

3. STATUS QUO REPORT ON THE SOURCES OF HCRW IN GAUTENG

3.1 Objectives of the Chapter

Previously, planning for HCRW treatment/disposal facilities was hampered as a result of the limited data that was available on the actual volume/mass of HCRW that was generated at the various health care facilities. Reliable information on the volume/mass of HCRW generated is required by the authorities to effectively plan primary and secondary storage facilities, collection strategies, transportation, treatment and disposal alternatives that can be controlled and monitored throughout the life of the facilities. This information is further required to determine the viability of recycling initiatives. This would also help to attract the private sector to invest in HCRW infrastructure and would assist in finalising contractual arrangements between the collection contractors and the owners of health care facilities. Furthermore, this would help in the formulation, implementation and monitoring of HCRW policy.

The purpose of this chapter is to outline the status of HCRW generation in Gauteng. This information will in turn be used to make recommendations on the ways in which the HCRW stream is to be managed. This chapter covers the methodology used, sources of information as well as number and location of HCRW generators in Gauteng. The survey results on the volume/mass of waste generated per service area together with the combined effect on total HCRW are also covered.

3.2 Methodology Used

In order to identify all potential generators of HCRW as well as to obtain all the relevant information on such generators, a desktop study was undertaken. This study included literature studies as well as consultation with various governmental and non-governmental bodies that are recognised in the medical field.

On completion of the desktop study and consultations with authorities and organisations dealing with HCRW, all potential HCRW generators identified were categorised and questionnaires that were appropriate for each particular group were developed with the aid of market research specialists. This not only ensured that the data collected would be valid, reliable and relevant to the study, but it also resulted in the development of a questionnaire that was user-friendly for use during the survey, as well as during the data capturing phase.

The questionnaires were then distributed to the members of the Project Steering Committee for comments, approval and subsequent finalisation. The various types of questionnaires, specifically developed for each of the categories were then used to capture data during the survey. The questionnaires for the different groups are attached in *Annexure 3.1*.

Statisticians from the University of the Witwatersrand were then employed to assist in determining the sample size for each of the health care institution categories to be surveyed, thus enabling the consultants to achieve a database that would be statistically representative.

Although the Project Brief indicated a number of potential sources of HCRW that were to be investigated, further investigations undertaken during the desktop study resulted in more potential sources being identified, which resulted in all sources of HCRW in Gauteng, with the exception of human bodies and animal carcasses, being included in the study. The complete HCRW stream was therefore identified and a scientifically selected number of facilities from each of the HCRW generating categories were then surveyed to have the generated waste masses quantified. It was important to cover the full spectrum of HCRW generators by first identifying all potential generators and then determining the contribution of each point source on the overall HCRW stream. The groups from which the sample size was determined were categorised as follows:

- Hospitals and clinics (Public as well as private);
- Medical Doctors, Veterinary Surgeons, Dentists, Medical Specialists;
- Old age homes, Mortuaries, Hospices;
- Pharmacies, Pharmaceutical Industries; and;
- Blood Banks, Pathology Laboratories.

The HCRW generated was weighed over periods ranging from one to seven days depending on the size of the facility under investigation (thus the volume of waste being generated) as well as the frequency at which HCRW was collected for treatment and disposal. HCRW containers (142 litre and 50 litre cardboard boxes with plastic liners; 85 litre plastic bags; 75, 50, 25 and 10 litre plastic buckets; 7,5 litre and 2,5 litre plastic sharps containers) were weighed to an accuracy of 10 grams on electronic platen scales. A total of 2 950 measurements were taken in the various health care institutions surveyed.

3.3 Sources of HCRW in Gauteng

Having identified all potential sources of HCRW in Gauteng, as well as the likely impact that each of these sources would have on the overall HCRW stream, the HCRW sources were divided into the major and minor sources as indicated below:

3.3.1 Major sources

The major HCRW generation sources were identified to be as follows:

- Provincial hospitals : Hospitals owned and operated by provincial Government
- Military hospitals : Hospitals for the exclusive use by military personnel
- Mine hospitals : Hospitals for the exclusive use by mine employees
- Private hospitals : Hospitals owned solely by the private sector
- Provincial clinics : Clinics owned and operated by provincial government
- Industrial clinics : Clinics owned and operated by private industries
- Private clinics : Clinics owned and operated by the private sector¹
- Municipal clinics : Clinics owned and operated by Local Councils
- Day clinics : Privately owned clinics with no overnight facilities

NOTE: some confusion exists on exactly where the line is drawn between a private hospital and a private clinic. A definition of a private clinic could not be found. The problem arises where a facility would have a number of beds, do major operations, keep patients overnight but be called a Clinic e.g. Park Lane Clinic, etc.

- Blood banks : Blood donor centres

3.3.2 Minor sources

The minor HCRW generation sources were identified as follows: -

- Laboratories : Private and Public Pathology laboratories.
- Pharmaceutical Industries : Industries with the potential of generating HCRW
- Pharmacies : Private dentists and dental surgeries
- Dentists : Private and public pharmacies not forming part of hospitals or clinics
- Old age homes : Institutions catering for the aged as well as Frail care
- Hospices : Home for destitute and terminally ill
- Mortuaries : Forensic laboratory where corpses are temporarily stored
- Doctors : Qualified practitioners of medicine
- Specialists : Specialists in the field of medicine
- Allied practitioners : Podiatrists, acupuncturists, chiropractors, etc
- Veterinary hospitals : Hospital for the treatment of animals
- Veterinary surgeon : Veterinarian treating diseases and disorders to animals
- Psychiatric hospitals : Hospitals for the treatment of patients with mental disorders
- Rehabilitation centres : Patients recovering after illness, imprisonment or substance abuse
- Prisons : Places of custody or confinement
- Private homes : Places where private persons live

At that stage, based on the number of patients treated as well as the extent of the treatment, it was anticipated that the various types of Hospitals and Clinics would be the primary generators of HCRW and that most of the effort had to be focussed on those generators. Attention was however also given to less significant generators of HCRW in order to verify what their respective impacts would be on the overall HCRW stream. It is however to be noted that although minor HCRW generators have limited impact on the HCRW stream in terms of the mass of waste being generated, it is still important with regards to the risk that its waste creates for society. It is therefore important that HCRW from such generators be monitored. In view of the minute quantities of HCRW expected to emanate from private homes as well as the difficulty with which such information would be obtained, no further attention would be given to this source category in the present study.

3.4 Number of Sources Generating Health Care Risk Waste in Gauteng

The desktop study, literature review and consultation with various stakeholders including the authorities and the private sector resulted in the compilation of a list of potential HCRW generators in Gauteng. As a point of departure, a list of potential HCRW generators (in the form of an *Excel* file) was obtained from *Med Pages*, which is a publication presenting details on most

health care institutions registered in South Africa. This database was initially compiled and is regularly updated by a private organisation. The list *inter alia* contained names, addresses, contact details and the respective sizes in terms of number of beds (where applicable) of a wide spectrum of health care institutions. This list was found to be reasonably accurate in most respects, but certain deficiencies became apparent. Firstly, some (public) institutions classified by *Med Pages* as hospitals were converted to Community Health Centres (“CHC’s”) and secondly, many (100-plus) public clinics were not reflected in the *Med Pages* database. The names of a number of health care facilities were also recently changed, which resulted in some confusion. The *Med Pages* database also included the number of beds available that was correlated with data provided by the DoH and where necessary verified when institutions were surveyed during the course of the study. In the case of public clinics the number of patients treated at the facility over a specified period of time was considered to be an objective measure of relative size (a calendar month in this instance).

For the public hospitals, the DoH classification system (i.e. “central, regional, district”, etc.) was adopted, in order to group these hospitals appropriately. It was thus possible to produce a comprehensive listing, on which rates of HCRW generation (as measured and/or as extrapolated for use in the various cost models) could also be reflected. This listing appears as ***Annexure 3.2***. A summary showing total numbers of public and private hospitals, clinics, etc. according to category and area is presented in ***Table 3.1*** below.

Table 3.1: Hospitals & Clinics in Gauteng according to category and area (Data summarised from the listing in Annexure 3.2)

Service	Ownership	Category	East Rand incl. Midrand	Jhb	Pretoria & surrounds	Vaal Triangle	West Rand	Total
Blood Transfusion	Public		6	8	7	2	3	26
Clinics	Military							24
	NGO			2				2
	Public		120	97	54	34	31	336
		Comm. Health Centres	2	3	1	2		8
		Marie Stopes		2	1		1	4
		Dental		3	2			5
	Private		8	15	9	3	5	40
		Day Surgery	9	10	8	3	5	35
		Dental	1					1
		Stepdown		3	5			8
Hospitals	Military				1			1
	Mining		2		1		6	9
	Private		21	20	28	5	12	86
		Psychiatric	5	6	2		3	16
		Rehabilitation	2	4	2		1	9
	Public	Central		1	2		1	4
		Regional	6	2	1	2	2	13
		District	2	1	2	1		6
		Psychiatric		1	1		1	3
		Rehabilitation			1			1
		Special		1				1

Minor HCRW sources were grouped and classified as Medical Doctors and Dentists, Pathology Laboratories, Pharmaceutical Industries and associated Healthcare Professionals such as Veterinarians. The total number of minor HCRW sources, grouped by area, is presented in **Table 3.2** below.

Table 3.2: Minor waste sources grouped by area

Area	East Rand incl. Midrand	Jhb	Pretoria & surrounds	Vaal Triangle	West Rand	Total
General Medical Practitioners	819	2 304	1 906	254	550	5833
Dentists	204	366	367	43	114	1 094
Physiotherapists	85	231	139	23	37	515
Retail Pharmacies	217	259	247	64	128	915
Hospital Pharmacies	13	16	17	6	9	61
Veterinarians	101	238	400	23	63	825
Pathology Laboratories	54	103	131	9	33	330
Pharmaceutical Companies	29	77	41	0	5	152
TOTAL	1 495	3 594	3 248	422	935	9 725

3.5 Location of HCRW Generating Sources in Gauteng

As a result of the magnitude of information to be included, only the large HCRW generators, i.e. hospitals and clinics (both public and private) are spatially presented on the Geographic Information System (GIS). Although not all clinics were expected to be significant generators of HCRW, it was felt that it would be useful to DACEL and to the DoH in particular to have the groundwork done for development of a comprehensive listing of these facilities. It was also decided that certain other (small) institutions would be spatially located, e.g. blood transfusion facilities, the Marie Stopes Termination of Pregnancy (TOP) clinics, etc. Locations of all hospitals, clinics (including Community Health Centres (CHC's)) and blood transfusion services are therefore as reflected on the Gauteng map presented in **Figure 3.1** below.

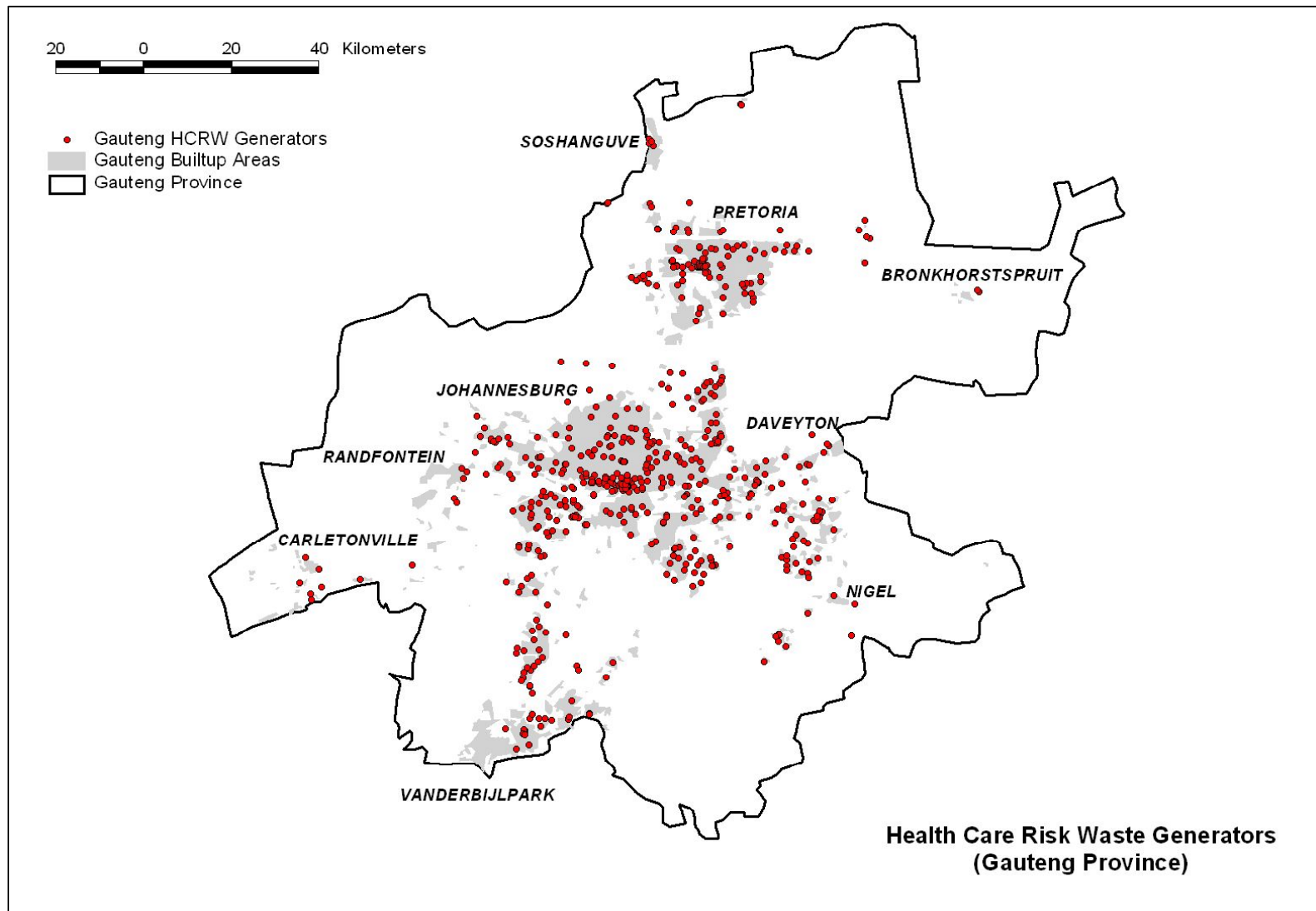


Figure 3.1: Location of major HCRW generators in Gauteng

To determine the coordinates of the various facilities that was not physically recorded by means of a GPS system, the *Map Studio* “*Map Master*” system was used. This system is in effect a computerised street-map system.

Once a health care facility was positioned on the “*Map Master*” system (using the best available information, viz. street address, suburb, zone, etc.) its longitude and latitude coordinates could be determined and recorded. The area covered by “*Map Master*”, however, did not include the extreme southern and western parts of Gauteng and for those areas, longitude and latitude coordinates were scaled from the *Map Studio* 1:20,000 “*Vaal Triangle*” street map or the *Map Studio* 1:250,000 Gauteng Map. In cases where GPS readings of incinerator locations were taken during the course of the present study, the latter was used where the incinerator location coincided with that of the HCRW generator.

A problem experienced during this phase of the work resulted from the many name-changes in Provincial Hospitals and Clinics that were not yet reflected in the *Map Studio* data.

Due to the large numbers as well as its limited impact on the overall HCRW stream, no attempt was made to spatially locate the following sources on an individual basis: pathology laboratories, general medical practitioners, dentists, associated medical practitioners, pharmacies, veterinarians, pharmaceutical manufacturers, mortuaries and forensic laboratories.

3.6 Rates and Types of HCRW Generated per Service Area in Gauteng

3.6.1 Notes on survey procedures

It is important to record that the field staff doing the actual weighing were careful to avoid influencing the waste generators as to what was regarded as HCRW. In other words, all the waste regarded by the HCRW generators as being HCRW, was treated as such and weighed.

3.6.2 Hospitals

A total of 29 hospitals were surveyed. Where HCRW was not collected during weekends, weighing was only done during the week, ultimately arriving at a total waste generation mass per week. The total mass of HCRW recorded at any particular hospital was then divided by the number of days over which weighing was undertaken to establish an average daily HCRW generation mass. This daily average mass was then multiplied by 30.4 (taken as the average number of days per month) to arrive at a monthly equivalent HCRW generation mass. The monthly HCRW figures are reflected in **Table 3.3** below.

The HCRW generation data, as recorded during the survey, was then compared with average monthly HCRW generation figures for certain institutions, as obtained from a private HCRW Management Company. These figures were accumulated during the course of the execution of its HCRW collection, treatment and disposal contract with the Gauteng DoH. The figures obtained from the private HCRW Management Company, as weighed at their incinerators, are presented in **Table 3.3**, together with a “key” showing the type of service provided in each case, viz. Sharps only (“s”), sharps plus 142 litre containers (“s,l”), sharps plus 142 litre containers plus wet-waste containers (20 litres) (“s,l,w”), etc.

In order to set a norm for comparison of the HCRW generation in the various facilities, the number of patients treated in the hospital at the time of the survey was also obtained, with a view of relating the amount of HCRW generated to the number of patients treated. (In some instances the “occupancy” figure was not immediately available as certain hospitals recorded the number of admissions and discharges over a period of one month. Occupancy figures (or percentages of available beds occupied) could therefore in some instances only be obtained once the admission/discharge data was processed by the hospital administration, which often only takes place after month-end.

The ‘Daily HCRW Mass per Patient’ column in **Table 3.3** reflects the following: -

Survey

The Daily Mass of HCRW generated per patient, as calculated from the survey results (measured in kg).

Group Average

This is used in cases where more than one hospital was surveyed in any particular category, e.g. “private”, “public: central”, “public: district” etc. (Calculation of the group average is reflected in **Annexure 3.3**) The “Group Average” was determined by treating the HCRW generation figure (in kg/patient) for **each** institution for **each** day as **one** result, and then determining the average of all these results.

Group Standard Error

This is the Intra-group Standard Error of the survey results, as reflected in **Annexure 3.3**.

Model

The Daily HCRW generation rate per patient, to be applied when extrapolation is done to obtain a representative HCRW generation figure for health care institutions that were not surveyed. This “model” generation rate has been taken at the “upper 90% confidence bound” (refer **Annexure 3.3**), which as explained in Section 1.3.3 above, means that there is only a 5% risk that the actual HCRW generation rate for the group is underestimated.

Due to significantly varying occupancy rates, it was anticipated that the ‘Daily HCRW mass per Patient’ is intuitively the more correct metric than ‘Daily HCRW mass per Bed’ which appears from literature to be the more common metric. The ‘Daily HCRW mass per Bed’ has, however, also been calculated for comparative purposes for each of the hospitals surveyed, and is reflected in **Table 3.3**.

Table 3.3

3.6.3 Clinics

For the purpose of this study, a “clinic” has been taken to be a health-care facility where patients are not accommodated overnight.

Fifteen clinics belonging to the private sector, local government as well as provincial government, were surveyed individually, and a further 12 clinics, referred to as the “Soweto Clinics”, were surveyed as a group. This was as a result of the fact that a single contractor handles collection of HCRW from the Soweto clinics, and it was possible for the team to weigh such HCRW over a period of seven days. In addition to the clinics, two blood transfusion centres were surveyed. Details of the institutions surveyed are presented in *Table 3.4* below.

Estimated monthly HCRW masses at the private clinics surveyed varied from 25kg to 160kg. (This relatively wide range is to be expected, reflecting both differences in size and in services offered.) The **per-patient** generation rates ranged between 0,06kg and 0,48kg. (This range reflects differences in level of servicing.)

For public clinics, the per-patient daily generation range had a comparatively wider spread (viz. 0.002 to 0.05kg) but was in general lower than for private clinics. This is not surprising, given the fact that the level of servicing as well as the ability to perform surgical and other procedures, etc. is much higher at the private clinics.

In the case of the public clinics, approximate monthly patient numbers were obtained from the DoH. In respect of the “Soweto Clinics”, the weighed HCRW masses and the patients/month figure produced a generation rate of 0.05kg/patient, which was considerably higher than generation rates for public clinics surveyed individually, as can be seen from *Table 3.4*.

As with hospitals, clinics have been grouped, and ‘Model’ HCRW generation values have been statistically derived for the “Upper 90% confidence limit”. In respect of the derivation of a model HCRW generation rate for private clinics, a “per institution” HCRW generation figure was used, rather than attempting to establish the number of patients treated over an average month. In part, this decision was taken as the clinics were reluctant to divulge patient numbers, and in part because it was felt that there would be no advantage in respect of the accuracy of the predictions if a “per patient” figure is used, given the relatively small contribution that these clinics make to the overall HCRW stream. The “per institution” figure for the highest group (day-surgery) was used for all private clinics except step-down facilities. This figure was also adjusted for sample size, in a similar way to the hospitals. The figure used was 135 kg/institution/month; for step-down facilities a figure of 20 kg/institution/month was used (as shown in *Table 3.3*).

Table 3.4

3.6.4 “Minor” HCRW Generators

In total, 58 surveys were undertaken covering general medical practitioners, dentists, pharmacies and other “minor” generators. A summary of these surveys is presented in *Tables 3.5 a & b* below.

Table 3.5(a): Categories catered for by number & geographical location

Category	Sample Size	HCRW Generation rate kg/month			Model (kg/month)	Notes
		Maximum	Minimum	Average		
Doctors (G.P.'s)	15	10	Nil	3,5	3,5	
Dentists	1	2	2	2,0	2,0	
Physiotherapists	2	3	1	2,0	2,0	Many spend some or all of their time in hospitals/clinics
Pharmacies	9	8	0.5	2,9	3,0	
Pathology Laboratories	2	68	28	48,0	50,0	
Pharmaceutical Manufacturers	1			400,0	300,0	
Veterinarians	9	50	0.5	9,4	5,0	Larger vets surveyed had up to 4 individuals; the model figure is applied per individual. Carcasses were excluded.

Table 3.5 (b): Categories catered for in general terms only

Category	Sample Size	HCRW Generation rate kg/month			Model	Notes
		Maximum	Minimum	Average		
Audiologists	1			Nil		
Optometrists	2	Nil	Nil	Nil		
Podiatrists	2	5	5	5,0		Approx. 75 in province
Old Age Homes	5	15	Nil	6,2		Approx. 200 in province. Waste generated varies with home size: largest surveyed had 300 residents
Hospices	1			25,0		Only Approx. 10 in province
Prisons	2	40	35	37,5		Small number in province
Onderstepoort Vet. Hospital.	1			150,0		Unique
Industrial Clinic	1			5,0		Est. 2,000 in province
Military Clinic	1			15,0		Approx. 15 in province
SAP Forensic Laboratory.	1			Nil		Unique
Mortuaries	1			Nil		
SPCA	1			1,0		Est. 100 in province

Estimated Total Mass of Medical Waste generated by the above: **13,000 Kg/month**

Tables 3.5 (a) & (b) reflect sources which, although individually small, contribute significantly when considered together. These sources were, in turn, treated in two different ways: for the first group (*Table 3.5 (a)*), which included general medical practitioners, dentists, physiotherapists, pharmacies, pathology laboratories, pharmaceutical manufacturers and veterinarians, the amount of HCRW emanating from these sources could be estimated by area, utilising the information contained in *Table 3.2* above.

For the second group (*Table 3.5(b)*), which included old-age homes, mortuaries, prisons, etc., the very small quantities generated (totalling an estimated 13,000kg/month) did not in the author's opinion justify any attempt to locate the sources spatially.

The resulting estimated HCRW generation figures are presented in *Table 3.6* below, showing a total mass of 93 230kg/month, estimated to emanate from these sources. To provide for possible omissions from the list, an adjustment of approximately 25% has been made to the totals. The adjusted overall total is 117 000kg.

3.7 Survey Results

As mentioned above, the HCRW generation rates for the institutions surveyed have been presented in both kg/patient/day and kg/bed/day terms. Due to the large range of bed-occupancy figures encountered, the former measure is more appropriate than the latter. (The actual occupancy rates recorded during the survey ranged from 10% in the case of the Premier Hospital (mining), to in excess of 100% in the case of the Johannesburg Hospital.) However, it should be noted that the hospitals with low occupancy rates tend to be private/mining hospitals, which generate more HCRW on a kg/patient/day basis than the larger (typically public) hospitals. For

this reason, the HCRW generation rates expressed on a kg/bed/day basis show a similar degree of variation (as measured by the standard deviation) to the generation rates expressed on a kg/patient/day basis. For this study the kg/patient/day rates will be used in the development of the Model (described in more detail in Paragraph 3.8 below), which seeks to estimate the overall rate of HCRW generation in Gauteng. The following points were deduced from the survey:

Table 3.6: Total estimated HCRW generation by minor sources (kg/month)

Category	HCRW generation rate kg/month	Pretoria Area (kg/month)	Mid & East Rand (kg/month)	West Rand (kg/month)	Vaal (kg/month)	Jhb (kg/month)	TOTALS (kg/month)
Doctors	3.5	6,670	2,870	1,930	890	8,060	20,420
Dentists	2.0	730	410	230	90	730	2,190
Physio-therapists	2.0	280	170	70	50	460	1,030
Retail	3.0	740	650	380	190	780	2,740
Hospital	10.0	170	130	90	60	160	610
Vets	5.0	2,000	510	320	120	1,190	4,140
Pathology Laboratories	50.0	6,550	2,700	1,650	450	5,150	16,500
Pharmaceutical Co.'s.	300.0	12,300	8,700	1,500	0	23,100	45,600
TOTALS		29,440	16,140	6,170	1,850	39,630	93,230
Adjustment		25%	25%	25%	25%	25%	23,770
ADJ. TOTAL		37,000	20,000	8,000	2,000	50,000	117,000

- The range of HCRW generation rates vary from a low of 0.001 kg/patient/day (Huis Herfsblaar Frail Care, Cullinan Rehabilitation Centre) to 4.04 kg/patient/day (Milpark Hospital).
- Taking public hospitals on their own, and excluding rehabilitation and psychiatric hospitals, which have low rates of generation, the range varies between 0.23 kg/patient/day (Kopanong) to 2.43 kg/patient/day (Pretoria Academic).
- Taken as groups, central hospitals showed an average generation rate of 1.23 kg/patient/day, district hospitals an average generation rate of 0.71 kg/patient/day and regional hospitals an average generation rate of 0.63 kg/patient/day.
- Amongst the central hospitals, Pretoria Academic is significantly higher than the other three hospitals.
- Amongst the regional hospitals, Helen Joseph is significantly higher than the other four hospitals surveyed.
- HCRW generation rates at private hospitals ranged from 0.50kg/patient/day to 4.04 kg/patient/day (Milpark).

3.8 HCRW Generation “Model” for Gauteng

The “Model” HCRW generation rates as derived and described above were applied to all institutions as listed in *Annexure 3.2*, by category/type, in order to produce an estimated monthly HCRW mass for each institution.

In cases where monthly patient numbers at public clinics were not known, these were estimated, by region, based on data that had been received from DoH. The data and calculations are reflected in *Table 3.7* below. The patient numbers used in the model are: East Rand 3 300; Johannesburg 9 200; Midrand 7 700; Pretoria and surrounds 4 100; Vaal 3 400 and West Rand 4 500. The figure estimated for Community Health Centres is 9 600.

Table 3.7 Patient Numbers: Public Clinics

	Clinics						C H C's
	East Rand	Jhb.	Midrand	Pretoria	Vaal	West Rand	
(Patient numbers per month at various clinics/CHC's as provided by the Dept of Health)	250	1,200	1,800	450	50	100	2,000
	250	1,500	4,400	1,700	1,000	250	4,000
	350	1,700	5,100	2,000	1,100	700	4,900
	350	1,800	6,100	2,100	1,100	1,000	5,300
	350	1,800	7,600	2,150	1,300	1,500	8,000
	450	1,800	9,900	2,200	1,300	1,600	15,000
	500	2,000		3,600	2,100	1,600	
	600	2,800		5,290	2,100	1,700	
	700	5,600		7,500	2,200	1,800	
	750	6,000			2,300	1,800	
	950	6,500			2,300	3,500	
	1,100	8,000			2,400	7,000	
	1,200	8,000			2,800	8,000	
	1,300	10,000			3,000	9,000	
	1,400	11,000			3,100	10,000	
	1,500	15,000			3,100		
	1,600	17,000			3,200		
	1,600	18,000			3,300		
	1,600	19,000			3,400		
	1,700				3,500		
	1,900				3,500		
	2,100				3,500		
	2,200				4,300		
	2,200				4,400		
	2,200				4,700		
	2,300				6,600		
	2,300				8,400		
	2,400						
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	3,300						
	3,400						
	3,990						
	4,000						
	4,100						
	4,100						
	4,400						
	4,400						
	5,200						
	5,200						
	5,200						
	5,200						
	5,800						
	6,600						
	6,600						
	7,000						
	14,700						
Average	2,853	7,300	5,817	2,999	2,965	3,303	6,533
Std. Dev.	2,400	6,116	2,778	2,157	1,743	3,390	4,582
N (obs.)	55	19	6	9	27	15	6
Conf. coeff. @ 90%	0.68	0.69	0.73	0.71	0.68	0.69	0.73
Model	3,100	8,300	6,700	3,500	3,200	3,900	8,000

The resulting estimated figures for HCRW generation at each facility are also reflected in *Annexure 3.2*. These figures are utilized in the “Feasibility Study into The Possible Regionalisation of HCRW Facilities in Gauteng”. (Chapter 6 below). However, for purposes of brevity, the estimated overall HCRW generation figures by type and category of institution are presented in *Table 3.8* below. As may be seen from this table, the estimated total HCRW generation figure for Gauteng is approximately 1 175 tons per month.

Table 3.8: Estimated HCRW Generation in Gauteng, by Type of Source and Area (kg/month)

Service	Ownership	Category	East Rand incl. Mid Rand	Johannesburg	Pretoria & surrounds	Vaal Triangle	West Rand	Total	Group Totals
Blood Transfusion Services	Public		510	680	595	170	255	2,210	2,210
Clinics	Public		32,640	69,120	16,850	8,470	9,750	136,830	143,290
		Comm. Health Centres	1,200	2,160	770	1,330		5,460	
		Marie Stopes		250	125		125	500	
		Dental		300	200			500	
	Private		1,080	2,025	1,215	405	675	5,400	10,445
		Day Surgery	1,215	1,350	1,105	405	675	4,750	
		Dental	135					135	
		Step-Down		60	100			160	
Hospitals	Military				8,460			8,460	8,460
	Mining		170		170		6,750	7,090	7,090
	Private		109,803	80,326	131,060	24,170	86,150	431,509	443,249
		Psychiatric	2,720	700	460		7,750	11,630	
		Rehabilitation	20	40	20		30	110	
	Public	Central		61,660	107,800		76,360	245,820	427,790
		Regional	61,090	24,190	24,140	26,110	19,760	155,290	
		District	7,670	4,110	6,300	3,840		21,920	
		Psychiatric		220	2,100		1,320	3,640	
		Rehabilitation			20			20	
		Special		1,100				1,100	
Totals:			218,253	248,291	301,490	64,900	209,600	1,042,534	
Minor waste sources: (ref. Table 3.6)			20,000	50,000	37,000	2,000	8,000	117,000	
Minor waste sources (general): (ref. Table 3.5(b))								13,000	
Estimated Grand Total for province:								1,172,534	kg/month

3.9 General Observations from the on-site surveys

3.9.1 Intermediate storage area

It was obvious that the storage areas in some hospitals were given a high profile whilst in others it was almost totally ignored. The following is a summary of some of the findings with respect to onsite storage:

Little Company of Mary

HCRW is stored under roof in close proximity of the incinerator. Access to HCRW is not restricted and the storage area is not supervised.

Pretoria West

No dedicated storage area for HCRW. HCRW is stored in an open courtyard that is in some instances amongst general household waste. Red plastic bags normally used for the disposal of HCRW were noticed in a municipal container for household waste. HCRW is left unsupervised.

Pretoria - East

HCRW is stored in specially demarcated area. The area is locked and under roof. HCRW is under supervision until incinerated.

Unitas

HCRW is stored in a lockable storage room until collected by contractor.

Garankuwa

HCRW is stored in a specially demarcated area, although it cannot be locked. HCRW is left unattended.

Tembisa

HCRW is stored outside in an open courtyard. A temporary permit was granted to do incineration. According to the supervisor, the Tembisa Hospital was at the time of the survey receiving HCRW from Pretoria Academic Hospital for incineration.

Mamelodi

HCRW is stored under roof in an open space outside the maternity section. HCRW is left unsupervised for the contractor to collect. The gate cannot lock.

Johannesburg General

An area is demarcated for HCRW but the area is too small for the volumes generated. HCRW is stored outside the building in the car parking area until the contractor collects it. No roof is provided and the area is not supervised. The HCRW is exposed to all elements.

Pretoria Academic

A dilapidated building is used to store HCRW until it is collected by the contractor. This old building cannot be locked and the roof is not waterproof. HCRW is left unattended. The floor and walls of this building are in a state of disrepair and are therefore not washable.

At the orthopaedic and maternity sections the HCRW is stored in lockable rooms and kept under supervision.

The Glynnwood

HCRW is stored in a dedicated storeroom that is locked and properly supervised. This hospital uses red plastic bags for HCRW collection and the HCRW is daily incinerated on the premises, except during weekends when cardboard boxes are used to collect the HCRW. No waste is incinerated during weekends. A private contractor was appointed to collect the HCRW accumulated during weekends for safe offsite treatment and disposal on Mondays.

Kalafong

HCRW is stored in a specially demarcated area under roof, outside the hospital. The HCRW storage area cannot be locked and is left unsupervised. Access to the HCRW is unobstructed.

3.9.2 Collection and internal transportation

Internal transport of HCRW in different institutions ranges from a tractor-trailer systems and trolleys, to workers carrying the HCRW by hand to the intermediate storage areas. This equipment was generally in a good state of repair and was found to be suitable for the intended purpose. It was however found that the trolleys were in some instances overloaded resulting in some containers falling over the sides. This happened in a number of cases at the Johannesburg General Hospital where huge quantities of HCRW are collected and transported to the intermediate storage area, which inevitably led to some damage to the containers and in some cases spillage of the contents.

The issuing of protective clothing to workers involved with collection and handling of HCRW in the hospitals does not receive the required attention and the associated risks involved with transmitting diseases to the workers should be emphasized.

3.9.3 Ash from the Incinerators

Where incinerators are in use at the HCRW source, the ash from the incinerators is in all instances disposed of at a municipal landfill site. No special precautions are taken to treat and dispose of the ash to an H:H hazardous waste disposal site as prescribed by the "Minimum Requirements". The ash is deposited amongst the household waste; often mixed with boiler ash.

3.9.4 Radioactive Waste

A limited amount of radioactive material is used and where encountered it is disposed of in a controlled manner. The hospitals receive all their radioactive pharmaceuticals in injection form from private pharmaceutical companies. Each syringe is packed separately in lead containers and once used, is placed back in the container and covered with a bio hazardous seal before being returned to the supplier the following day for safe disposal. A hospital the size of The Glynnwood (289 beds) would use on average 250 radioactive syringes in any one month. Radioactive waste is not stored on site at the hospitals.

3.9.5 Human Tissue

Human tissue is treated in various ways by the hospitals. The personnel in hospitals are in some instances unaware of prescriptions on the way in which to handle, treat or dispose of human tissue. Human tissue is incinerated where incinerators are available. One hospital buries all human tissue with unidentified bodies, although the responsible person admits that this is not the desired option of disposing human tissue and that this method of disposing will be stopped. Outside waste management contractors such as Sanumed provide specially marked plastic, waterproof containers for disposal of e.g. placentas. In all instances proper records are kept of amputated human body parts. Human tissue is refrigerated until collected by outside contractors or in the event of downtime on onsite incinerators.

3.9.6 Mortuaries

No HCRW, including sharps, are generated in these facilities. All clothing not claimed by relatives is treated as “infected waste“ and is incinerated on the premises where the mortuary forms part of a hospital. Very few disposable products are used and body tissue that may have been removed is buried with the corpse. Water used for cleaning and disinfection of the premises is flushed into the municipal sewer system.

3.9.7 Blood Banks

At the Blood Transfusion Centres water that has been contaminated with blood is stored in 25lt plastic containers. These containers are collected by a contractor and transported to the Head Office of the Blood Transfusion Service for safe disposal. Water used for washing and disinfection of the premises is flushed into the municipal sewer system. At the two facilities surveyed, the estimated monthly HCRW mass was 30 and 50 kilograms, respectively

3.9.8 Containers

Different size biohazard cardboard boxes are used i.e. 142lt capacity (15kg dry waste) and 50lt capacity (15kg wet waste). Different size biohazard plastic buckets i.e. 85, 75, 50, 25, 10, 7.5, 5 and 2.5lt are used. Some institutions make use of red 85lt plastic bags for the disposal of HCRW. The main consideration for using plastic bags instead of boxes or buckets is financial. The 2.5lt container is most commonly used for the disposal of sharps. Unconventional containers, which pose a health and safety hazard i.e., empty 2lt plastic cooldrink bottles etc. were also used to collect sharps. This might be the reason for the spilled used sharps in most of the intermediate storage areas.

The colour of the plastic liner bags is not uniform and is in many instances also determined by financial considerations.

3.10 Trans-boundary Movement of HCRW.

The trans-boundary movement of HCRW into and out of Gauteng can be considered on two levels. Firstly, HCRW can originate from or be transported to other South African Provinces and particularly those that border Gauteng, i.e. Mpumalanga, Free State, Northern Province and the North West Province. In the past, some movement to Gauteng has occurred because of lack of treatment facilities within the neighbouring Provinces, although recent developments (particularly in the Free State and Northern Province) have resulted in lower amounts being transported to Gauteng for treatment. According to a large waste management company, the quantity of HCRW from outside Gauteng regularly treated at their facilities amounts to no more than 2% of the total volume handled by them. This equates to approximately 6 to 7 tons per month.

The recent HCRW crisis in Gauteng and the lack of facilities that one required to manage the HCRW generated lead to a build up of waste. Apart from some being landfilled, the crisis has been addressed by transporting HCRW for treatment to Kwa-Zulu-Natal and the Western Cape. Clearly, it is important that each Province manages its own HCRW and transport of HCRW over such long distances on a regular basis is not acceptable. It is, however, understood that the

medium to long term policy of most Provinces is to manage their own waste streams. In the short term, until facilities can be made available, it is likely that limited disposal across Provincial borders will occur. Collaboration between Provinces in the long term is however considered important, as it would make economic sense to transport waste to the nearest facility, even if it is located within a different Province.

The trans-boundary movement of hazardous waste including HCRW between countries is managed within the requirements of the Basel Convention of which South Africa and many of its neighbours, such as Botswana, Zimbabwe and Swaziland are signatories. Many of the SADC countries are looking to South Africa to assist them with their hazardous waste management and importation of selected hazardous waste in terms of the Basel Convention is a possibility in the future. However, Gauteng does not border directly onto any of the SADC countries and importation of HCRW into Gauteng is considered unlikely. Some SADC countries, such as Botswana and Swaziland, are in the process of developing their own HCRW strategies. This is in the former case done with GTZ support and in the latter through technical and financial assistance from DANCED.

3.11 Training and Awareness

3.11.1 Introduction

The need for training and awareness programmes for both general and hazardous waste, which includes HCRW, was identified as a key issue during the development of the National Waste Management Strategy. There is clearly a lack of capacity at National, Provincial and Local level to implement and monitor HCRW at health care facilities. Training programmes for the authorities and health care workers are required and emphasis should be given to HCRW in waste awareness and education programmes. Management of HCRW is an integral part of hospital hygiene and infection control. HCRW should be considered as a reservoir of pathogenic microorganisms, which can cause contamination and give rise to infection. If HCRW is inappropriately managed, these microorganisms can be transmitted through direct contact, in the air, or by a variety of vectors. HCRW can contribute in this way to the risk of infections, putting the health conditions of hospitals at risk.

In South Africa, there have been a number of initiatives that lead to, at least, a portion of the infectious waste stream being managed in a reasonably acceptable manner. For example, guidelines for the disposal of waste materials within health care facilities that are based on a Canadian system were developed and published in 1993 by the SABS, (SABS 0248; 1993). In addition, systems for the handling and disposal of infectious waste have since 1990 been introduced by waste management companies, in collaboration with the Department of Environmental Affairs and Tourism, the Department of Health and the Department of Water Affairs and Forestry. Such handling, collection, treatment and disposal systems are based on many of the principles contained in SABS 0248 and those that have been in use in the USA and Europe. Although some of the HCRW stream is managed reasonably well, the regular presence of HCRW in the general waste stream (on permitted as well as non-permitted disposal sites and even discarded illegally), indicates that many facilities are managing their waste incorrectly which results in a considerable threat to human health. Currently, the SABS is in the process of updating their code of practice on the disposal of waste generated by health care facilities and a working

committee has already been established. This offers a considerable opportunity for the development of appropriate guidelines that can be used as the basis for the development of training programmes.

3.11.2 Survey observations

During the survey it was apparent that training on HCRW management in the health care institutions is inadequate, which results in a lack of awareness and understanding of the correct management procedures and risks involved if the correct waste management procedures are not adhered to. In most health care facilities training manuals on HCRW management were non-existent. Infection control personnel on the other hand, who often expressed the opinion that HCRW management is not given sufficient status in the curriculum, undertake training of hospital staff on HCRW management.

Insufficient training and awareness is not only resulting people's health and safety being put at risk, but it is also resulting in large volumes of HCRW being treated that may have been disposed of with the domestic waste. Poor segregation leads to HCRW being disposed of on general waste landfills in some instances, whilst also resulting in general waste is being incinerated in other instances.

A clear lack of motivation and awareness was evident. One of the observations made was that the provincial hospital staff is not aware of the cost implications of the HCRW treatment and is therefore not committed towards a reduction in the HCRW stream. The persons responsible for managing HCRW is often not familiar with the "cradle-to-grave" and "polluter pays" principles. The importance of appropriate training in the management of HCRW cannot be overemphasised, as this will not only result in safer and more responsible management for HCRW, but it will also bring some financial savings through a reduction in the HCRW stream that is to be treated.

On enquiry whether the institutions have training manuals or documents available that specifically deals with HCRW management, a wide variety of responses were received, and in particular from the persons handling the HCRW. The general feeling is however that even where the senior staff were aware of the manuals or documentation, this information was not passed on to the waste handlers.

The following documents can be considered to be relevant to the subject and could be used in training programs:

Acts

- The Health Act, 1977 (Act 63 of 1977).
- Occupational Health and Safety Act, 1993 (Act 85 of 1993).
- Medicines and Related Substances Control Act, 1965 (Act 101 of 1965).
- Human Tissue Act, 1983 (Act 56 of 1983).
- National Environmental Management Act, 1998 (Act 107 of 1998).
- Hazardous Substances Act, 1973 (Act 15 of 1973).
- Environmental Conservation Act, 1989 (Act 73 of 1989).

- Nuclear Energy Act, 1993 (Act 131 of 1993) (Repealed).
- National Nuclear Regulator Act, 1999 (Act 47 of 1999).
- Atmospheric Pollution Prevention Act, 1965 (Act 45 of 1965).

Internal Policy Documents

- Environmental Policy on Waste Disposal.
- CDC Standards.
- Netcare Infection Control Standards.
- Internal Circular 47 of 1997 – Medical.
- Presmed Infection Control Policy - G4.1.
- Health and Safety Policy 1.24 - Medical Waste Control.
- Infection Control Policy No 24 – Disposal of Medical Waste.
- Infection Control Policy No 33 – Disposal of Human Tissue.
- Infection Control Policy – How to deal with a blood spill.
- Health and Safety Policy - Recycling Policy.
- Health and Safety Policy – Hazardous Chemical Spill.
- SABS Code of Practice on Hazardous Substances Code 0228.
- SABS Code of Practice for the Handling and Disposal of Waste Materials within Health Care Facilities – SABS 0248:1993.

3.11.3 Lack of Motivation and Awareness at health care facilities

In a brief survey conducted on behalf of the NWMS (Baldwin and Ball, Proceedings WasteCon 2000, Somerset West, 2000, p432) considerable apathy and lack of awareness was found amongst the health care professionals regarding HCRW management. This of course does not serve to motivate the majority of staff who have to handle the HCRW. This lack of motivation and awareness at professional level also results in a failure to promote awareness and training programs to improve the situation, as well as the development of proper job descriptions for the people doing the work. At this level, most felt overwhelmed by the enormity of the task and were apathetic. Of the four people encountered during the NWMS study, who had had some training, only one was aware of the risks associated with HCRW management. On investigation, it was found that the training received was a "once off" training day comprising several lectures. Although there are Infection Control Committees in hospitals and clinics, there was insufficient emphasis on training in the management of HCRW. Since HCRW management training is not a priority, it follows that the standard of HCRW management leaves much to be desired. Cleaners and casual labourers, who were observed emptying colour-coded bags into black bags, had apparently never been trained or instructed regarding HCRW.

The proper training of workers who handle HCRW is essential and it has been noted that most of the HCRW waste management companies had training programmes for their staff and in one case for hospital staff. Workers at risk include health-care providers, hospital cleaners, maintenance workers, operators of waste treatment equipment, and all operators involved in waste handling and disposal within and outside health-care establishments.

3.11.4 Training programmes

All hospital personnel, including senior medical doctors, should be convinced of the need for a comprehensive HCRW management policy and the related training, and of its value for the health and safety of all. This should ensure their collaboration in the implementation of such a policy.

Separate training activities should be designed for, and targeted to, four main categories of personnel:

- Hospital managers and administrative staff responsible for implementing regulations on HCRW management;
- Medical doctors;
- Nursing staff;
- Cleaners, porters, auxiliary staff, and waste handlers.

Since action is needed at management level, by those producing the waste, as well as by the waste handlers, training of all of these categories of personnel is equally important.

Medical doctors may be educated through senior staff workshops and general hospital staff through formal seminars. Training of the HCRW manager and regulators, could take place outside the hospital, at public health school or at Technikons and Universities.

Training programmes will clearly depend on the target group but could include:

- Information on, and justification for, all aspects of the HCRW policy;
- Information on the role and responsibilities of each hospital staff member in implementing the policy;
- Technical instructions relevant for the target group, on the application of HCRW management practices;
- The nature of HCRW and the potential risks it poses to human health and the environment;
- The procedures for the packaging, handling, storage and safe transport of the HCRW;
- The treatment of HCRW and the disposal of any residues;
- The value of immunization against viral hepatitis B and the importance of consistent use of personal protection equipment (PPE), i.e.;
 - Helmets, with or without visors - depending on the operation;
 - Face masks - depending on operation;
 - Eye protectors (safety goggles) - depending on operation;
 - Overalls (coveralls) - obligatory;
 - Industrial aprons - obligatory;
 - Leg protectors and/or industrial boots - obligatory;
 - Disposable gloves (medical staff) or heavy-duty gloves (waste workers) - obligatory;
- The need for basic personal hygiene to reduce the risks from handling HCRW;
- Convenient washing facilities (with warm water and soap) should be available for personnel involved in the handling of HCRW. This is of particular importance at storage and incineration facilities;

- The procedures that apply in the case of receiving a needle stick injury or coming into contact with infectious material. This should include the automatic provision of an AZT injection to guard against the possibility of contracting AIDS;
- The Emergency procedures required for a leakage or spillage that involves infectious material.

Periodic repetition of courses will provide refresher training and orientation for new employees as well as existing employees with new responsibilities; it will also update knowledge in line with policy changes. Follow-up training is instructive for trainers, indicating how much information has been retained by course participants and the likely need for future refresher courses.

The responsibility for all training related to the segregation, safe handling (i.e. collection, transport, storage, treatment and disposal) of HCRW should be given to the Infection Control Officer (ICO). He or she should ensure that staff at all levels is aware both of the HCRW management plan and policy and of their own responsibilities and obligations in this regard. A record should be kept of all training sessions, and the content of training programmes should be periodically reviewed and updated where necessary.

3.11.5 Public education and awareness on hazards linked to HCRW

Promotion of the appropriate handling and disposal of HCRW is important for the health of the community, and every member of the community should have the right to be informed about potential health hazards. The objectives of public education on HCRW should include the following:

- *Prevent exposure* to HCRW and related health hazards. This exposure may be voluntary, in the case of scavengers, or accidental, as a consequence of unsafe HCRW disposal methods;
- *Create awareness and foster responsibility* among patients and visitors to health-care institutions regarding hygiene and HCRW management;
- *Inform the public* about the risks involved with handling, transport and disposal of HCRW, focusing on people living or working in close proximity of, or visiting, health-care institutions, families of patients treated at home, and scavengers on waste disposal sites.

The following methods can be considered for public education on the risks involved, waste segregation, or HCRW disposal practices:

- Poster exhibitions on HCRW issues, including the risks involved in scavenging discarded syringes and hypodermic needles;
- Education of patients and visitors, on the health-care facility's HCRW management policies;
- Informative poster exhibitions at strategic points in hospitals, such as waste bin locations, giving instructions on HCRW. Posters should be explicit, using diagrams and illustrations to convey the message to as broad an audience as possible. For maximum effectiveness, all information should be easily accessible for patients and visitors and should be displayed or communicated in an attractive manner that will hold people's attention;

- In the health-care establishment, waste containers should be easily accessible for patients and visitors and should be clearly marked with the waste category for which they are intended.

Growing awareness of health and environmental hazards has greatly increased public demand for information and guidance on these issues. Demand has intensified as the prevalence of HIV/AIDS and viral hepatitis B has risen. Health-care institutions should set an example to society by managing their waste in a manner designed to protect health and the environment.