

# Chapter F

## Management of hospital wastes

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### F-1 INTRODUCTION

Hospital wastes are generated in the process of investigation of disease or treatment of patients. The wastes may be in either solid or liquid form. Wastes arising in hospitals may be classified into two categories: - *hazardous* wastes which pose a particular threat, and *general* wastes which are no more hazardous than ordinary domestic wastes.

Hospital wastes	
Hazardous waste	General wastes
human organs and tissues used needles and syringes microbiology wastes (culture dishes etc.) discarded chemicals and medicines radioactive wastes blood, sera, sputum, cerebro-spinal fluid, urine, often in pads , swabs and dressings	canteen waste floor sweepings discarded drinks containers cardboard waste paper from offices etc.

Some of the hazardous clinical waste is dangerous because it may contain pathogens like bacteria, viruses, protozoa, helminths and fungi. Some waste materials such as medicines and used chemicals from laboratories are toxic and pose threats if used wrongly, if they contaminate containers, or if they are discharged to bodies of water. Some wastes are regarded as very offensive because of their appearance or smell. Incidences of recognisable human body parts being carried around by dogs or birds are not easily forgotten.

Syringes with needles attached are probably the most dangerous of all hazardous clinical wastes for the following reasons:

- ◇ They may contain blood which can harbour and sustain the deadly viruses of hepatitis and AIDS;
- ◇ The sharp point of the needle can easily puncture the skin and introduce the infective pathogens into the bloodstream;
- ◇ Syringes are in demand by drug addicts, who use them for injecting drugs into themselves, by children who like to play with them, and with unscrupulous or untrained medical practitioners who wish to use them to save the cost of purchasing new ones

Because of these hazards it is essential to isolate dangerous wastes and dispose of them in a way that safeguards the public; often this requires some form of treatment before final disposal.

Another type of medical waste that is not hazardous in itself, but which may pose a threat to the public, is medicine containers. Bottles and other reusable containers that have been used for medicines may be filled with spurious materials and sold as the original medicine (Grover, 1997). This problem is made more difficult to control by the fact that medicine containers are discarded from private homes as well as medical establishments. Perhaps the best means of control is specifying the type of container that may be used for medicine, such that they cannot be resealed, and a public awareness campaign. There is also a trade in bottles outside hospitals, leading to a risk that infection may be transmitted if the bottles are filled with medicines, or that specimens may be wrongly diagnosed if the bottles are not clean.

Incineration is generally regarded as the best means of disposal of hazardous and offensive wastes, but the word *incinerator* can mean many different things, from a simple combustion chamber to a large and sophisticated plant with two combustion chambers in series and sophisticated gas cleaning equipment. In some countries air pollution controls require that very sophisticated incinerators be

used, and that the incinerators be operated with great care. It was reported that the Pollution Control Board at Delhi had objected to the pollution caused by a clinical waste incinerator, and air pollution problems had been experienced with a crematorium in Mumbai.

It is likely that many of the problems mentioned in this chapter have been addressed by the authorities, and so the observations made here should be regarded as historical, not current. They serve as a useful guide to techniques of investigations in general, and examples of conditions that may be found.

## F-2 INVESTIGATIONS

In order to study the practices that are being followed in some of the hospitals and to suggest methods for safe disposal, three hospitals were visited to discuss the issues with senior personnel and observe how wastes were managed. One hospital was run by the Municipality, one was an urban health centre in a poor suburb, and the third was a privately-run hospital. The municipal hospital had 1345 beds; 36 wards and 17 operating theatres.

### a) Municipal Hospital

When the team visited the premises of the municipal hospital it is found that the refuse storage area constructed within the premises of hospital was full of waste containing both clinical and general waste of all sorts, including dressing wastes, plastic bottles, glass bottles, injection needles, cardboard boxes, bottles used for blood samples and other samples, etc. The team tried to determine whether there were any dust bins provided for storage of hazardous waste and found that there were no such containers.

The team met the Dean of Hospital and the Assistant Medical Officer (AMO) and visited various wards with the AMO and investigated how the different wastes were managed.

The procedure adopted in Microbiology Department appeared reasonably satisfactory. The person in charge explained the system adopted for disposal of the clinical (hazardous) waste. Used syringes and needles were found cut into two in a small piece of equipment called a syringe and needle destroyer, making the needles and syringes unfit for reuse. After being cut in this way the syringes and needles were disinfected with sodium hypochlorite before being sent to garbage bins for disposal.

**Comment** There is some doubt about the effectiveness of sodium hypochlorite as a disinfectant of needles, because of the lack of penetration of the disinfectant into the bores of the needles.

Samples of blood, serum, stools, urine and cerebro-spinal fluid were said to be autoclaved at 125° C at a pressure of 15 to 20 lb./inch<sup>2</sup> for a period of 15-20 minutes before their disposal to the refuse storage bin. The studies revealed that both the Medical Officer and the staff were well aware of the health implications of untreated clinical waste but they were able to implement safe practices only to the extent that infrastructural facilities were available. It was estimated that an average of 3 to 4 kg of clinical waste was generated in this ward each day.

The team then visited the Biochemistry Department where the waste was found to have been disposed of as ordinary waste into the common storage facility. Discussions revealed the fact that the health officer in charge and the staff were of the opinion that the waste they were dealing with was not hazardous since their activities were confined to chemical analysis. In this ward also about 3 to 4 kg. of waste per day were thought to be generated.

The investigators were astonished to know that samples of blood taken from a person having a serious infectious disease were treated differently by different departments - in one ward the sample is treated as hazardous waste, in the other no special care was being taken. This shows a lack of co-ordination between the two departments.

The team also visited the Anatomy Department and had discussions with the Medical Officer in charge. The waste generated in this ward comprises discarded human parts, amputated limbs, body wastes generated in operation theatres and also dissected parts of human bodies from practical studies of the medical students. As these wastes may not only be hazardous but may also be aesthetically offensive, they need careful and safe disposal. It was found that all these wastes were being sent to incinerators where they were assumed to be completely burned prior to disposal.

The team also visited the Pathology Department to which the organs removed in the operation theatres were sent for histological studies. Tissues of tumours, glands etc. of in-patients and out-patients were also sent for histological analysis to this ward. During discussions with the professor it was learned that all samples after analysis were being stored carefully in a container and later sent to the incinerator in a polythene bag for final disposal. On an average nearly 10 kg of such waste were generated from the department each day.

The team also visited the other wards and premises and found that no special care was being taken anywhere to segregate the clinical waste and ensure satisfactory storage and disposal, all the waste being deposited in the common bin.

The team also visited the crematorium.. The premises were not enclosed by any form of fencing. The system adopted was satisfactory but more care should have been taken to ensure complete burning.

In total the hospital waste generated per day was estimated to be about one metric ton from all the wards and laboratories, out of which about 25 kg waste was being incinerated, and the rest of the waste was being thrown into the general garbage bin from whence it was taken by municipal vehicles to the dumping site along with other wastes of the city. It was also observed that recyclable articles were being segregated at the common refuse storage point and taken away by a private agency. There was no supervision of the private agency workers to ensure that they were taking away only recyclable material and no item hazardous to health.

#### **b) Health Centre**

The team also visited an Urban Health Centre which also was managed by the Municipal Corporation of Greater Mumbai. This hospital had both out-patient and in-patient wards, with a total of 100 beds. The waste generated in this hospital was not segregated at any stage, all the waste being thrown into common refuse enclosure before it was ultimately taken away by a Municipal Corporation vehicle once every two days for disposal at the dumping ground. The total waste generated per day was estimated to be 150 to 175 kg. Here it appeared that no special care was being given to the disposal of waste and also it appeared that neither the doctors nor the staff were concerned about the safe disposal of the hospital waste.

#### **c) Private Hospital**

After completing its studies in public sector hospitals, the team decided to study the systems adopted in a private hospital and therefore visited a large private hospital and medical research centre in Mumbai. The hospital is a well maintained 294 bedded hospital with facilities for out-patient treatment also. The hospital had facilities for treatment of all cases except for maternity and prolonged cancer treatment. During discussions with the Senior Executive, Marketing, and the Manager of House-keeping Department, the team learned that they were using two colours of plastic bags for storing and disposing of clinical and non-clinical wastes. Black bags were used for hazardous waste and green bags for general waste. Every ward was provided with both the bags and the staff had been trained to segregate the waste at source and deposit the different wastes in the appropriate bags. The black bags containing the clinical waste were tied and carried in a separate lift to the 5<sup>th</sup> floor where there was an incinerator in good working condition. On average 40 to 45 of these black bags were incinerated each day suggesting a daily weight of 200 kg to 225 kg. Nothing was done to render the used syringes and needles unusable before their disposal in the incinerator.

The wastes generated in each ward and in the research centre were segregated so that all sharps such as needles, syringes and blades, were stored in plastic containers. These containers were also taken to the incinerator together with the black bags. At the incinerator, it was observed that the black bags were thrown in as a whole whereas only the contents of the plastic cans were thrown into the incinerator. It was found that, on average, 800 g of clinical waste was being generated per bed per day.

The team also visited various wards and premises with the Housekeeping Manager, whose duties were exclusively the supervision and up-keep of the premises and the disposal of the waste. The non-clinical (or general) wastes generated in the wards and the kitchen were being stored in green bags which were provided in the kitchen, in each ward and in public places within the hospital. On an average day an estimated 2 to 2.5 tonnes of wastes were generated from these various sources. The wastes thus collected in green bags were carried by the house keeping staff to a separate shed constructed for the purpose and stored there. According to the need, the private contract vehicle

which the hospital authorities had engaged was called in once or twice a day to collect all these wastes and take them to a municipal disposal site.

It is useful to know the quantities of waste generated by hospitals. Using the data for the municipal hospital mentioned above, the rate for all types of solid waste comes to about 0.7 kg per bed each day. The rate for the urban health centre was about 1.5 kg per bed each day, but here there may have been a larger proportion of the total number of patients who were outpatients and so did not use a bed, so the weight generated per bed would have been higher. If the total weight of waste generated each day at the private hospital was 2 tonnes, this represents a generation rate of 7 kg per bed, which is ten times the figure for the municipal hospital. The amount of *hazardous* waste for the private hospital was estimated to be 0.7 kg per bed each day. As is often the case, it is very important not to accept figures without ascertaining how they were determined. The figure of 7 kg per bed was based on a total figure of 2 tonnes per day, which may have simply been a figure guessed by someone looking at a pile or estimated by a driver or loader who is accustomed to handling much denser materials. The generation rate for private hospitals is likely to be higher because private concerns often have more money to spend on disposable paper and plastic items whereas municipal hospitals may have to rely more on reusable items made from cloth and glass.

The team made determined efforts to obtain information from both the private and public hospitals about incidences of diseases or injuries to staff handling infectious wastes. Unfortunately no such data were available with the any of the hospitals. It was observed that even though 90% of the doctors and staff in Municipal Hospitals were well aware of the implications of handling hazardous hospital wastes, no efforts appeared to have been made to remedy deficiencies for the reason that this issue was thought to be outside their control.

### F-3 SUGGESTIONS

**a) Colour coding:** It is always advisable to minimise the risk of persons accidentally coming into contact with hazardous waste, and this risk can be reduced by always putting hazardous wastes into containers of a particular colour. Such containers, suitably labelled, should be provided in every operating theatre, ward and laboratory where such wastes may arise.

**b) Sharps:**

- ◇ Sharps such as needles, syringes, blades etc. are to be stored in a metal box or rigid plastic container till they are finally disposed of. The walls of the container should be strong enough that they are unlikely to be pierced by the contents. Plastic bottles made for carbonated drinks have been used successfully. The container should be destroyed or buried with the sharps - the containers should not be emptied and reused. It is probably better to use a cheap container (such as a soft drink bottle) and discard it with the sharps still inside than to use a specially designed sharps container repeatedly, emptying out the contents each time.
- ◇ Sharps, especially syringes with needles, often have a resale value, and may be reused by certain (often unlicensed) medical practitioners, by drug addicts, or by children. Such reuse poses the most serious threat to public health because viruses of AIDS and hepatitis can survive in blood within the needles and infect those who use them. Whilst every effort should be made to prevent the public from gaining access to these items, the best protection is provided by cutting the needles and syringes immediately after use so that they are not reusable. This places a heavy weight of responsibility on ward staff and those who train and supervise them.
- ◇ Before disposal all sharps should either to be autoclaved or disinfected chemically. Simply dipping these items into sodium hypochlorite may not be effective in killing pathogens within the needles or within deposits adhering to the outsides.
- ◇ If sharps cannot be incinerated they should be buried in a secure way such they cannot be recovered. One method may be to deposit them in a pit within the hospital grounds; the pit should be covered with a heavy concrete slab into which a steel pipe is embedded so that the needles and blades can be dropped down the pipe into the pit. (Coad, 1994)

**c). Other items of concern**

- ◆ Medicines are also a cause for concern since they may be used wrongly by people trying to treat themselves or by unscrupulous or untrained practitioners. Of particular concern are cytotoxic

drugs used to fight cancer because they are so potent and so dangerous when used without a high degree of supervision. All unused medicines in medical establishments should be returned to the pharmacy for reuse or safe disposal. Pharmacies may seek the assistance of the suppliers of the drugs and chemicals. The prospect of unauthorised people selling unused or expired drugs makes the need for strict security much greater.

- ◆ Containers, particularly bottles, pose a risk if they are not fully cleaned and disinfected after being used to hold chemicals or infected samples. Patients are often required to bring bottles with them so recycled bottles are often for sale outside hospitals and medical centres.
- ◆ Radioactive material is another cause for concern because people handling such material may not be aware of the risks. It may be satisfactory to incinerate or bury low level solid wastes (such as discarded protective clothing - which again has a resale value), but medium and high level wastes need specialist attention. Radioactive liquid wastes should not be flushed down drains without confirming with specialists that such a practice is acceptable.

**d) Less hazardous wastes** Other clinical waste which is less hazardous to health, if it cannot be incinerated, should be disposed of in landfills in a such way that access by any person or animal is denied. To achieve this a pit may be dug within the garbage fill and the waste deposited in it and then covered fresh garbage that will be filled as the next layer.

**e) Code of practice** In view of the importance and responsibility to be exercised in disposing the hospital waste, mere recommendations or instructions from time to time from the governing authority to the implementing authority will not solve the problem. To ensure improvements it is necessary to implement a code of practice which defines the individual in each hospital or health centre who is responsible, and imposes legal penalties on defaulters. One method of instilling a sense of responsibility in ward staff is to insist that every bag or container of waste is marked with a label to show which ward it has come from; if this is done then any failure to comply with mandatory procedures (such as a loose needle and syringe in a bag) can be traced back to the person responsible.

**f) Monitoring** The monitoring authority as well as the authority responsible for the management of hospital waste should be identified by means of legislation empowering the monitoring authority to initiate legal action under the criminal law against any defaulter. There are agencies like the State Pollution Control Boards, State Health Authorities and Local Body Health Authorities which are capable of monitoring the safe disposal of the waste under Pollution Control Acts, the Environment Protection Act 1986 (E.P. Act, 1986) and the Public Health Act, but which could not monitor hospital waste effectively due to the lack of legislative powers. Laws should be enacted empowering the monitoring authorities to initiate action against a defaulter, - the one person being designated as responsible for safe disposal of waste in every hospital.

**g) Training** Even though doctors are well aware of the importance of safe disposal of wastes, the system outlined above would not work unless effective training and guidance is given to the lower levels of staff. In fact the same opinion was also expressed by doctors. Therefore it is necessary to conduct training and refresher courses periodically for all medical and paramedical staff including doctors and unskilled manual workers, and all grades in between, Doctors, nurses and administrators need to be kept informed about the latest developments in hospital waste management and the legal implications in case of failure to discharge their duties of safe collection, transportation and disposal of hospital waste. Other staff, such as orderlies, cleaning staff and porters need to understand precisely how they should handle all types of waste, and should be supervised to ensure that they play their part effectively and conscientiously. If the waste must be transported away from the hospital premises, and treated and disposed elsewhere, this should be done by a special team of trained workers under strict supervision.

This being said, the crucial factor is motivation - how to make the individuals in every link of the chain want to protect the community and the environment from hazardous hospital wastes.

## References

- Grover, Velma I; Recycling and household waste management in India; IWM Proceedings, March 1997; Institute of Wastes Management, UK  
Coad, Adrian "Managing medical wastes in developing countries", World Health Organisation WHO/PEP/RUD/94.1, 1994.