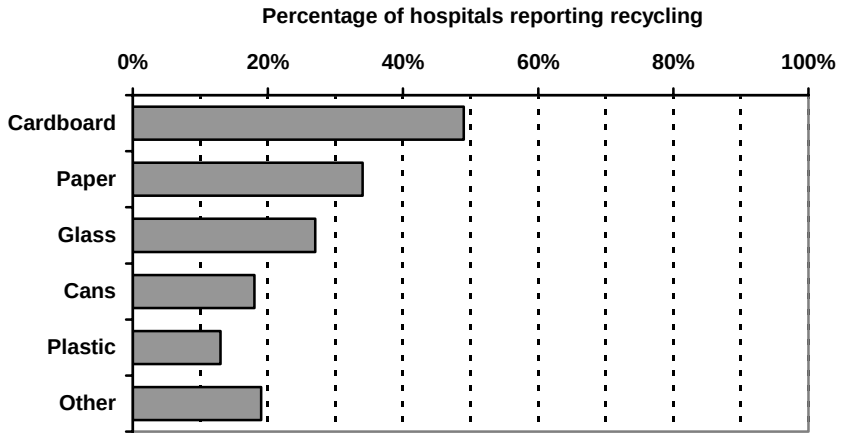
Source: Environmental Protection Agency, ***National Waste Database Report 2001***

2.20 The Environmental Protection Agency's findings were based on an examination in only one acute hospital, and so cannot be regarded as an estimate of the composition of non-risk waste output for all hospitals. However, in the hospital examined, up to 63% of the non-risk waste was categorised as material that potentially is suitable for recycling in one form or another i.e. cardboard, newspaper and magazines, office paper, glass, other packaging and food waste. This suggests that there may be scope for significant recycling of waste from hospitals.

2.21 As part of the survey undertaken for this examination, hospitals were asked to indicate what kinds of waste materials they recycle, and the quantity of material recycled. Figure 2.6 shows the percentage of hospitals that reported they recycle, and the kinds of waste materials involved.

2.22 Almost half the hospitals surveyed reported that they now recycle cardboard. About one third report they recycle paper but in some cases, this relates to office paper only, and may involve the shredding of confidential documents before they are removed from hospital premises.

Figure 2.6 Percentage of hospitals reporting recycling of non-risk waste materials in 2002, by type of material



Source: Analysis by Office of the Comptroller and Auditor General

2.23 In some of the hospitals visited, confidential paper waste (e.g. copies of medical records) was shredded and recycled but normal office paper was not. Other hospitals had a two-tier system in place to recycle confidential paper and office paper. In one hospital, all office paper was treated as confidential, shredded and recycled.

2.24 Only five hospitals were able to provide data relating to quantities of waste recycled. (A number stated that they had only started recycling during 2002 or 2003 and that they did not yet have reliable data about quantities.) For the hospitals where data is available, it was noted that

- The quantity of waste sent for recycling ranged from 2% to 32% of total non-risk waste.
- In terms of waste output per BDU, recycled waste varied from 0.1 kg to 1.63 kg per BDU.
- The variation in the amount of waste recycled by individual hospitals related mainly to whether or not the hospital recycles cardboard and paper. One hospital reported recycling 42 tonnes of cardboard in 2002 — this equated to 1.5 kg of cardboard per BDU, and about 13% of total non-risk hospital waste. Another hospital recycled 39 tonnes of cardboard — 0.5 kg per BDU, and 18% of total non-risk waste generated. (The Environmental Protection Agency estimated that cardboard accounted for 16% of hospital non-risk waste.)

2.25 Based on the survey responses received, it appears that there is scope for a significant increase in the level of recycling of waste materials in Irish hospitals. However, during visits to hospitals as part of this examination, hospitals managers reported a number of difficulties in developing systems for recycling non-risk waste.

- Hospitals in some areas have difficulty in finding contractors willing to accept the full range of recyclable material. In addition, the market for recyclable products can fluctuate during the year. Some hospitals were informed at short notice by contractors that materials previously accepted for recycling would no longer be accepted.
- There may be a perception among recycling companies that any kind of hospital waste is risky to handle. For example, problems were encountered by some hospitals in recycling glass because some contractors refuse glass that had contained medicines, and will only accept ‘domestic’ glass e.g. from the kitchens. A number of hospitals dealt with this

Good practice note 2

Recycling suitable material

Some hospitals have already significantly reduced the amount of waste they send to landfill by recycling. As well as reducing the environmental impact of waste disposal, this can also result in saving money that can be used instead for other hospital services.

Some hospitals have consulted with their local authorities about developing a comprehensive recycling strategy for their non-risk waste.

Others examine the likely costs of disposal of waste materials generated from equipment and other supplies they purchase. Where it is practical and cost effective to do so, preference is given to purchasing products that result in waste materials that are easy to recycle, in preference to alternative products where the waste generated is less recyclable.

In 2002, food waste from some hospitals in the Eastern region was collected and sent for deep burial in landfill facilities at a cost of around €30 per bin. Since September 2003, the waste contractor serving the hospitals started sending food waste instead to a licensed treatment facility in Northern Ireland for composting, and now charges €18 per bin for the service — a saving of 40%.

problem by informing the contractor about the contents of the glass and providing assurance that any residual contents did not represent a health or environmental risk; in other cases, glass was rinsed prior to being recycled and this was acceptable to the contractor.

- Awareness of possibilities for recycling among staff had contributed to the development of recycling programmes in some hospitals. In areas where recycling services were provided for private domestic use, hospitals also tended to have more developed recycling programmes. On the other hand, some hospitals had encountered a negative attitude to recycling among staff and found that the benefits of recycling have to be demonstrated. The active support of hospital management and an emphasis on recycling in training programmes were considered important for success in developing a recycling culture.
- Finding space for a range of recycling bins was a problem in some hospital wards. Where space is limited, a single bin for all (dry) recyclables is situated at ward level, with subsequent separation of materials in a central waste handling area.
- Some kinds of hospital waste do not represent risks of infection, but are nonetheless potentially hazardous e.g. electrical equipment and computer components, fluorescent light tubes, and old beds or lifting equipment with oil-filled hydraulic systems. Special arrangements may have to be made for their disposal separately from other forms of non-risk waste. In some cases, the component materials may be suitable for recycling, but it may be difficult and/or expensive to source specialist companies to carry out the recovery work and ensure the various waste materials are treated appropriately.

Recycling of Risk Waste

2.26 Recycling of risk waste material at hospital level is not feasible because of the infectious nature of the waste. Because of its nature, a small proportion of the material requires incineration. However, the bulk of the risk-waste material is removed from hospitals under a common national contract, for shredding and disinfection. Following treatment, the waste material should no longer be harmful, and recyclable material can potentially be extracted.

2.27 As part of the national contract for healthcare risk waste disposal, the contractor is expected to recycle as much of the non-risk waste material as possible. The current contract specifies that by 2006, a quarter of the waste material collected should be recycled. An incentive scheme is to be developed so that, for quantities above the target 25%, the contractor and the hospitals will share any reduction in the payment of landfill charges.

2.28 Tests of the feasibility of a number of methods of recovering materials for recycling from the risk waste stream have been carried out, but a suitable methodology has not yet been identified.

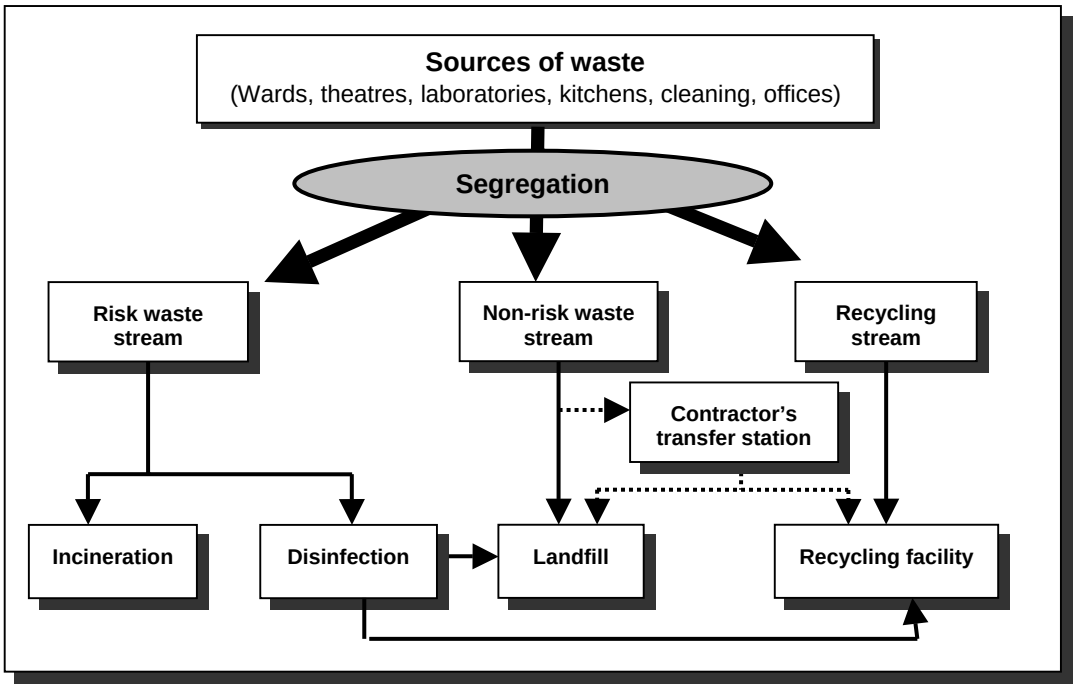
3 Handling and Disposal of Hospital Waste

3.1 The primary economic objective in the disposal of hospital waste is, for each kind of waste, to use the least expensive means of handling, treatment and disposal that is consistent with the safety of hospital staff, patients and visitors and with minimising the environmental impact. Different solutions deliver the least cost outcomes for different kinds of waste, so careful segregation of waste materials into different streams — including recovery of materials for recycling — helps to ensure that only the required minimum amount of waste is handled in high cost ways.

3.2 Figure 3.1 outlines the different streams into which hospital waste may be segregated, and the disposal methods required under the Department's policies and guidelines. Hospitals are required to ensure that

- certain categories of risk waste (e.g. cancer treatment drugs and human tissue) are sent for incineration
- all other categories of risk waste (e.g. blood stained items, blood administration sets, incontinence wear from patients with known or suspected infections) are sent for disinfection, following which materials may be disposed of safely in controlled landfills; some suitable materials, such as plastics and metals, may potentially be recovered for recycling, following disinfection treatment.
- non-risk waste is recycled or, where this is not possible, is sent to controlled landfill for disposal

Figure 3.1 Sources and destinations of hospital waste



Source: Office of the Comptroller and Auditor General

3.3 This chapter looks at the costs incurred by hospitals in the handling and disposal of waste, and the extent to which costs vary from hospital to hospital. The main factors that influence the costs of handling and disposing of waste are also examined.

Overall Cost of Waste Handling and Disposal

3.4 As part of the survey, hospital managers were asked to identify and report how much they spent directly on arrangements for handling risk and non-risk waste within their hospitals, and on the removal, treatment (where required) and final disposal of each kind of waste. Based on the results of the survey, it is estimated that hospitals directly spent around €13.2 million in 2002 on the handling and disposal of waste (see Figure 3.2).

Figure 3.2 Estimated expenditure on handling and disposal of hospital waste (including VAT), by hospital sector, 2002

Hospital sector	Handling and disposal costs (€ 000's)		
	Risk waste	Non-risk waste	All waste
Acute	7,000	4,140	11,140
Maternity	470	190	660
Community	30	370	400
Psychiatric	30	920	950
Total	**7,530**	**5,620**	**13,150**
	57%	**43%**	**100%**

Source: Office of the Comptroller and Auditor General

3.5 While the direct expenditure on handling and disposing of waste in public hospitals is small in the context of the overall public provision for hospital services, it still represents a significant cost element for hospitals, and one which may escalate if not properly managed. Furthermore, hospitals incur other significant costs in connection with waste management, but which cannot readily be identified. These include

- employment costs related to time spent by hospital porters and grounds staff involved in the delivery and removal of waste bins and bags, and the operation of waste handling equipment
- the costs of employing and accommodating staff who are involved (full time or part time) in the administration and management of waste
- depreciation costs of equipment owned by some hospitals, and used in handling and storing waste, such as compactors, balers and vehicles (other hospitals rent such equipment from waste contractors).

The internal financial reporting systems used in hospitals should include such expenses in accounting for the overall cost of the waste management function (including management of recycling). This would facilitate the proper monitoring of expenditure on the function. Central agreement on the approach to be taken by all hospitals in arriving at an overall cost of the waste management function would allow for meaningful benchmarking of expenditure.

3.6 The costs of handling and disposing of waste increased significantly between 2002 and 2004. Charges for removing risk waste increased during 2002, and the effect of the cost increase carried over into 2003. Charges for access to landfill facilities also increased significantly in many areas in 2003 and 2004. If the volume and composition of hospital waste in 2004 was similar to that in 2002, the combined effect of the cost increases would have resulted in the direct expenditure by hospitals on waste handling and disposal increasing by around 18%, to an estimated €15.5 million a year.

Relative Costs for Waste Handling and Disposal

3.7 While risk waste accounted for less than one fifth of the volume of hospital waste in 2002, it accounted for more than half of the expenditure.

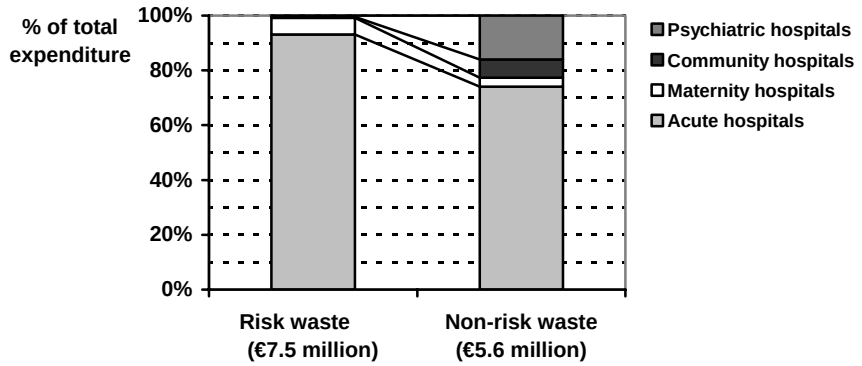
3.8 In unit cost terms, hospitals spent an estimated average of around €1,430 per tonne to handle and dispose of risk waste, compared to an estimated average of just over €250 per tonne for the handling and disposal of non-risk waste — a ratio of 5.7:1. This difference in unit costs underlines the economic importance of ensuring that waste is properly segregated, so that only waste that needs to be treated as risk waste is channelled towards disinfection or incineration.

Costs by Hospital Sector

3.9 Figure 3.3 shows the disposal costs of risk and non-risk waste streams by hospital type. The acute and maternity hospitals together account for almost all of the cost of risk waste disposal and for three-quarters of the cost of non-risk waste disposal.

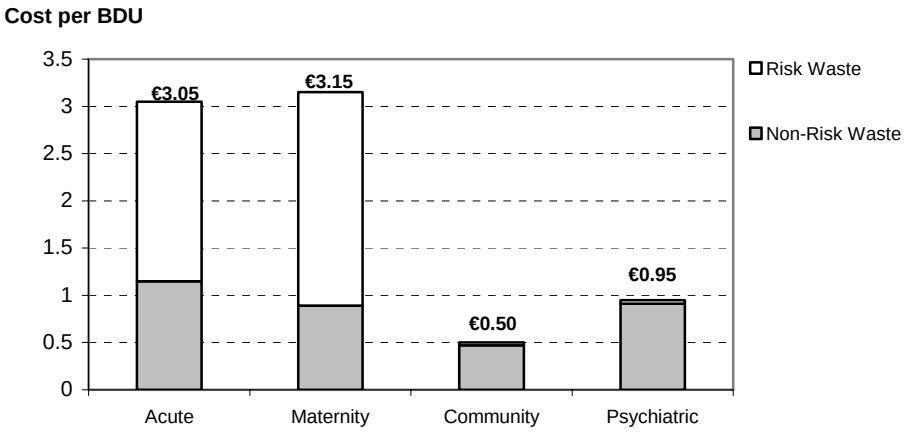
3.10 Figure 3.4 shows the average cost of handling and disposal of waste per BDU for each hospital sector in 2002. Average expenditure was highest in the acute and maternity sectors, mainly reflecting the high volumes of risk waste being produced.

Figure 3.3 Distribution of expenditure on disposal of waste, by type of waste and by sector, 2002



Source: Office of the Comptroller and Auditor General

Figure 3.4 Average cost of disposal of waste, by hospital sector, 2002



Source: Analysis by Office of the Comptroller and Auditor General

3.11 The estimated cost of handling and disposing of non-risk waste in community hospitals (about 50 cent per BDU) is only about half the estimated cost for other hospital categories. Many community hospitals are very small, and in 2002, may have had their non-risk waste collected by the area local authority service for a nominal annual fee. By comparison, other kinds of hospitals are generally larger, and tended to pay for refuse collection at more commercial rates.

Costs Elements for Risk Waste

3.12 The costs incurred directly by hospitals in relation to risk waste comprise two main elements. These are the costs associated with

- safe and appropriate containment of risk waste at the point of production and during handling and storage of the waste while on hospital premises
- removal of risk waste from hospitals, and its subsequent treatment and final disposal.

Containers for Risk Waste

3.13 There are legal requirements about the types of containers that must be used when different forms of hazardous waste (including healthcare waste) are being handled and transported.

3.14 The Department's guidelines on segregation, packaging and storage of waste[5] set out a detailed scheme indicating what kinds of containers should be used for each type of waste. The guidelines also include a standard colour-coding system designed to minimise confusion about what can be placed in each type of container, and how containers should be disposed of. For example, the guidelines require that

- all kinds of containers used for hospital risk waste (bags, rigid bins or boxes) should be yellow in colour
- bags, and bins or boxes with yellow lids, should be sent for disinfection treatment

5 Department of Health and Children, **Segregation, Packaging and Storage Guidelines for Healthcare Risk Waste**, third edition, April 2004

■ bins or boxes with purple or black lids should be sent for incineration.

3.15 Risk waste containers, with their contents, are removed from hospital premises in larger locked yellow bins, which are cleaned and disinfected and then brought back to hospitals for re-use. Similarly, outer containers used to move the yellow containers around hospitals are usually disinfected and re-used.

3.16 The containers used to package healthcare risk waste at the point where waste is generated are destroyed along with the waste they contain. Consequently, the cost of purchasing the containers must be included in estimating the overall cost of handling and disposing of waste. It should be noted also that the weight of the containers increases the weight of waste being disposed of, which also adds to the cost.

3.17 Although the cost of containers may be considerable, using the right kind of containers and minimising the amount of waste handling reduces the likelihood of injuries to workers engaged in handling waste and the risks of injury or infection during the transportation of waste. In the hospitals visited during this examination, the numbers of needlestick injuries each year that were attributed to poor waste segregation or handling practices were low.

Unit Cost of Risk Waste Containers

3.18 The prices charged in 2002 by the main suppliers for the different types and sizes of risk waste containers were examined. List prices for similar products varied between suppliers, and different rates of discount applied to different customers. Indicative prices for selected containers are shown in Figure 3.5.

Figure 3.5 Indicative prices for healthcare risk waste containers, VAT inclusive, 2002

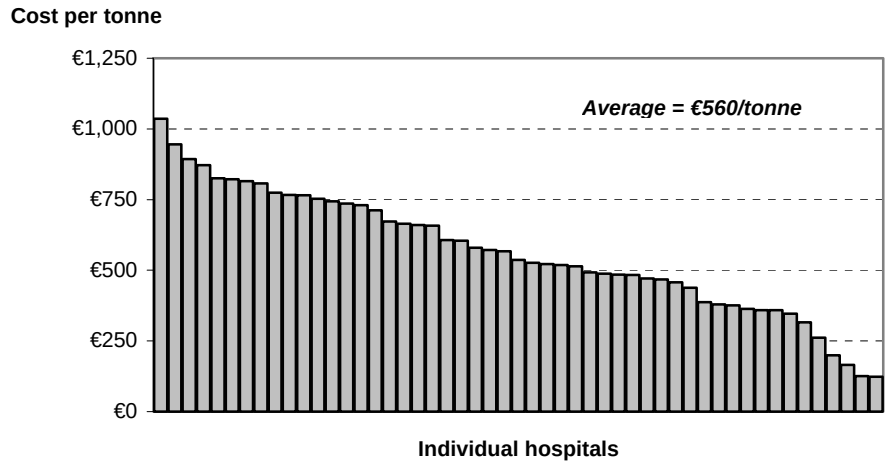
Type of container	Capacity of container	Unit cost
	Litres	€
Plastic bags (yellow)		0.14
Standard yellow bins	30	6.85
	60	7.40
Sharps containers	0.6 -1	1.45
	5	1.75
	11.5	3.20
	22	5.65
Cytotoxic waste[a] containers	5	1.75
	11.5	3.20
	22	6.30
Placenta containers	5	2.00
	10	4.00

Source: Analysis by Office of the Comptroller and Auditor General

Note: [a] Waste produced while using drugs to treat cancer.

3.19 Based on the data supplied by acute and maternity hospitals[6] in response to the survey questionnaire, the cost of containing risk waste in 2002 is estimated to have averaged around €560 per tonne. The cost varied between hospitals from around €125 per tonne to over €1,000 per tonne (see Figure 3.6).

Figure 3.6 Cost of containers per tonne of risk waste in 2002, in acute and maternity hospitals (n=51)



Source: Analysis by the Office of the Comptroller and Auditor General

3.20 Some of the larger acute hospitals reported spending up to twice as much as others in containing waste. For example

- The estimated cost of containers for risk waste ranged from €380 per tonne to €745 per tonne — almost a 100% difference — in four of the five major Dublin teaching hospitals.
- There was similar variation — from €480 to €822 per tonne — between large regional hospitals.

3.21 The estimates of cost per tonne are based on amounts that hospitals reported they spent on buying risk waste containers in 2002. In some cases, the value of containers bought in 2002 may differ from the value of containers used in the year e.g. where bulk supplies purchased in 2001 were drawn down in 2002. However, it seems unlikely that differences in purchasing and stock use could explain the degree of variation in the average cost of containers per tonne of waste. Differences in how containment of risk waste is managed are more likely to explain the variations between hospitals in the average expenditure per tonne.

3.22 The composition of the risk waste produced in each hospital should be the main determinant of the unit cost of containment of waste. For example, where most of the risk waste produced is dry, bulky material that does not represent risks of 'sharps' injuries, standard yellow plastic bags — costing around 14c each — will usually be the appropriate container, and the average unit cost of containment of risk waste may be quite low. Using standard rigid yellow bins where yellow plastic bags would be suitable would result in container costs being more than fifty times greater, for a given volume of waste.

6 Acute and maternity hospitals produce 99% of hospital risk waste.

3.23 In order to minimise costs, containment of risk waste requires active management.

- As far as possible, all the required containers should be available reasonably close to where staff work. This should allow them always to place waste in the appropriate least-cost container. However, it may not always be feasible due to space constraints to place a full range of containers in each work area.
- Different sizes of containers are appropriate in different circumstances, but encouraging the use of larger sizes could result in a significant economy of scale. Small containers may have to be used (and removed immediately) where there are risks of waste spills or odours, but in other situations, it may be feasible to use larger containers and remove them less often. Where it is feasible to do so, using 60 litre bins instead of 30 litre bins could result in an estimated saving of as much as 46% in the cost of containment of a given volume of waste. Similarly, using larger sizes of sharps containers could generate savings of 6% to 13%.
- For health and safety reasons, the guidelines recommend that risk waste containers should not generally be filled beyond three-quarters capacity or the manufacturer's fill line. The general guideline for plastic bags is to fill to two-thirds capacity. These limits help reduce the risk of spills, breakage of containers and lifting injuries. However, if containers are under-filled relative to these guideline limits, the cost of containment increases significantly. For example, if 60 litre bins are filled to 60% capacity on average, rather than the target 75%, the cost of containment of a given volume of waste is increased by more than a quarter. Consequently, monitoring the utilisation of container capacity could help to identify where savings could be made.

Good practice note 3

Saving on the cost of risk waste containers

Opportunities for savings in the cost of containers for risk waste may be identified by periodic review of arrangements for collecting waste in individual work areas. Reviews should take account of the kind of waste being produced, and the available space. The following are some of the strategies that could help to reduce costs.

- Ensure staff have easy access to the kinds of bags and bins that are most appropriate for the waste they handle.
- Include bags or bins for recyclable materials.
- Select the bin sizes that are most cost-effective in each situation.
- Monitor how full bins are when they are being removed. If they are often underfilled, consider changing the collection frequency.
- Inform staff about the level of costs involved in using different kinds of containers and about the kind of savings that can be achieved by using the appropriate least-cost container for waste materials.

Removal and Treatment of Risk Waste

3.24 For many years, all hospital waste — risk and non-risk — was usually incinerated on-site in each hospital's own incinerator. By the early 1990s, many hospital incinerators no longer met all the statutory environmental standards and the cost of upgrading the incinerators was considered to be uneconomic. As a result, most hospital incinerators were closed in the early 1990s. The last hospital incinerator ceased operation in 1998.

3.25 In order to dispose of hospital risk waste, the Department put in place arrangements for the exportation and incineration of risk waste in the UK. These arrangements lasted until the end of 1997. Thereafter, risk waste was sent for incineration in Belgium and the Netherlands.

3.26 Exporting large volumes of waste for disposal was considered not to be a viable long-term option because of the danger that the countries receiving waste could, possibly at short notice, prohibit the importation of hazardous waste. The Department of Health and Children and the Northern Ireland Department of Health and Social Services established a Joint Waste Management Board (JWMB) in 1995, with the intention of putting in place permanent arrangements for the collection and treatment of risk waste for medical service providers in the whole island of Ireland.

3.27 The JWMB researched the feasibility of using technologies other than incineration. The Board concluded that disinfection was a better means of treating most hospital risk waste. This involves the shredding of the waste (and the containers), with the shredded material then being heat-treated using steam. Following disinfection, the waste material is baled and disposed of at landfill.

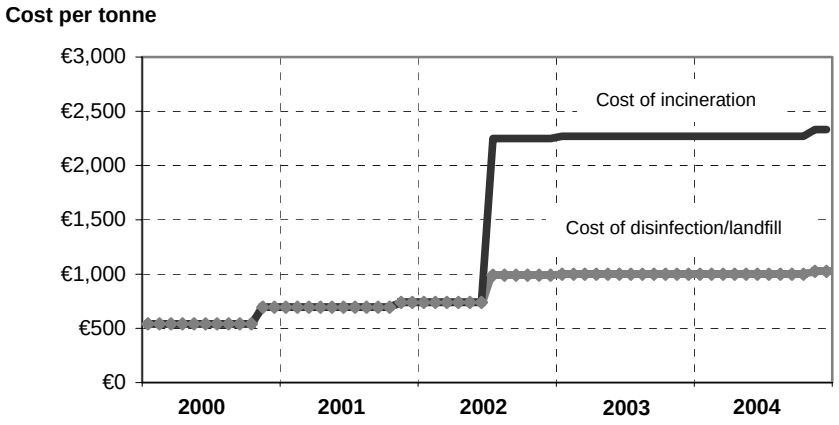
3.28 In 1996, the JWMB tendered for a draw-down contract for the collection, treatment and disposal of risk waste produced in all publicly-funded hospitals on the island of Ireland. Sterile Technologies Ireland (STI) won the tender competition and was awarded the contract for a 10-year period. STI constructed a waste treatment plant to carry out the disinfection process. The plant became operational in 2000. Waste that requires incineration is still sent to Belgium.

3.29 The arrangements with STI provided for hospitals to enter into individual contracts with STI for the removal of risk waste from their premises. A common national price structure was agreed — all hospitals pay the same amount for removal of waste, irrespective of hospital location.

3.30 Almost all of the publicly-funded hospitals availed of the STI service at the agreed price per tonne. However, unforeseen cost increases (e.g. in landfill charges for disinfected waste, and in costs for export and incineration of waste) and tight pricing arrangements in the contract meant that STI could not recover its costs through the agreed charges, and it incurred significant trading losses. As a result, the contract between STI and the JWMB was terminated by agreement in June 2002, and the service was retendered. In the meantime, STI continued to provide services at agreed higher prices. STI subsequently won the new tender competition — on price terms that were more favourable to the company — and was awarded a new 10-year contract effective from October 2003.

3.31 For the hospitals availing of the STI contract, the charges incurred for the removal, treatment and disposal of risk waste have increased significantly since 2000 (see Figure 3.7). The same rate was charged for material removed for disinfection or for incineration until June 2002, but the rates have diverged very significantly since then.

Figure 3.7 Sterile Technology Ireland's charges (including VAT) for removal, treatment and disposal of hospital risk waste, January 2000 to December 2004



Source: Analysis by Office of the Comptroller and Auditor General

Removal and Treatment Cost per Tonne

3.32 The overall average cost to hospitals to have risk waste removed and treated in 2002 was around €870 per tonne. There was relative consistency between hospitals in the average cost per tonne — this is to be expected, since almost all hospitals avail of the same STI contract terms. One large acute hospital that used another service provider incurred costs per tonne that were close to the overall average.

3.33 The proportion of risk waste sent for incineration is a variable influencing the average cost per tonne for removal and treatment of risk waste in individual hospitals. In some cases — for example, in hospitals that specialise in cancer treatment — a high proportion of the risk waste produced may need to be incinerated. In other cases, only negligible amounts of waste may require incineration. Medical and nursing staff make professional judgements about which treatment route is appropriate to use for individual items of waste, within the segregation guidelines. Monitoring levels and trends in the proportion of waste sent for incineration may be a useful way of checking that segregation is, by and large, being done as expected.

Good practice note 4

Saving on the cost of treating and disposing of risk waste

Incineration of risk waste now costs almost three times the amount for disinfection and subsequent disposal, so careful segregation can help to ensure costs are minimised. Staff make professional judgements in choosing whether to send risk waste for disinfection or incineration, but an overcautious approach may develop. Monitoring trends in the proportion of material being sent for incineration may help to identify areas where practice is changing. Periodic audit — by suitably qualified personnel, working in controlled circumstances — could also help to ensure the right balance is being struck.

3.34 When the JWMB was planning its initial tender competition for a risk waste removal service, it estimated that up to 95% of the risk waste from publicly-funded hospitals could be treated using the disinfection process, with the remaining 5% requiring incineration. In 2002, around 98% of the risk waste removed by STI was treated using the disinfection method, and just 2% was sent for incineration.

Control of Risk Waste Removal

3.35 Hospitals are legally obliged to ensure that risk waste removed from their premises is transported, treated and disposed of properly. Suitable mechanisms to control waste removal are therefore required.

3.36 STI provides each hospital it services with large yellow 'wheelie' bins, each of which is bar-coded and lockable. Containers of risk waste are placed by hospital staff in the wheelie bins. When a consignment of waste is brought from a hospital to STI's treatment plant, each bin is weighed separately, and the weight of the contents, the bar code number, the date and the hospital's details are recorded. Hospitals can access information about their own waste through a restricted internet site, allowing them to check where their bins of waste are and how they have been handled. The charges invoiced to each hospital are based on the recorded weights, and the kind of treatment (incineration or disinfection) applied to the bin contents.

3.37 As part of this examination, the arrangements for control of risk waste consignments were reviewed during visits to ten hospitals. The degree of control exercised by the hospitals over the removal of risk waste was found to vary.

- Consignments of risk waste were weighed before collection in only one of the hospitals visited. In the Midlands region, risk waste from the Regional Hospitals in Tullamore and Portlaoise is brought by Health Board staff to a central waste marshalling area at Mullingar Regional Hospital, where equipment for weighing waste has been installed. Each individual bin is weighed by health board staff before removal by STI, and the weight of the contents, the bar code number and the origin of the waste are recorded manually. Health board staff use the record to verify the invoice charges, and to confirm that all bins dispatched were received in the treatment plant and treated appropriately. The data also potentially allow for analysis of waste output and waste cost trends.
- In the six other health board hospitals visited, risk waste bins are counted by hospital staff when they are being dispatched, but neither the weights nor the bar codes are routinely recorded.
- In three Dublin voluntary hospitals visited, the bins are not weighed prior to removal, but the bar code numbers are recorded by hospital staff. This allows the hospital to confirm that the bins reached the appropriate destination, but does not help the hospital to verify the weight-based charges it pays.

3.38 As part of the survey, hospitals were asked to state if they record the weight of consignments of risk waste before collection. Only 7 of the 55 acute and maternity hospitals (around 13%) said they did. Most of the hospitals that generate the bulk of the risk waste therefore do not have independent evidence of the quantity of risk waste they are consigning for treatment and disposal, or the quantities for which they should be invoiced.

3.39 One Dublin hospital reported that it has, on a number of occasions, carried out a sample weight test as a control check on the amounts invoiced by STI. Individual waste containers were

weighed before being placed in a selected STI bin. The bar code number and the overall weight for the STI bin were recorded, and subsequently checked against the invoice received. The hospital reported that it had discovered no discrepancies in the invoicing through these tests.

Cost Elements for Non-Risk Waste

3.40 The direct costs of handling and disposing of non-risk waste includes the cost of rubbish bags, costs for storing waste in hospital premises, and charges for the removal and disposal of waste.

Cost of Refuse Bags

3.41 In general, black or clear plastic bags are used to contain non-risk waste at the point of production (wards, kitchens, etc.). Where segregation of materials for recycling is encouraged, separate bags or containers may be provided for suitable materials (paper, cardboard, plastics, cans, etc). In most cases, porters and cleaning staff remove the bags routinely, or as required.

3.42 Based on the survey responses, it is estimated that hospitals spent a total of around €670,000 on the purchase of refuse bags in 2002. One of the large Dublin teaching hospitals reported spending €57,000; one of the large regional hospitals reported spending €42,000.

3.43 Based on the reported data, hospitals spent an average of around €33 on refuse bags per tonne of non-risk waste but some reported spending up to €100 per tonne. Four of the large Dublin teaching hospitals reported costs varying from around €18 per tonne to around €57 per tonne. Two large regional hospitals reported spending around €25 per tonne, while another reported spending around €78 per tonne.

Waste Storage Costs

3.44 Most hospitals have designated areas within their grounds for sorting and storing waste. Depending on the volume of non-risk waste being processed and the method and frequency of its removal, the waste marshalling area may have equipment such as a waste compactor, waste baling machine, lifting gear, one or more skips (closed or open) or wheelie bins. There may also be washing and disinfection facilities for bins and other re-usable equipment.

3.45 In all of the hospitals visited, containers of cytotoxic waste were kept in covered and locked areas. Five of the hospitals visited also kept other containers of risk waste in lockable areas, but containers of risk waste were not in secure areas in the remaining five hospitals. Good practice note 5 comments on the importance of keeping risk waste securely.

3.46 Only two of the ten hospitals visited had fully secure waste marshalling compounds. These were fenced off areas within which all waste handling and storage equipment was kept. Access to the compounds was controlled.

3.47 Plans for major hospital building programmes now provide for secure waste marshalling compounds. Proposals for improvements in waste marshalling areas have also been drawn up in a number of existing hospitals, and these are awaiting funding.

Good practice note 5

Making waste marshalling areas secure

The kinds of waste stored in hospital waste marshalling areas includes dangerous materials. The equipment used in such areas is also dangerous if not operated properly. Marshalling areas therefore need to be secure, and access controlled.

In one regional hospital where the waste marshalling area was open, security camera footage recorded children opening risk waste bins and playing with used syringes. As a result, the hospital reconstructed the waste marshalling area, installed security fencing and lockable gates. Risk waste bins are now locked up in stores within the waste marshalling compound.

Properly secured waste marshalling areas also prevent unauthorised dumping into hospital skips and compactors, which has been a problem in some hospitals in the past.

Cost per Tonne

3.48 Some hospitals (particularly the larger ones) have purchased compactors to store non-risk waste while awaiting removal. In other cases, compactors are hired from waste contractors, with the hospital making daily, weekly, or monthly rental payments. Whether the equipment is owned outright or rented, hospitals typically pay waste removal contractors for each up-lift of compactors or skips, in addition to the charges based on the tonnage of waste removed.

3.49 The prices paid for rental and up-lift of equipment vary considerably between hospitals. In part, this may reflect differences in the level of competition between contractors in different areas but there are also differences between contractors in the balance between flat rate charges (for equipment hire or uplift) and tonnage-related charges. Individual hospitals should examine carefully the size of equipment they use, the frequency of waste removal and the pricing structures on offer in order to optimise their strategies in relation to the hire of waste contractors. The choice about buying or renting equipment should also be informed by careful analysis of local rental and up-lift costs, equipment purchase prices and expected payback periods.

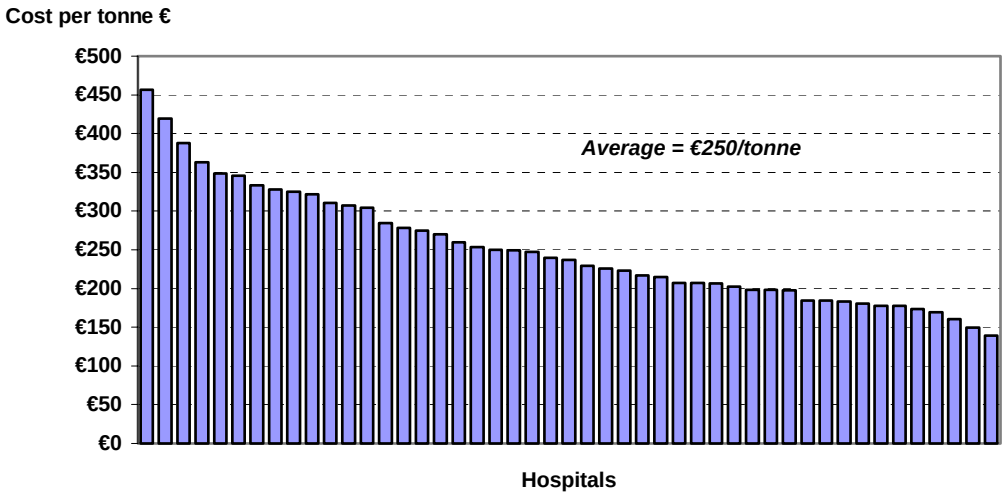
3.50 Because of the complex pricing structures that hospitals encounter in storing waste and in paying waste contractors for removal services, the most meaningful measure of the costs involved in storing and removal of non-risk waste is the overall cost per tonne.

3.51 Figure 3.8 indicates the estimated cost per tonne of non-risk waste paid by individual hospitals. The average ranged from around €140 per tonne to just over €450 per tonne. The average cost was around €250 per tonne.

3.52 The average cost per tonne paid by individual hospitals reflects the combined influence of factors that vary significantly from hospital to hospital. These include

- the prices charged at the landfill sites to which the hospitals' waste is brought
- the distance that the waste has to be transported to the landfill sites
- the level of competition that exists between waste contractors locally, and the degree of access to recycling services
- whether the hospital has its own storage equipment, or rents equipment from the contractor.

Figure 3.8 Estimated cost per tonne for handling and disposing of non-risk waste, 2002 (n=47)



Source: Analysis by Office of the Comptroller and Auditor General

Control of Waste Charges

3.53 Because tonnage-related charges account for the bulk of the waste charges faced by most hospitals, some way of identifying the weight of waste removed by contractors is desirable as a means of verifying the invoiced charges. None of the hospitals visited had facilities for weighing non-risk waste before it is removed from their premises.

3.54 In practice, where large waste containers are being used, the only practical means of weighing waste is the use of weighbridges. These are used in many situations where bulk loads have to be weighed — a laden vehicle is driven onto a weighbridge and weighed and the weight recorded; when the load is dropped, it can then be re-weighed, and the difference in weight is attributed to the load.

3.55 Only one third of the acute and maternity hospitals surveyed, and a quarter of psychiatric hospitals stated that they received weighbridge receipts in support of the charges invoiced by their waste contractors. Almost none of the community hospitals said they received weighbridge receipts.

3.56 In some cases, the non-provision of weighbridge receipts may be a legacy of payment systems which did not operate on a 'pay-by-weight' basis. However, weighbridges are installed at all landfill sites and in waste transfer stations operated by licensed waste contractors, and are subject to independent checks on their accuracy. Ideally, all hospitals should insist on receiving independent weighbridge receipts in connection with waste removal.

3.57 Where weighbridge receipts are provided, hospitals should check their reliability. One hospital reported that it received a refund of €5,000 in respect of landfill charges paid at a local authority landfill. The practice at the landfill was to weigh lorries on the way in but not on the way out. Instead, the weight of the load was estimated by deducting the tare weight for the lorry and the compactor — their official unladen weight — from the recorded laden weight. The

landfill operators used an incorrect tare weight for the vehicle in question, and so ended up overcharging the contractor, who passed the charges on directly to the hospital. Even after the problem was discovered and repayments were made by the local authority, the same error was repeated on subsequent occasions.

3.58 Waste managers should monitor waste consignment weight data over time, and particularly when they change contractors, to see if there are any unusual patterns. They could also share information with waste managers in other similar hospitals, to try to establish general norms for the weight of contents of standard sized equipment. This could assist in identifying unusual charging patterns.

Tendering and Contracts

3.59 In most of the health board hospitals visited, there was no formal contract in place with the waste contractors being used. The voluntary hospitals visited had formal contracts in place with their contractors.

3.60 Technical services personnel in the health boards stated that hospitals generally seek cost quotations among the waste contractors operating locally for the provision of waste disposal services and equipment. However, in some areas, there may be only one contractor with the capacity to provide the necessary services, leaving the hospital with little choice about who to use. In this way, restricted competition can result in individual hospitals incurring high charge rates.

3.61 There may be scope for combined tendering by a number of hospitals in a region, so as to yield a sufficient volume of business to attract more potential suppliers within a region, or from outside a region.

Costs of Recycling

3.62 In some areas, materials for recycling may be collected free of charge by the relevant recycling companies. In other areas, the recycling companies charge their customers for removal of materials. However, in most cases, the unit charges levied for recycling are less than the unit costs for landfill. For certain materials, especially paper and cardboard, the charges may vary on a monthly basis, depending on demand for the recycled material.

3.63 In general, hospitals reported that they paid up to €80 per tonne to have recyclable materials such as cardboard, paper, plastic and cans taken away. Payment for removal of glass was up to €160 per tonne. A number of hospitals reported that some recyclable materials were taken away for free.

3.64 Some hospitals reported paying higher prices to have paper taken away for recycling. In some cases, the service being provided included shredding of documents.

3.65 Relative to the level of landfill charges being faced by hospitals and the associated removal charges (e.g. for up-lift of waste), recycling would appear in many cases to offer scope to reduce significantly the costs of removal and disposal of non-risk waste material.

4 Good Practice in Hospital Waste Management

4.1 Active management of waste in all hospitals, but particularly in those that deal with large numbers of patients and procedures, will help to ensure that costs and environmental damage related to healthcare waste are minimised, and that patients, staff and local communities are protected from harm. As part of this examination, waste management practices were reviewed in nine acute hospitals and one maternity hospital, in different regions. The aim was to identify and report good management practices as a guide to assist hospital and other health sector managers in developing and improving their strategies for dealing with all forms of waste.

Waste Management Policies and Procedures

4.2 The Department published, in 1994, a statement of policies and principles to be adopted by all publicly-funded health agencies in relation to the management of healthcare waste. The document, entitled ***Health Services Waste Policy***, was developed because of the extensive changes that were occurring – nationally and internationally – in the legislative and regulatory frameworks governing the generation and disposal of waste materials. The main waste management principles set out in the document are summarised in Figure 4.1.

4.3 The policy document states that the proposed waste management principles were based on what was considered to be current good practice in the management of waste in Europe and the United States. The Department recognised that management practice in this area was 'in a state of flux', and pointed out that the policy principles should be viewed as being subject to alteration in the light of experience gained and changing knowledge and attitudes.

4.4 In practice, the Department has not amended its policy document since it was published. Based on interviews with personnel engaged in waste management in hospitals as part of this examination, there appears to be general acceptance of the principles. Nevertheless, very extensive changes have occurred since 1994, and are still occurring, in the overall context in which healthcare waste management is conducted. This includes organisational change, new environmental legislation and regulation, increasing costs, and advances in waste handling and recycling technology. It therefore may now be timely to review the policy framework and principles guiding healthcare waste management, to establish if they still represent good practice internationally, or if changes — including changes in emphasis or priority — are required to take account of current circumstances.

Good practice note 6

Ensuring hospital staff are aware of the latest in good practice

All hospitals face a similar challenge in ensuring that the waste management policies and procedures they adopt are up-to-date and reflect the latest thinking on good practice, and in identifying relevant benchmark performance data. It is most efficient to develop and maintain a reference database of this kind centrally. Making the database available by internet would potentially allow all health agency managements to base their own waste management plans on common policies and procedures that reflect the latest developments in environmental regulation, legislation, technology and market conditions.

Figure 4.1 Department of Health and Children's principles for management of hospital waste

Responsibility for management of waste

- Each hospital is responsible for the management of all wastes generated in its premises, for the safety of staff and public who may be exposed to the waste and for its proper handling, storage and disposal.
- Overall responsibility for all waste operations within a hospital, and for the implementation of the waste management plan, should rest with a suitably qualified person.

Waste management plans

- Producers of large quantities of waste should have in place formal waste management plans covering all aspects of their waste related activities.
- All producers of healthcare risk waste are required to have in place a formal written waste management plan, covering all aspects of the producer's healthcare waste related activities and clearly laying down the responsibilities of those involved with the activity.

Minimising waste production and environmental impacts

- The amount of waste produced should be minimised.
- Where possible, environmentally difficult materials should be eliminated.
- Preference should be given to 'greener' products.
- Products made of materials suitable for re-cycling should be chosen wherever practicable, and the use of re-cycled products should be encouraged.
- Waste should be managed in such a way as to maximise its recycling capability e.g. separation and collection of materials for which there are recycling outlets.

Handling and storage of waste

- Waste should be stored, contained, handled or otherwise processed in ways that are appropriate to their contents.
- Every effort should be made to achieve the maximum amount of segregation consistent with and appropriate to the methods of handling and disposal employed.
- Staff should be adequately informed, trained and equipped to carry out their duties in these areas in a manner which is safe and hygienic for themselves, other staff, the public and the environment, and in accordance with all relevant regulations.

Transport of waste

- Transportation of waste should be by appropriate vehicles and be done in such a way as not to cause nuisance or offence.

Disposal of waste

- Integrated and appropriate methods should be employed which take account of the nature of the waste, regulatory requirements and the need for an effective, efficient and acceptable service for the safe disposal of all healthcare waste.
- The disposal methods used should be appropriate, safe and hygienic and should be in accordance with the principle of best practicable environmental option.

Source: Summary based on Department of Health and Children, ***Health Services Waste Policy***, 1994

4.5 Subsequent to the issuing of its healthcare waste policy document, the Department issued a separate, detailed guidance document about the procedures to be adopted in relation to the segregation, storage and packaging of risk waste. This has been up-dated twice. The latest version, issued in April 2004, is available on the Department's website.

4.6 Detailed procedures manuals, such as those produced by the Department, require on-going amendment to ensure they keep pace with constantly changing circumstances. This creates problems for dissemination and ensuring that all relevant personnel remain aware of what is the latest guidance. For this reason, development centrally of a national reference database of health waste management policies and procedures should be considered. This could be made available to all interested readers via a specialist healthcare waste management website.

4.7 The Department's procedures document makes only minor references to the handling of non-risk waste, or to recycling. The provision of further central guidance, focusing more on the need to reduce waste-related costs and the environmental impacts of non-risk waste, should be considered.

Adoption of Waste Management Plans

4.8 A key feature of the Department's policy is the requirement that each healthcare agency that produces a significant volume of healthcare waste should prepare and adopt a formal written waste management plan. The plans were to be reviewed and updated on a regular basis, and compliance with the aims of the plans was to be assessed and verified. Each plan was expected to include the following elements

- a statement of the strategies for minimising the quantities of waste generated
- an outline of the protocols for segregating, packaging, labelling, moving, storing, treating and transporting the various waste types, both on-site and off-site
- a description of the methods for keeping records of the quantities and types of waste generated, treated and disposed of
- a schedule and copies of all the relevant regulations and legislation, including requirements of the relevant local authority
- a listing of those responsible for managing healthcare risk waste in the event of an accident or spill
- a description of the provisions for regular, ongoing staff instruction about waste management and associated hazards.

4.9 Of the ten hospitals visited during this examination, only two had developed and adopted agency-specific waste management plans. Another hospital had developed its own internal protocols in relation to risk waste, but other plan elements as recommended by the Department were not included in the document. Two hospitals were in the process of developing waste management plans.

4.10 Six of the hospitals visited had not developed their own plans, but operated their waste management systems in line with the waste management plans adopted by their respective health boards. Most of the health board plans were developed in the mid-1990s, but only one appears to have been updated (in 2003). One health board adopted its plan, for the first time, only in 2003.

Good practice note 7

Performance-based waste management plans for hospitals

Waste management plans for individual hospitals should focus more on performance. Local protocols and procedures for handling and disposing of waste could better be recorded as handbooks or manuals, drawing on guidance material compiled centrally to reduce duplication of effort.

Each hospital should develop its own performance-based waste management plan, since overall responsibility for the proper handling and disposal of waste lies within hospitals, and circumstances vary from hospital to hospital.

Having individual hospital waste management plans does not rule out the option of co-operation and co-ordination between hospitals — e.g. within regions, or in treatment-specific groups — in such areas as procurement, sharing of facilities, provision of staff training, etc.

4.11 In general, the waste management plans reviewed conform to the structure outlined in the Department's policy guidelines. Many of the plans focus mainly on the segregation and handling of risk waste, and are shortened or amended versions of the Department's procedures guidelines. In general, recycling options and procedures for handling and disposing of non-risk waste receive relatively little attention.

4.12 The plans adopted contain little information about hospitals' and health boards' performance in managing waste e.g. the incidence of waste-related health and safety incidents, the amount of waste produced, the costs incurred, the proportion of waste recycled, etc. None of the plans include waste management performance targets. Developing multi-annual plans for specific time periods, focusing primarily on performance objectives and quantified targets to be achieved by stated dates in each area, would provide a much stronger incentive to improve waste management in hospitals.

Setting Performance Targets and Monitoring Progress

4.13 None of the hospitals or health boards visited had adopted a clear set of relevant and comprehensive targets for waste management performance. Many of the waste management plans contained statements of general objectives (e.g. increase the level of recycling, reduce costs, ensure proper segregation) but it is not generally made clear how the achievement of any of these objectives is to be assessed. The plans contain little information about what is the baseline position, how performance should be measured, or by what date the desired improvements were to be achieved.

4.14 Some of the waste management plans in the hospitals visited include sections on planned data collection and waste tracking systems, as envisaged by the Department. In practice, waste tracking systems have been implemented but there were few systems in place to systematically record data about waste output or costs. What information is gathered generally relates to risk waste only. Some one-off studies have been carried out in a few hospitals or in parts of hospitals, but routine and comprehensive monitoring of waste management performance was not observed in any of the hospitals visited.

4.15 In hospitals that produce a significant amount of waste each year, a group of about twelve key measures could be used in assessing, monitoring and setting targets for waste management performance (see good practice note 8). These could usefully be incorporated in waste

Good practice note 8

Key performance measures for waste management

Monitoring a small number of key measures would significantly improve the ability of larger hospitals to manage their waste output and develop strategies to ensure safety, reduce environmental impacts and make financial savings. These could include the following

- incidence of waste-related health and safety incidents
- total amount (by weight) of waste produced per bed day used
- amount of risk waste produced
- amount of non-risk waste produced
- % of risk waste sent for incineration, and % sent for disinfection
- % of non-risk waste sent for recycling, and % sent for landfill
- total direct cost of handling and disposing of waste
- average direct cost of containing risk waste (per tonne)
- average direct cost of removal of risk waste (per tonne)
- average direct cost of removal of non-risk waste (per tonne)
- average direct cost of removal of non-risk waste for recycling (per tonne)
- expenditure on waste management/recycling overheads (including staff costs of porters and other staff involved in waste management and handling, and depreciation of equipment)

management plans for the hospitals in the future. For smaller hospitals, focusing on fewer performance measures would usually be sufficient e.g. the total expenditure by the hospital on handling and disposing of waste, and the amount of waste produced per bed day used.

Assignment of Responsibility for Waste Management

4.16 The Department's principles for waste management envisage that overall responsibility for managing waste within a hospital, and for the implementation of the waste management plan should be assigned formally to a suitably qualified individual. To be effective in this role, the individual concerned should have the required authority and command of resources to ensure that waste management objectives are achieved.

4.17 In general, responsibility for waste management at health board level and in larger hospitals was assigned to senior technical services personnel. (Traditionally, such personnel were responsible for overseeing the construction and operation of hospital incinerators.) This location of responsibility potentially allows for waste policies and procedures to be integrated with other environmental services, such as energy and water consumption and emissions.

4.18 In smaller hospitals, responsibility for waste management is usually assigned to a general administrator or a nurse manager.

4.19 In some health board regions, the boards' technical services managers (and their staff) have direct responsibility for the provision of waste management services for health board owned hospitals and other health facilities, such as health clinics. In other regions, the boards' technical

services managers have an advisory role, assisting hospital managers with technical advice and support in relation to waste management (and other services like energy and facilities maintenance). Clear, formal assignment of responsibilities is required in such situations to avoid confusion about who ultimately is responsible for waste management performance, target setting and the achievement of objectives.

4.20 Waste management committees, to which waste managers report, have been established in a number of large hospitals. The membership of the committees varies, but typically includes infection control staff, microbiologists, technical services staff, and representatives of house-keeping, catering and portage departments.

Awareness of Waste Management Procedures

4.21 The performance of hospitals in relation to waste management is determined to a large degree by the actions of all members of the hospital community. In general, staff, patients and visitors are likely to share the objectives of ensuring the hospital is a safe and clean place to be, that the environmental impact of waste is limited to the greatest extent possible and that unnecessary expenditure on the handling and disposal of waste is avoided. Making all hospital users aware of the procedures they should follow in disposing of waste is therefore a key aspect of waste management.

Staff Training

4.22 All of the hospitals visited had provided training for staff in relation to waste handling and disposal. Training courses were developed taking account of the requirements of staff working in different areas and in different roles, the nature of the waste they produce and handle, and the circumstances in which they come in contact with waste. Programme content was developed by waste management staff and/or infection control staff. The kinds of training provided include

- modules on waste handling and disposal procedures as part of general induction training for new staff
- specific training programmes for staff involved in collecting, moving and storing waste e.g. house-keeping staff, porters and grounds staff
- ward or area-specific training, if required, following waste audits or health and safety incidents (see good practice note 9).

4.23 The cleaning of hospital wards is contracted out in some hospitals. The contract companies are responsible for providing training for their own employees, including in relation to health and safety. Hospital waste managers have assisted the contract companies in the development of training programmes to cover such areas as proper procedures for handling risk and non-risk waste, and the action to be taken in the event of a waste-related incident.

4.24 In all hospitals, health and safety procedures require all accidents, such as needle-stick injuries, to be investigated. The number of such injuries related to poor waste segregation and handling recorded in each hospital each year is low, and the circumstances leading to the incident are investigated. Where necessary, refresher or up-date training is provided in areas where waste handling and disposal practices have resulted in accidents.

Good practice note 9

Learning from waste-related incidents

In two regional hospitals, near- accident incidents resulting from waste materials that have been improperly handled or disposed of are treated as opportunities to re-enforce policies about how waste should be segregated and handled safely. This may include situations where containers are broken, waste materials are spilled resulting in slip hazards, or sharp instruments (such as syringes with needles attached) are found protruding from bags or bins.

Photographs are taken of the circumstances around the incident. These are used as instructional aids during training. Where appropriate, the photographs may also be displayed in the area the incident occurred. This kind of publicity is designed to heighten awareness of individual responsibility for proper handling and disposal of waste, and of the potential consequences of negligent behaviour.

Incidents are also followed up by random waste audits to ensure proper segregation, and additional training, where necessary.

Signage

4.25 Signs, posters and photographs on, and in the vicinity of, bins are used in all hospitals to try to ensure that staff, patients and visitors are constantly reminded of the need to segregate waste carefully, and what material is suitable for each kind of container. This helps to get key messages across in a simple way, in a situation where there is a high turnover of staff and of other hospital users.

Waste Management Auditing

4.26 Training and careful and effective signage cannot guarantee full compliance with the recommended procedures. For example, if a recycling bin is not close to hand, or is already full, some staff may not be inclined to take the extra time to find one and may instead use an available general bin, or even a risk waste container. Errors in disposing of waste may also occur, and some staff may simply disregard the procedures laid down, resulting in risk waste being disposed of in an unsuitable container. In some hospitals, periodic spot-check audits are carried out by waste management staff on waste containers selected at random. This provides a useful means of checking on the degree to which segregation guidelines are being followed.

4.27 A number of the hospitals visited had commissioned independent audits of their waste management procedures and practices, carried out by private consultants. In the Eastern region, the Waste Management Unit of the Eastern Health Shared Services[7] has also carried out waste management audits in health board and voluntary hospitals. The audits have included reviews of

- trends in the quantity and composition of waste produced
- the sources of the waste
- the costs of handling and disposing of waste

7 The Eastern Health Shared Services was established in March 2000 to provide a range of professional, technical and information support to the ERHA and the three area health boards in the Eastern region.

- the quality of documentation and waste tracking systems
- the quality of training programmes, signage and staff awareness.

View of the Health Services Executive

4.28 The Health Services Executive has stated that waste management in hospitals is a priority from environmental protection and value for money perspectives in 2005. The Executive is in discussion with technical staff with a view to putting in place a robust strategy in this area.

Appendices

Appendix A Healthcare Waste Definitions and Categories

Under the Waste Management Act, 1996, anatomical, clinical or hospital waste is defined as hazardous if it has the properties of being toxic, carcinogenic or infectious. Infectious substances are defined as substances containing viable micro-organisms or their toxins, which are known to cause disease.

Other related definitions, including a definition of 'infectious waste', developed by an EU Priority Waste Stream (PWS) Project Group[8] were adopted in the Department of Health and Children's 1994 ***Health Services Waste Policy***. The definitions are set out in the following table.

Healthcare:	The medical activities such as diagnosis, monitoring, treatment, prevention of disease or alleviation of handicap in humans or animals, including related research[a] performed under the supervision of a medical practitioner or veterinary surgeon, or by any other person authorised by virtue of their professional qualifications to do so
Healthcare waste	The solid or liquid waste arising from healthcare
Healthcare risk waste	***Biological*** — recognisable anatomical waste
	Infectious — any healthcare waste known or clinically assessed to be at risk of being contaminated with ➢ any of the biological agents mentioned in Article 2(d) groups 3 and 4 or identified through the procedure set out in article 3 of the Council Directive (90/679/EEC) of 26 November 1990 on the protection of workers from risks related to exposure to biological agents at work (subsequently amended by Directives 95/30/EC, 97/59/EC and 97/65/EC, each amending the list of biological agents to which the regulations apply) or ➢ other viable biological agents artificially cultivated to significantly elevated numbers
	Chemical, toxic or pharmaceutical including cytotoxins
	Sharps — e.g. needles, scalpels, sharp broken materials
	Radioactive — refer to Radioactive Waste Directive(s)

Source: Department of Health and Children, **Health Services Waste Policy**, 1994, pages 8 and 9

Note a: Wherever appropriate and applicable, waste from basic and fundamental biomedical and other research shall be managed in accordance with the principles set out for Healthcare Waste and Healthcare Risk Waste.

When the Department was drawing up guidelines for segregation, packaging and storage of health care risk waste in 1998, it wished to elaborate on the definition of terms, so as to make them more practical for users of the guidelines. For that purpose, a categorisation of healthcare waste, developed by the Irish Regional Group of the Infection Control Nurses Association and the Irish Society of Clinical Microbiologists, was included as an appendix in the Department's guidelines.

The various categories of healthcare waste are listed in the table overleaf, together with examples of each category of waste. The recommended arrangements for disposal of each category of waste are also indicated.

8 The Priority Waste Stream (PWS) Project Group was established in 1992 by the EU Council of Environment Ministers to examine and develop a strategy for dealing with healthcare waste.

Category of waste	Examples of waste type	Disposal guidelines
Healthcare Risk Waste		
Infectious waste - general	Blood, and any items visibly soiled with blood e.g. blood giving sets and bags, wound dressings, wound drains, swabs, disposable aprons, gloves and gowns that are blood stained	**Must be rendered non-infectious or non-hazardous prior to their final disposal**
	Contaminated waste from patients with transmissible infectious diseases e.g. suction catheters, tissues or sputum containers from patients with Tuberculosis	
	Incontinence wear/nappies from patients with known or suspected enteric pathogens e.g. rotavirus or salmonella	
	Items contaminated with body fluids other than faeces, urine or breast milk i.e. pus, sputum or peritoneal fluid e.g. suction containers, suction tubing and other suction related equipment, and thoraseal drains	
	Other healthcare waste from treatment areas as covered by the definition of infectious waste	
Infectious waste from laboratories	Microbiological cultures: liquid or solid media in which organisms have been artificially cultivated *(Note: The Department's guidelines recommend that cultures with significant growth should be autoclaved prior to disposal.)*	
	Specimens and potentially infectious waste from pathology departments	
Biological	Anatomical waste i.e. all human tissue, organs, and body parts; carcasses and animals used for medical tests or research, including leeches and worms	
Sharps	Any object that has been used in the diagnosis, treatment or prevention of disease and that is likely to cause a puncture wound or cut to the skin e.g. used needles, scalpels, razors, lancets, contaminated broken glass, guidewires, sharp tips of clear intravenous giving sets, stitch cutters or any other contaminated disposable sharp instrument or item	

Category of waste	Examples of waste type	Disposal guidelines
Chemical (toxic) waste	Discarded hazardous chemicals, reagents and medicines	**Must be disposed of in accordance with relevant regulations and licence conditions**
Radioactive waste	Waste which includes materials in excess of authorised clearance levels, and classified as radioactive under the General Control of Radioactive Substances Order, 1993 (SI No 151 of 1993)	**Must be disposed of in accordance with relevant regulations and licence conditions**
Healthcare Non-Risk Waste		
Domestic waste	Includes normal household and catering waste, all non-infectious waste, non-toxic, non-radioactive waste, and non-chemical waste e.g. flowers, office waste, paper hand towels, wrapping paper, cardboard, newspapers, aerosol canisters and cans	**Suitable for landfill, provided they are secured appropriately**
Confidential material	Includes shredded waste documents of a confidential nature e.g. patient notes and laboratory results	
Medical equipment	Equipment which is assessed as non-infectious (i.e. not contaminated with blood or hazardous body fluids or otherwise covered by the definition of infectious waste) e.g. plastic items, plastic bottles, plastic packaging, intravenous solution bags and sets excluding sharp tips, ventilator and oxygen tubing, oxygen facemasks, enteral feeding bags and administration sets	
Potentially offensive material	Waste which is assessed as non-infectious (i.e. not contaminated with blood or hazardous body fluids or otherwise covered by the definition of infectious waste) but which may be considered offensive e.g. incontinence wear/nappies, stoma bags, urinary drainage bags and tubing, urinary catheters, naso-gastric tubes, unless visibly contaminated with blood	

Source: Adapted from *Appendix 1: Guidelines for the Categorisation of Healthcare Waste*, in **Segregation, Packaging and Storage Guidelines for Healthcare Risk Waste**, third edition, Department of Health and Children, April 2004

Appendix B Hospital Waste Survey

A questionnaire-based survey of hospitals was carried out to collect data about

- the quantity of risk and non-risk waste produced in hospitals
- the methods used to dispose of waste, including recycling
- the costs associated with handling and disposal of waste.

Survey Scope

The survey included acute, maternity, community and psychiatric hospitals run by the health boards. Voluntary hospitals in the Eastern Regional Health Authority (ERHA) area were also invited, through the Authority, to participate in the survey.

Survey Administration

Each of the health boards and the ERHA appointed liaison personnel to co-ordinate the circulation, filling-in and collection of the survey questionnaires. The Service Planner for Acute Hospitals in the ERHA acted as liaison for the voluntary hospitals in the region.

Pilot Test

A meeting was held with the nominated liaison personnel to discuss the design and piloting of the survey.

A draft questionnaire was piloted in a small number of hospitals to assess the likely availability of information and to identify problems that might arise in its completion. The questionnaire was tested in one acute hospital and one community hospital in the eastern region, an acute hospital in the midland region, and a psychiatric hospital in the south east region.

Based on results from the pilot and interviews with the hospital personnel who completed the draft questionnaire, a number of minor changes were made to the survey form prior to its issue to all hospitals.

Survey Response Rate

The questionnaire was issued to a total of 114 hospitals and replies were received from 111 hospitals — an overall response rate of 97%.

In their responses, many hospitals indicated that they were unable to provide the required data in relation to some questions. Consequently, the response rates for individual questions were lower than the overall survey response rate.

Checking and Validation of Data

A number of steps were taken to check and validate the data received in the questionnaire responses.

- The internal consistency of data presented in the responses was checked on receipt from hospitals and as it was being entered into a database.

- Data reported by hospitals about the quantities of risk waste produced and the associated disposal costs was checked against data supplied separately, on a hospital-by-hospital basis, by Sterile Technologies Ireland, which collects, treats and disposes of risk waste from most publicly-funded hospitals.
- Outlier values were identified and checked during data analysis.

Where the checks carried out suggested a doubt about any of the information received, the survey team contacted directly the hospital personnel involved in completing the questionnaire to discuss the apparent problems. In some cases, the data originally supplied was confirmed as being correct. In other cases, the hospitals provided corrected data or withdrew their original responses (i.e. changing to a 'not available' response).

Survey Results

The key results of the survey are presented, hospital-by-hospital, in Figures B.1 (output of waste, by type) and B.2 (cost of handling and disposing of waste, by type).

Because some hospitals were unable to provide estimates of the amount of waste produced and/or of the costs of handling and disposing of waste, some scaling up of the survey results was required to arrive at estimates of the total output of hospital waste nationally, and the total national cost of handling and disposing of hospital waste. The main steps involved in this scaling-up exercise were

- Where hospitals did not report the cost of containers for risk waste or of rubbish bags for non-risk waste, estimates were arrived at based on the average cost per tonne of waste for hospitals that did report such figures.

- Where the volume of waste produced was not reported, an estimate was included based on the average output of waste per bed day used reported for similar hospitals. Risk waste and non-risk waste estimates were calculated separately.

- Where the cost of waste handling and disposal was not reported, an estimate was included based on the average cost per bed day used reported for similar hospitals.

Figure B.1 Reported output of waste by type and by hospital, 2002

	Risk waste	Non-risk waste	Total waste
	Kg	Kg	Kg
Acute Hospitals			
Adelaide & Meath inc the National Childrens Hospital	279,717	679,560	959,277
Bantry General	24,000	55,372	79,372
Beaumont	377,670	1,005,030	1,382,700
Cappagh National Orthopaedic	28,705	102,000	130,705
Cavan General	85,000	223,540	308,540
Cherry Orchard	30,000	154,103	184,103
Childrens University Hospital	66,670	259,440	326,110
City of Dublin Skin & Cancer Hospital	2,000		
Cork University Hospital	448,000		
Ennis General	18,000	229,350	247,350
Galway Regional Hospitals	277,000	1,172,571	1,449,571
Nenagh General	15,064	54,100	69,164
Incorporated Orthopaedic Hospital of Ireland	1,300		
James Connolly Memorial	188,198	322,160	510,358
Kilcreene	10,161		
Letterkenny General (incl. St. Conal's)	146,000		
Louth County Hospital, Dundalk	31,000	227,130	258,130
Mallow General	24,000		
Mater Misericordiae University Hospital	348,500	534,400	882,900
Mayo General	183,000	144,414	327,414
Midlands Regional Hospital, Mullingar	43,448		
Midlands Regional Hospital, Portlaoise	23,574		
Midlands Regional Hospital, Tullamore	35,787		
Mid-Western Regional	197,970	585,620	783,590
Mid-Western Regional Orthopaedic Hospital	9,000		
Monaghan General	16,230	145,620	161,850
Naas General	31,000		
National Rehabilitation Hospital	21,000	92,970	113,970
Our Lady of Lourdes Hospital, Drogheda	111,000		
Our Lady's, Cashel	18,000		
Our Lady's Hospital for Sick Children	103,615	641,910	745,525
Our Lady's, Manorhamilton		82,140	
Our Lady's, Navan	44,706	205,242	249,948
Peamount	13,900	222,857	236,757
Portiuncula	66,000	152,920	218,920
Roscommon County	12,849	70,100	82,949
Royal Victoria Eye & Ear	20,000	114,000	134,000
Sligo General	119,000	502,102	621,102
St Columcille's	69,533	305,698	375,231
St Joseph's, Clonmel	23,000		

	Risk waste	Non-risk waste	Total waste
	Kg	Kg	Kg
St. Finbarr's	115,000	460,000	575,000
St. James's	504,441	1,122,286	1,626,727
St. Luke's, Dublin	19,000	128,665	147,665
St. Luke's, Kilkenny	57,915	244,868	302,783
St. Mary's, Baldoyle	10,000		
St. Mary's Orthopaedic	29,000		
St. Vincent's, Elm Park	253,000		
Tralee General	94,000	624,000	718,000
Waterford Regional	192,000	536,640	728,640
Wexford General	52,373	305,910	358,283
Maternity Hospitals			
Coombe Womens Hospital	86,133		
Erinville	33,000		
Mid-Western Regional Maternity	33,000	135,790	168,790
National Maternity	99,574	210,260	309,834
Rotunda	82,000		
Community/District Hospitals			
Ballina	200		
Baltinglass	596	60,620	61,216
Bandon			
Belmullet	150		
Cahirciveen			
Carlow			
Carndonagh		102,000	
Carrick-on-Suir			
Castlecomer			
Clifden	230		
Clogheen			
Castletownbere			
Lifford		41,000	
Birr	58		
Abbeyleix	57		
Athlone	648		
Donegal		60,000	
Dungloe		76,800	
Dunmanway			
Ennistymon			
Fermoy	1,000		
Gorey			
Kanturk	1,000		

	Risk waste	Non-risk waste	Total waste
	Kg	Kg	Kg
Kenmare			
Killarney	2,000		
Kinsale			
Listowel			
Macroom			
Midleton	3,000		
Millstreet	200		
Mount Carmel, Clonakilty	2,000		
Raheen	10	32,000	32,010
Schull		10,160	
Sheil Hospital, Ballyshannon			
Skibbereen			
St Josephs & St Vincent's, Dungarvan			
St. Elizabeth's, Dingle			
Swinford	140		
Youghal	1,000		
Psychiatric Hospitals			
Central Mental Hospital	591		
Clonskeagh			
Newcastle Hospital, Co. Wicklow		125,200	
Our Lady's Hospital, Cork	300		
St Columba's			
St Davnet's			
St. Brendan's	1,139	207,931	290,070
St. Brigid's		78,000	
St. Canice's	480	143,000	143,480
St. Finan's	6,000	96,760	102,760
St. Fintan's	1,828		
St. Ita's	1,003	366,000	367,003
St. Joseph's Hospital, Limerick		214,000	
St. Loman's Hospital, Palmerstown	147		
St. Loman's Hospital, Mullingar	442		
St. Mary's Hospital, Castlebar			
St. Otteran's			
St. Senan's			
St. Stephen's Hospital, Sarsfieldscourt	1,000		
St. Vincent's Hospital, Fairview		78,000	

Figure B.2 Reported cost of waste by type and by hospital, 2002

	Risk waste	Non-risk waste	Total waste
	€	€	€
Acute Hospitals			
Adelaide & Meath inc the National Childrens Hospital	447,930	165,879	613,809
Bantry General	29,908	11,297	41,205
Beaumont	530,520	309,044	839,564
Cappagh National Orthopaedic	45,581	37,653	83,234
Cavan General	143,533	61,183	204,716
Cherry Orchard	42,670	69,064	111,734
Childrens University Hospital	87,182	91,016	178,198
City of Dublin Skin & Cancer Hospital	2,456	3,206	5,662
Cork University Hospital	609,836	104,626	714,462
Ennis General	13,745		
Galway Regional Hospitals	463,937	392,566	856,503
Nenagh General	28,924	15,054	43,978
Incorporated Orthopaedic Hospital of Ireland	1,543	15,329	16,872
James Connolly Memorial	202,405	104,641	307,046
Kilcreene	12,981	14,986	27,967
Letterkenny General (incl. St. Conal's)	176,429	63,055	239,484
Louth County Hospital, Dundalk	44,495	51,539	96,034
Mallow General	30,599	12,314	42,913
Mater Misericordiae University Hospital	448,301	208,243	656,544
Mayo General	232,235	35,628	267,863
Midlands Regional Hospital, Mullingar	62,279	55,119	117,398
Midlands Regional Hospital, Portlaoise	33,097	72,978	106,075
Midlands Regional Hospital, Tullamore	53,151	122,677	175,828
Mid-Western Regional	337,847	121,387	459,234
Mid-Western Regional Orthopaedic Hospital	14,306	36,543	50,849
Monaghan General	28,840	26,679	55,519
Naas General	34,313	82,795	117,108
National Rehabilitation Hospital	20,826	28,264	49,090
Our Lady of Lourdes Hospital	151,327	76,594	227,921
Our Lady's Hospital, Cashel	30,573	46,565	77,138
Our Lady's Hospital for Sick Children	174,835	81,839	256,674
Our Lady's, Manorhamilton	653	22,692	23,345
Our Lady's Hospital, Navan	68,198	44,521	112,719
Peamount	12,113	46,185	58,298
Portiuncula	127,138	30,930	158,068
Roscommon County	17,802	34,119	51,921
Royal Victoria Eye & Ear	34,216	32,400	66,616
Sligo General Hospital	161,222	120,237	281,459
St Columcille's Hospital	79,171	60,099	139,270
St Joseph's, Clonmel	19,981		
St. Finbarr's	171,720	189,858	361,578

	Risk waste	Non-risk waste	Total waste
	€	€	€
St. James's	452,520	295,268	747,788
St. Luke's Hospital, Dublin	34,197	42,919	77,116
St. Luke's, Kilkenny	77,250	53,041	130,291
St. Mary's, Baldoyle	17,784	1,564	19,348
St. Mary's Orthopaedic	36,568	34,322	70,890
St. Vincent's, Elm Park	358,095	114,433	472,528
Tralee General	158,002	144,084	302,086
Waterford Regional	248,365	127,995	376,360
Wexford General	107,087	69,244	176,331
Maternity Hospitals			
Coombe Womens Hospital	127,264	28,281	155,545
Erinville	40,528	58,079	98,607
Mid-Western Regional Maternity	54,137	34,285	88,422
National Maternity	130,913	25,725	156,638
Rotunda	118,571	39,346	157,917
Community/District Hospitals			
Ballina	250	8,750	9,000
Baltinglass	857	16,697	17,554
Bandon	21	2,880	2,901
Belmullet	870	12,667	13,537
Cahirciveen		4,810	
Carlow		90,500	
Carndonagh	313	21,529	21,842
Carrick-on-Suir			
Castlecomer		5,489	
Clifden	240	11,800	12,040
Clogheen			
Castletownbere	179	2,655	2,834
Lifford	134	6,157	6,291
Birr	96	8,682	8,778
Abbeyleix	80	14,562	14,642
Athlone	1,654	16,411	18,065
Donegal		14,669	
Dungloe	66	16,600	16,666
Dunmanway	162	3,094	3,256
Ennistymon	480		
Fermoy	967	1,837	2,804
Gorey			
Kanturk	1,143	3,703	4,846
Kenmare	48	1,267	1,315
Killarney	1,228	2,100	3,328
Kinsale	230	1,846	2,076
Listowel	739	3,640	4,379

	Risk waste	Non-risk waste	Total waste
	€	€	€
Macroom	251	2,081	2,332
Midleton	3,400	13,189	16,589
Millstreet	404	760	1,164
Mount Carmel, Clonakilty	1,515	10,597	12,112
Raheen	480	8,100	8,580
Schull	174	3,375	3,549
Sheil Hospital, Ballyshannon	71	12,060	12,131
Skibbereen	74	3,708	3,782
St Josephs & St Vincent's, Dungarvan		12,838	
St. Elizabeth's, Dingle	172	3,250	3,422
Swinford	2,000	11,100	13,100
Youghal	876	980	1,856
Psychiatric Hospitals			
Central Mental Hospital		16,262	
Clonskeagh		59,392	
Newcastle Hospital, Co. Wicklow	3,930	43,602	47,532
Our Lady's Hospital, Cork	741	73,920	74,661
St Columba's		41,068	
St Davnet's		34,515	
St. Brendan's	1,188	66,811	67,999
St. Brigid's	290	30,343	30,633
St. Canice's		26,353	
St. Finan's	7,318	21,954	29,272
St. Fintan's	1,823	47,432	49,255
St. Ita's	500	136,332	136,832
St. Joseph's Hospital, Limerick		42,265	
St. Loman's Hospital, Palmerstown		22,458	
St. Loman's Hospital, Mullingar	819	58,057	58,876
St. Mary's Hospital, Castlebar	2,548	37,876	40,424
St. Otteran's		13,200	
St. Senan's	938	71,905	72,843
St. Stephen's Hospital, Sarsfields Court	1,860	34,760	36,620
St. Vincent's Hospital, Fairview	803	13,520	14,323

Appendix C Hospitals Visited

Cork University Hospital

Galway Regional Hospital

Louth County Hospital, Dundalk

Mater Misericordiae University Hospital

Mid-Western Regional Hospital

Midlands Regional Hospital, Tullamore

National Maternity Hospital

Our Lady's Hospital, Manorhamilton

St James's Hospital, Dublin

Waterford Regional Hospital