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Agenda item 3

**Promotion and protection of all human rights, civil,
political, economic, social and cultural rights,
including the right to development****Report of the Special Rapporteur on the adverse effects of
the movement and dumping of toxic and dangerous products
and wastes on the enjoyment of human rights, Calin
Georgescu***Summary*

In the present report, the Special Rapporteur focuses on the adverse effects that the unsound management and disposal of medical waste may have on the enjoyment of human rights.

While approximately 75 to 80 per cent of the total waste generated by health-care establishments does not pose any particular risk to human health or the environment, the remaining waste is regarded as hazardous and may create a variety of health risks if not managed and disposed of in an appropriate manner. Hazardous health-care waste includes infectious waste, sharps, anatomical and pathological waste, obsolete or expired chemical products and pharmaceuticals, and radioactive materials.

In many countries, significant challenges persist with regard to the proper management and disposal of health-care waste. The amount of waste generated by health-care facilities in developing countries is increasing owing to the expansion of health-care systems and services, a situation exacerbated by the lack of adequate technological and financial resources to ensure that health-care waste is managed and disposed of in a manner that is safe for human health and the environment.

Medical waste is often mixed with general household waste, and either disposed of in municipal waste facilities or dumped illegally. In health-care establishments where hazardous medical waste is incinerated, open burning and widespread deficiencies in the operation and management of small-scale medical waste incinerators result in incomplete waste destruction, inappropriate ash disposal and dioxins emissions, which can be even 40,000 times higher than emission limits set forth in the Stockholm Convention.

Contaminated sharps is the category of medical waste that attracts the most attention. Needle-stick injuries and reuse of infected sharps expose health-care workers and the community as a whole to blood-borne pathogens, including hepatitis B virus, hepatitis

C virus and Human immunodeficiency virus (HIV). However, each type of hazardous medical waste presents hazards that jeopardise the enjoyment of human rights.

The present report contains several examples of the adverse impact that the improper management and disposal of medical waste continue to have on the enjoyment of human rights in many countries. Nevertheless, the international community has to date paid little attention to this issue, despite the fact that a significant number of people – including medical staff, patients, workers in support services linked to health-care facilities, workers in waste disposal facilities, recyclers, scavengers and the general public – are potentially at risk of injury and/or contamination through accidental exposure to health-care waste.

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I. Introduction

1. The present report is submitted in accordance with Human Rights Council resolution 9/1, in which the Council requested the Special Rapporteur to continue to undertake, in consultation with the relevant United Nations bodies, organizations and the secretariats of relevant international conventions, a global, multidisciplinary and comprehensive study of existing problems and new trends in, and solutions to, the adverse effects of the trafficking and dumping of toxic and dangerous products and wastes on human rights, with a view to making concrete recommendations and proposals on adequate measures to control, reduce and eradicate these phenomena.

2. In the report, the Special Rapporteur focuses on the adverse effects that the unsound management and disposal of medical waste may have on the enjoyment of human rights. It consists of four substantive parts: the first part provides general information on the various categories of hazardous medical waste, and considers the way hazardous health-care waste is currently managed and disposed of. The second part focuses on the adverse human rights impact of the improper management and disposal of medical waste. The third part contains an analysis of the current normative framework elaborated at the international and national levels to regulate the sound management of hazardous medical waste. The last section contains conclusions and recommendations focusing on the additional measures that relevant stakeholders should consider adopting and implementing to bring about real and tangible improvements in the safe and environmentally sound management and disposal of medical waste.

3. In choosing this topic, the Special Rapporteur considered a number of factors, in accordance with the methodology outlined by the previous mandate holder in his first report submitted to the Commission on Human Rights.¹ These factors include the scale and seriousness of the phenomenon; the lack of an adequate regulatory framework; and the need to consider the phenomenon from a human rights perspective.

4. The Special Rapporteur wishes to thank the secretariat of the Basel Convention, the secretariat of the Stockholm Convention, the World Health Organization (WHO), Health Care Without Harm and the Centre for International Environmental Law for the information and assistance provided during the preparation of the present report.

II. Management and disposal of medical waste

A. Medical waste: definition

5. The terms “medical waste” or “health-care waste” refer to all waste generated by health-care establishments. They include waste generated by medical or other related practices. Major sources of medical waste are hospitals, clinics, laboratories, blood banks and mortuaries, whereas physician’s offices, dental clinics, pharmacies, home-based health care and so on generate smaller amounts.

6. Most of this waste, approximately 75 to 80 per cent of the total amount, consists of general health-care waste that does not pose any particular risk to human health or the environment. It includes materials that have not been in contact with patients, such as glass, paper, packaging material, metal, food or other wastes that are similar to household wastes.

¹ E/CN.4/2005/45, paras. 18-21.

7. The remaining 20 to 25 per cent of health-care waste includes that part of the health-care waste that is generated as a result of patient diagnosis, treatment or immunization. It is regarded as hazardous and may create a variety of health risks if not managed and disposed of in an appropriate manner. Hazardous medical waste may be classified into different types of waste according to the source, type and risk factors associated with its handling, storage, transport and ultimate disposal. These include (a) infectious health-care waste; (b) sharps; (c) anatomical and pathological waste; (d) chemical and pharmaceutical waste; and (e) radioactive waste.

8. Infectious health-care waste includes all biomedical and health-care waste, such as discarded materials or equipment contaminated with blood and other body fluids, contaminated waste from patients known to have blood-borne infections, and laboratory waste, which has the potential of transmitting infectious agents to humans or animals. Infectious waste constitutes from 15 to 20 per cent of all health-care waste. It must either be incinerated or be disinfected prior to final disposal through non-burn technologies, such as autoclaving and microwave treatment.² Incineration is the method most commonly used in developing countries to dispose of infectious waste.

9. Sharps include needles, syringes, blades, scalpels and other discarded objects with sharp or pointed parts able to cause injury. Since they can pierce the skin and are often contaminated with blood or other body fluids of patients with hazardous communicable diseases, sharps must be categorized as infectious waste. Sharps constitute approximately 1 per cent of all health-care waste. In order to prevent needle-stick injuries, used syringes and needles must be collected in puncture-resistant plastic containers. Treatment options include steam, heat or chemical disinfection, burial in a concrete pit on the health-care premises or incineration at a high temperature and with appropriate air pollution control to ensure minimal emission of toxic gases. Needles can be separated from the plastic syringe with a needle remover or cutter and placed in puncture-proof plastic or metal boxes for disposal in a sharps pit or other controlled on-site burial location.

10. Pathological waste is waste containing pathogens that could cause disease to humans and animals. It includes blood, mucus and anatomical parts or tissues removed during surgery or autopsy, as well as other materials, such as laboratory cultures and stocks requiring special handling and disposal procedures. Anatomical waste is a subgroup of pathological waste and consists of human body parts, including amputated body parts and other anatomical waste that is recognizable by the public or health-care staff and that demand, for ethical reasons, special disposal requirements. Anatomical and pathological waste represents 1 per cent of total health-care waste, and is always treated as potential infectious waste for precautionary reasons. In many countries, this waste is incinerated, but non-technologies can also be applied. Infectious laboratory waste should be autoclaved at the point of generation to reduce its hazardousness.

11. Chemical waste includes discarded chemicals that are generated during disinfecting procedures or cleaning processes. Pharmaceutical waste consists of expired, unused, spilt and contaminated pharmaceutical products, drugs and vaccines, as well as discarded items used in the handling of pharmaceuticals (such as bottles or vials). Waste in this category includes a multitude of preparations ranging from pharmaceuticals and cleaning agents not posing any risk to human health and the environment to disinfectants containing heavy metals and specific medicines containing a large variety of hazardous substances. Chemical and pharmaceutical waste constitutes 3 per cent of all medical waste. It should be disposed of in an appropriate waste disposal facility, according to the risk it poses. Whenever

² Non-burn technologies employ heat to destroy disease-causing micro-organisms in waste. These technologies operate at temperatures that are high enough to kill micro-organisms but insufficient to cause combustion, thereby avoiding the creation of toxic by-products, like dioxins. Chemical and biological processes can also be used to digest tissue, pathological waste and anatomical parts.

feasible, the best option is to return old pharmaceuticals/chemicals to the manufacturer for reuse of active ingredients or proper disposal.

12. Medical radioactive waste may be defined as radioactive waste arising from diagnostic, therapeutic and research applications in medicine. It includes spent radionuclide generators and spent sealed radiation sources, anatomical and biological waste from patients administered with radionuclides, and miscellaneous solid dry waste (for example, gloves, paper tissues and equipment parts) containing small amounts of radioactivity. The majority of radioactive waste generated by health-care establishments is classified as “low-level waste”. Most of the radioisotopes used in hospitals for medical diagnostic procedures and treatments are very short-lived, and in most cases the only treatment needed is segregation and storage for decay before further treatment to eliminate biological hazards and/or release into the environment.

13. In accordance with the mandate conferred on the Special Rapporteur by the Human Rights Council in its resolution 9/1, the present report focuses solely on medical waste that is of a hazardous or toxic nature.

B. Current practices

14. In view of the significant risks that hazardous medical waste poses to human health and the environment, it should be segregated at source from non-risk medical waste and handled, labelled, packaged, collected, stored, transported and disposed of in a safe and environmentally sound way. However, a recent literature review shows that substantial public health challenges continue to exist in many developing countries with regard to the proper management and disposal of health-care waste.³ Not only is the amount of waste generated by health-care facilities increasing owing to the expansion of health-care systems and services; the situation is exacerbated by the lack of adequate technological and financial resources to ensure that health-care waste is properly managed and disposed of.

15. In many countries, medical waste continues to be mixed with general household waste and either disposed of in municipal waste facilities or dumped illegally. Although no comprehensive study is available to assess the amount of medical waste that is disposed of in municipal waste facilities, it appears that this is the main disposal route in low- to middle-income countries.⁴ Some types of health-care waste, such as used syringes and needles, are reused or recycled in many developing countries without any proper sterilization.

16. In response to immediate and pressing concerns about the spread of diseases caused by exposure to health-care waste, many developing countries have opted for the combustion or incineration of health-care waste as a disposal method. Some facilities use open burning, while others have installed small-scale medical waste incinerators to dispose of the waste they produce. The use of medical waste incinerators appears to be expanding rapidly in developing countries at the same time as it is being phased out in many industrialized countries for health and environmental reasons. Given the deleterious health threats from emissions and ash, incineration cannot be regarded as the best method of disposal of hazardous medical waste, and should only be employed as an interim method in developing countries, if other options, such as non-burn technologies, are not available.⁵

³ Harhay et al., “Health care waste management: a neglected and growing public health problem worldwide”, *Tropical Medicine and International Health*, vol. 14, No. 11 (November 2009).

⁴ A recent country study on India showed that only 50 to 55 per cent of medical waste was segregated and handled in accordance with national legislation, while the remaining part was dumped with municipal solid wastes. See Indian Institute of Management, “Evaluation of Central Pollution Control Board (CPCB)”, February 2010, p. 42.

⁵ World Health Organization, *Safe health-care waste management*, policy paper, 2004.

17. Official data on the transboundary movement of hazardous wastes show that only a limited amount of medical waste is subject to international movement. On average, approximately 12,000 tons of medical waste were exported for disposal in the period 2004-2006 (2 per cent of the total amount of waste exported in the same period).⁶ At times, medical waste is illegally shipped to other countries, as shown by a recent incident in which 1,400 tonnes of used condoms and syringes mixed with general household waste were exported from the United Kingdom of Great Britain and Northern Ireland to Brazil for recycling.⁷

III. Human rights impact of medical waste

18. The World Health Organization (WHO) recognizes that the safe and sustainable management of health-care waste is a public health imperative and a responsibility of all.⁸ However, in many countries, including some developed countries, improper management and disposal of medical waste continue to pose a significant, although underestimated, threat to the enjoyment of several human rights, including the right to life, the right to the highest attainable standard of physical and mental health, the right to safe and healthy working conditions and the right to an adequate standard of living.

19. All individuals exposed to health-care waste are potentially at risk of being injured or infected. They include:

- (a) Medical staff: doctors, nurses, sanitary staff and hospital maintenance personnel;
- (b) In- and out-patients receiving treatment in health-care facilities, and their visitors;
- (c) Workers in support services linked to health-care facilities such as laundries, waste-handling and transportation services;
- (d) Workers in waste-disposal facilities, including scavengers;
- (e) Communities living close to municipal waste facilities or illegal dump sites where medical waste is disposed of, and more specifically children playing with discarded items they find in the waste.

A. Right to life/right to health

20. The Special Rapporteur notes that much more remains to be done to ensure the effective enjoyment of the inherent right to life, as set out in article 6 of the International Covenant on Civil and Political Rights, and the right to the highest attainable standard of health, as defined in article 12 of the International Covenant on the Economic, Social and Cultural Rights in the context of the management and disposal of medical waste.

21. The improper handling or disposal of hazardous medical waste can result in death, permanent or temporary disability or injury. In 1988, four people died from acute radiation syndrome and 28 suffered serious radiation burns following the improper disposal of

⁶ Secretariat of the Basel Convention, *Waste without frontiers: global trends in generation and transboundary movements of hazardous wastes and other wastes* (Geneva, 2010). Available from www.basel.int/pub/ww-frontiers31Jan2010.pdf.

⁷ BBC News, "UK waste prompts Brazil complaint", 24 July 2009. Available from http://news.bbc.co.uk/2/hi/uk_news/8166403.stm.

⁸ World Health Organization, *WHO core principles for achieving safe and sustainable management of health-care waste* (Geneva, 2007).

equipment for radiotherapy treatment in Goiânia, Brazil.⁹ Similar accidents occurred in Algeria (1978), Morocco (1983) and Mexico (1962 and 1983).¹⁰ Furthermore, low-level chronic exposure to some hazardous substances contained in medical waste or produced by its incineration may lead to slow-progressing but fatal diseases, including several forms of cancer.

22. All persons exposed to hazardous medical waste are potentially at risk of injuries and/or contamination through accidental exposure. They include persons in health-care establishments, such as medical staff, patients and workers in support services, and persons within and outside health-care establishments who either handle the waste (for example, people involved in waste handling or disposal) or are exposed to it as a consequence of unsound management or disposal (such as people living close to the places where waste is incinerated, used in landfill or illegally dumped).

1. Infectious waste

23. Infectious waste may contain a great variety of pathogenic micro-organisms, which may infect the human body through skin absorption, inhalation, absorption through the mucous membranes or (rarely) by ingestion. Pathological waste is among the most dangerous category of infectious waste owing to its potential of transmitting life-threatening diseases such as acquired immune deficiency syndrome (AIDS), viral hepatitis, typhoid fever, meningitis and rabies, to mention but a few.

24. Incineration is the method most commonly used in developing countries to dispose of infectious waste, though alternative technologies, such as autoclaving, are increasingly being used. As small-scale incinerators often operate at temperatures below 800° C, the incineration process may lead to the production of dioxins, furans and other toxic pollutants as emissions and/or in bottom/fly ash. Although pathological waste, including anatomical waste, is often incinerated, there are several reports of illegal disposal together with non-hazardous municipal waste or illegal dumping in many regions of the world.

2. Sharps and needles

25. Contaminated sharps are considered the most hazardous category of medical waste for health-care staff and the community at large. They may not only cause cuts and punctures but also infect wounds with agents previously contaminating them. Syringe needles are of particular concern because they constitute an important part of the sharps and are often contaminated with the blood of patients.

26. The lack of sufficient financial resources drives many health-care facilities to reuse objects and materials contaminated by blood or body fluids, such as syringes, needles and catheters. In some cases, these products are simply rinsed in a pot of tepid water between injections. In other cases, used medical products are sold to waste recyclers and then reprocessed and sold back to hospitals without proper sterilization.

27. The reuse of unsterilized syringes and needles exposes millions of people to infections. Worldwide, up to 40 per cent of injections are given with syringes and needles reused without sterilization, and in some countries this proportion is as high as 70 per cent.¹¹ Other unsafe practices, such as poor collection and the dumping of dirty injection

⁹ International Atomic Energy Agency, *The radiological accident in Goiânia* (Vienna, 1988).

¹⁰ World Health Organization, *Wastes from health-care facilities*, fact sheet No. 253, 2007.

¹¹ World Health Organization, *Injection safety*, fact sheet No. 231, October 2006. An assessment of injection practices in India found that nearly two thirds (62.9 per cent) of all injections administered each year in the country were unsafe, and almost one third (31.6 per cent) carried the potential risk of spread of blood-borne viruses. See Indian Clinical Epidemiology Network, "Assessment of injections safety practices in India", 2004, pp. 22-23.

equipment in uncontrolled sites where it is easily accessible to the public, expose health-care workers and the community to the risk of needle-stick injuries. Children are particularly at risk, since they can be hurt while playing with used needles and syringes.

28. Unsafe injection practices are a powerful means of transmitting blood-borne pathogens, including hepatitis B virus, hepatitis C virus and HIV. These viruses cause chronic infections that can lead to disease, disability and death a number of years after the injection. Epidemiological studies indicate that a person who experiences a needle-stick injury from a needle used on an infected source patient has risks of 30 per cent, 1.8 per cent and 0.3 per cent of becoming infected with hepatitis B, hepatitis C and HIV respectively.¹² In 2000, WHO estimated that injections with contaminated syringes caused 21 million cases of hepatitis B infection (32 per cent of all new infections), 2 million cases of hepatitis C infection (40 per cent of all new infections) and 260,000 cases of HIV infection (5 per cent of all new infections).¹³

3. Chemical and pharmaceutical waste

29. Many chemicals and pharmaceuticals used in health-care establishments are hazardous. Some chemicals may cause injuries, including burns. Injuries can be caused when the skin, the eyes or the mucous membrane of the lung come into contact with flammable, corrosive or reactive chemicals (such as formaldehyde or other volatile chemicals). Other chemical and pharmaceutical products may have toxic effects through either acute or chronic exposure. Intoxication can result from absorption of the products through the skin or the mucous membranes, or from inhalation or ingestion.

30. Disinfectants constitute a particularly important group of hazardous chemicals, since they are used in large quantities and are often corrosive. Chemical residues discharged into the sewage system may have toxic effects on the operation of biological sewage treatment plants or on the natural ecosystems of receiving waters. Pharmaceutical residues may have the same effects, as they may include antibiotics and other drugs, heavy metals (such as mercury), phenols and derivatives and other disinfectants and antiseptics.

31. The severity of health hazards for health-care workers handling cytotoxic waste arises from the combined effect of the substance toxicity and the extent of exposure that may occur during waste handling or disposal. Exposure to cytotoxic substances in health care may also occur during preparation for treatment. The main pathways of exposure are inhalation of dust or aerosols, skin absorption and ingestion of food accidentally in contact with cytotoxic (antineoplastic) drugs, chemicals or waste, or from contact with the secretions of chemotherapy patients.

32. In most developing countries, chemical and pharmaceutical wastes are either disposed of with the rest of municipal waste, or sent to cement kilns for burning. Incineration is often regarded as the safest option to dispose of obsolete pharmaceuticals in developing countries. Most small-scale medical waste incinerators are not, however, equipped with the complex air pollution devices needed to keep dioxin emissions to the levels recommended by the Stockholm Convention (see paragraph 69 below). A significant amount of chemicals and pharmaceuticals is also disposed of through hospital wastewater. In countries where no wastewater treatment facilities exist, effluents from health-care facilities are discharged directly in rivers and other water streams, and risk contaminating surface and groundwater resources used for drinking and domestic purposes (see paragraph 55 below).

4. Mercury waste

¹² World Health Organization, *Health-care waste management*, fact sheet No. 281, October 2004.

¹³ World Health Organization, *Core principles* (see footnote 8).

33. Mercury is a hazardous product common in hospitals owing to its prevalent use in a number of laboratory and medical instruments, such as thermometers and blood pressure devices, as well as in other products, such as fluorescent light tubes and batteries. It is a potent neurotoxin that can have several adverse effects on the central nervous system in adults, increase the risk of cardiovascular disease and cause kidney problems, miscarriage, respiratory failure and even death.

34. In the health-care context, elemental mercury may be released as a result of spillage from broken thermometers or leaking equipment. In many developing countries, there is no clean-up protocol for mercury spills. Mercury spills are not properly cleaned, and mercury waste is not segregated and managed properly. Inhalation of mercury vapours may cause damage to the lungs, kidneys and the central nervous system of doctors, nurses, other health-care workers or patients who are exposed to it.

35. In many developing countries, mercury waste is either incinerated with infectious waste or treated as municipal waste. If improperly disposed of, elemental mercury may travel long distances and eventually deposit on land and water, where it reacts with organic materials to form methyl mercury, a highly toxic organic mercury. This type of mercury, which affects the nerves and the brain at very low levels, bio-accumulates and become part of the aquatic food chain. The main source of human exposure to this form of mercury derives from the ingestion of contaminated fish and seafood. Even at very low levels, methyl mercury can cause severe, irreversible damage to the brain and nervous system of foetuses, infants and children.

36. Owing to their adverse effects on human health and the environment, mercury-containing medical devices are now banned or severely restricted in many developed countries. WHO has issued technical guidance to promote the use of alternatives to mercury-containing thermometers and other medical instruments,¹⁴ and a global legally binding instrument to phase out the use of mercury is currently being negotiated under the auspices of the United Nations Environment Programme (UNEP) (see paragraph 59 below).

37. Thermometers and sphygmomanometers containing mercury continue, however, to be widely used in many developing countries. In some cases, when health-care institutions in industrialized countries decommission their old mercury-containing instruments, they donate them to institutions in developing countries. Without health-care management systems that assure the use of mercury-free devices and the proper clean-up and final disposal of mercury-containing ones, the total amount of mercury released into the environment by health-care institutions in developing countries is expected to grow in the future.

5. Radioactive waste

38. Radioactive materials can cause harm through both external radiation (when they are approached or handled) and their intake into the body. The degree of harm depends on the amount of radioactive material present or taken into the body and on the type of material. Exposure to radiation from high-activity sources, such as those used in radiotherapy, can cause severe injuries, ranging from superficial burns to early death. Radioactive waste arising from nuclear medicine is unlikely to cause such harm, but exposure to all levels of radiation is considered to be associated with some risk of carcinogenesis.

39. There are well-established procedures for minimising the hazards arising from handling radioactive materials. The International Atomic Energy Agency (IAEA) has elaborated a number of recommendations and guidelines on the safe handling of radioactive substances produced in health-care establishments and on safe radioactive waste storage

¹⁴ World Health Organization, *Replacement of mercury thermometers and sphygmomanometers in health care: technical guidance*, May 2011.

and disposal (see paragraphs 75-77 below). While most hospitals and health-care facilities in developed countries comply with these safety procedures, the lack of appropriate information on the risks posed by radioactive materials and waste and on the procedures to minimize these risks may lead to their inappropriate management and disposal in some developing countries.

6. Dioxins and furans

40. Medical waste contains a high proportion of polyvinyl chloride (PVC), a chlorinated plastic that is used in containers for blood, catheters, tubing and numerous other applications. When burned, PVC releases polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (dioxins), a family of 210 persistent organic pollutants that are unintentionally formed and released from a number of industrial and incineration processes, including medical waste incineration, as a result of incomplete combustion or chemical reactions (see paragraph 70 below).

41. Dioxins are a known human carcinogen. Chronic lymphocytic leukaemia, soft-tissue sarcoma, non-Hodgkin's lymphoma and Hodgkin's disease have been linked to dioxin exposure. There is further evidence of a possible association with liver, lung, stomach and prostate cancers. Short-term high-level exposure may result in skin lesions and altered liver functions, while low-level exposure to dioxins may lead to impairment of the immune system, the nervous system, the endocrine system and reproductive functions. Foetuses and new-born children are most sensitive to exposure.

42. In the late 1980s, developed countries began to adopt strict regulations to reduce the amount of dioxins released into the atmosphere as a result of combustion and incineration processes.¹⁵ The enforcement of stricter emission standards significantly reduced the release of these substances into the environment and their concentration in many types of food (including breast milk). In the European Union, for example, industrial emissions of dioxins and furans were reduced by 80 per cent between 1990 and 2007.

43. The Stockholm Convention on Persistent Organic Pollutants establishes that emission levels of dioxins and furans should not be higher than 0.1ng/m³ (see also paragraph 69 below). The emission standards set out in the Convention require the reduction of atmospheric emissions of dioxins and furans through the use of various air pollution control devices as well as monitoring, inspection and permitting programmes. The majority of small-scale medical waste incinerators used in developing countries do not, however, incorporate any air pollution control devices or other equipment necessary to meet modern emission standards, since this would increase greatly costs for their construction and operation.

44. An assessment of small-scale medical waste incinerators in developing countries showed widespread deficiencies in the design, construction, siting, operation and management of these units. These deficiencies often result in poor incinerator performance, for example, low temperatures, incomplete waste destruction, inappropriate ash disposal and dioxin emissions, which can be even 40,000 times higher than the emission limits established by the Stockholm Convention.¹⁶ Small-scale incinerators used in developing countries also release significant amounts of other hazardous pollutants through gaseous emissions, fly and bottom ash, and occasionally through wastewater. Such pollutants

¹⁵ Dioxin emission limits vary from 0.1ng/m³ for incinerators of all types, in the European Union, to 0.013 and 2.3 ng/m³, depending on the size and construction date of the incinerator, in the United States of America.

¹⁶ Stuart Batterman, *Assessment of small-scale incinerators for health-care waste* (Geneva, World Health Organization, 21 January 2004). Available from www.who.int/immunization_safety/publications/waste_management/en/assessment_SSIs.pdf.

include heavy metals (such as arsenic, cadmium, mercury and lead), acid gases, carbon monoxide and polycyclic aromatic hydrocarbons (PAHs).

B. Right to safe and healthy working conditions

45. Information on the hazards associated with the handling of hazardous medical waste, access to training opportunities on the safety procedures to minimize hazards, and proper personal protective equipment constitute essential preconditions for the enjoyment of the right to safe and healthy conditions of work as set out in article 7 (b) of the International Covenant on Economic, Social and Cultural Rights.

46. In many health-care establishments around the world, the lack of adequate waste management plans to ensure the safe and environmentally sound segregation, collection, transport, treatment and disposal of medical waste continue to expose a significant number of people from a wide range of occupations to the risk of injury and illness. The main occupational groups at risk include hospital personnel, workers handling and transporting waste, persons working at waste disposal facilities, and scavengers.

1. Hospital personnel

47. Hospital personnel include doctors, nurses and workers in support services of health-care establishments, such as hospital cleaners, waste handlers and drivers.

48. In many developing countries, nurses and (to a lesser extent) doctors do not receive adequate information on the hazards associated with the unsafe handling of hazardous medical waste, nor do they receive any training on how to eliminate, or reduce to a minimum, such hazards. Medical personnel often receive limited instructions on the use of personal protective equipment, and are not aware of safety emergency procedures for dealing with spillages (for example, when mercury-containing equipment breaks) and accidents. In some health-care establishments, staff members are not vaccinated against common infectious diseases, such as tetanus and hepatitis.

49. Hospital cleaners and waste handlers are in an even more vulnerable position than the medical staff that produce the waste. An increasing number of them are employed by external contractors rather than being directly employed by the hospital, and may not receive any information on the occupational risks to which they are exposed and on the correct procedures for handling, loading and unloading waste bags and containers. They are often poorly educated, and often do not receive any vaccinations or proper personal protective equipment.¹⁷ Disposable latex gloves may be provided, but they are usually thin and offer little protection. In many health-care establishments, it is not uncommon to see medical waste being transported by hand in bin bags, risking spills of toxic or infectious liquids, or staff injuries from protruding needles or other sharp objects.

2. Waste workers and waste recyclers

50. Like hospital cleaners and waste handlers, operators of small-scale medical waste incinerators, garbage collectors and people working in municipal waste facilities, where large amounts of medical waste are mixed and disposed of with general household waste,

¹⁷ A survey of 300 medical waste handlers employed by a local contractor found that only 7 per cent were trained to handle medical waste and 21 per cent were immunized against hepatitis B. Although almost all wore overalls (presumably the company uniform) when working, only 57.7 per cent wore gloves, 55 per cent wore boots and only 17 per cent wore masks when handling medical waste. The survey showed that prevalence rates of hepatitis B and C were significantly higher in medical waste handlers than those in non-medical waste handlers examined. See Franka et al., "Hepatitis B virus and hepatitis C virus in medical waste handlers in Tripoli, Libya", *Journal of Hospital Infection*, vol. 72, No. 3, July 2009.

are unlikely to receive proper training on the risks associated with the handling of hazardous medical waste or protective clothing, including gloves against needle-stick injuries. They do not usually receive any vaccinations against common infectious diseases.

51. Untreated medical waste can reach the recycling industry by a number of routes. In many developing countries, where hospitals have no recycling programmes, staff at health-care facilities often sell medical waste to waste recyclers in order to supplement their incomes. This practice allows for the reuse and recycling of a large amount of non-hazardous hospital materials, such as empty bottles and containers or aluminium from vial caps. Other materials, such as syringes, blood bags or laboratory waste, are, however, extremely hazardous, and the practice puts whoever processes these products at risk. Waste recyclers usually have no formal education and possess very little or no knowledge of the risks associated with the handling of hazardous substances or the precautions to adopt to minimize their adverse health effects. They usually use no protective gear to prevent them from exposure to the hazardous substances contained in medical waste.

3. Scavengers

52. Medical waste is also sought out by scavengers, who put themselves at great risk by collecting it. In some countries, scavengers are often seen in hospital grounds, while others collect waste from municipal dumps or at illegal landfills. In December 2007, for instance, a large number of scavengers, mainly children, were suspected to have contracted hepatitis C as a result of needle-stick injuries during the collection of used syringes and other clinical waste for recycling.¹⁸ Even in countries where there is less of a recycling industry, the practice of mixing medical waste with ordinary garbage exposes scavengers to a number of infectious diseases, such as hepatitis and tetanus, and to physical risks associated with the handling of infected needles and broken glass.

C. Right to an adequate standard of living

53. The inappropriate management and disposal of hazardous medical waste may adversely affect the enjoyment of the right to an adequate standard of living. Article 11.1 of the International Covenant on Economic, Social and Cultural Rights specifies a number of rights emanating from, and indispensable for, the realization of this right, including adequate food, clothing and housing. Although it has not been expressly included in this list, the right to safe drinking water clearly falls within the category of guarantees essential for securing an adequate standard of living, particularly since it is one of the most fundamental conditions for survival.¹⁹

54. Most hospitals, health-care facilities and pharmacies are situated in the centre of cities, towns and villages, close to residential areas where people live. Owing to the lack of adequate waste management plans, on-site disposal is often the norm for many health-care establishments in developing countries. Hazardous medical waste is collected together with non-hazardous waste, and often disposed of in the backyard of hospitals. Open burning, uncontrolled dumping and incineration are the most common methods of on-site disposal.

55. The combustion of medical waste at low temperatures may release significant amounts of dioxins, furans and other toxic air pollutants through gaseous emissions and/or in bottom and fly ash. Fly ash often contains high concentrations of heavy metals, as well as small amounts of dioxins and furans, while bottom ash may contain needles, broken glass and other sharps, as well as such toxic substances as heavy metals, dioxins and furans. Incineration ash is often disposed of in nearby landfills and ash ponds. When used as

¹⁸ "Hospital waste spreading hepatitis", *The News International* (Karachi), 24 December 2007.

Available from www.thenews.com.pk/TodaysPrintDetail.aspx?ID=87554&Cat=4&dt=12/24/2007.

¹⁹ See Human Rights Council resolution 15/9.

landfill, bottom ash may contaminate foodstuffs and groundwater resources used for drinking water. An analysis of free-range chicken eggs collected near a small-scale medical waste incinerator showed levels of dioxins that were five and half times higher than the European Union dioxin limit for eggs.²⁰

56. When it is not disposed of in the backyard of the health-care establishments that generate it, medical waste is often mixed with ordinary municipal waste and disposed of in municipal landfills or illegal dumpsites. Heavy metals and other toxins can leach into the soil and contaminate groundwater resources used for drinking, farming or domestic purposes by local populations.

57. In countries where no wastewater treatment facilities exist, wastewater from health-care facilities is directly disposed of in rivers and other water streams. Health-care facility effluents contain a significant amount of pathogens, chemicals and pharmaceuticals excreted by patients that can contaminate surface and groundwater resources used for drinking and domestic purposes. Because they are designed to have a biological effect, pharmaceuticals can also have a significant adverse impact on fish and seafood used for human consumption.

IV. Current normative framework

58. In spite of the risks that medical waste may pose to human health and the environment, the international community has not yet elaborated a comprehensive framework to regulate the sound handling, transport and disposal of hazardous waste generated by hospitals and health-care facilities.

59. While not focusing solely on medical waste, a number of international environmental treaties regulate specific aspects of the management and disposal of this particular type of waste; these include the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal and the Stockholm Convention on Persistent Organic Pollutants. In February 2009, the UNEP Governing Council agreed on the need to develop a global legally binding instrument on mercury.²¹ The aim of the instrument, which is currently being negotiated, is to reduce risks to human health and the environment from the effects of mercury.

60. Several international organizations, including WHO and IAEA, have elaborated a number of technical guidance and policy documents to ensure that hazardous waste falling within the scope of their mandate is managed and disposed of in a safe and environmentally sound manner.

61. In addition to the above-mentioned evolving body of norms, the Special Rapporteur stresses again that the unsound management and disposal of medical waste may negatively affect the enjoyment of human rights by individuals who either handle this waste or are exposed to it as a consequence of unsound management or disposal. These rights, which have been considered in some detail in the part concerning the human rights impact of medical waste, are set out in the International Bill of Human Rights as well as in other international and regional human rights treaties.

²⁰ International POPs Elimination Network, *Contamination of chicken eggs near the Queen Mary's Hospital, Lucknow medical waste incinerator in Uttar Pradesh (India) by dioxins, PCBs and hexachlorobenzene*, 2005.

²¹ *Official Records of the General Assembly, Sixty-fourth Session, Supplement No. 25 (A/64/25)*, annex I, decision 25/5, part III.

A. Basel Convention

62. The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal is the first global instrument that aims to protect human health and the environment against the adverse effects resulting from the generation, management, transboundary movement and disposal of hazardous and other wastes. It was adopted on 22 March 1989 and entered into force on 5 May 1992. As at 10 June 2011, the Convention had been ratified by 176 States.

63. For the purposes of the Basel Convention, “wastes” are defined as “substances or objects which are disposed of or are intended to be disposed of or are required to be disposed of by the provisions of national law” (article. 2.1). Article 1.1 defines “hazardous wastes” as:

(a) Wastes that belong to any category contained in annex I, unless they do not possess any of the characteristics contained in annex III;

(b) Wastes that are not covered under paragraph (a) but are defined as, or are considered to be, hazardous wastes by the domestic legislation of the party of export, import or transit.

64. Some categories of wastes – such as radioactive wastes – are excluded from the scope of the Basel Convention (articles 1.3 and 1.4).

65. The Basel Convention rests on two main pillars:

(a) First, it establishes a “prior informed consent” procedure for the transboundary movements of wastes between parties (articles. 4.1 and 6), according to which the transboundary movement of hazardous wastes can take place only upon prior written notification to the competent authorities of the States of export, import and transit, and upon consent of these authorities to the movement of the wastes in question. Shipments to and from non-parties are illegal unless there is a special agreement (articles. 4.5 and 11.1);

(b) Second, the Convention lays down the principle of “environmentally sound management”, which requires the adoption of all practicable steps to prevent or minimize the generation of wastes at source, to treat and dispose of wastes as close as possible to their place of generation and to minimize the quantities that are moved across borders (article 4.2). Strong controls have to be applied from the moment of generation of a hazardous waste to its storage, transport, treatment, reuse, recycling, recovery and final disposal.

66. “Clinical wastes from medical care in hospitals, medical centres and clinics”, “wastes from the production and preparation of pharmaceutical products” and “waste pharmaceuticals, drugs and medicines” are included in the list of hazardous wastes covered by annex I to the Basel Convention (categories Y1-Y3). “Infectious substances” (H6.2), defined as “substances or wastes containing viable micro-organisms or their toxins which are known or suspected to cause disease in animals or humans”, are included in the list of hazardous characteristics (annex III).

67. In 2002, the sixth Conference of the Parties to the Basel Convention adopted technical guidelines on the environmentally sound management of biomedical and health-care wastes.²² The primary objective of the guidelines is to provide guidance on measures to minimize the amount of medical waste generated, ensure their separation and segregation at source and promote their safe handling, storage, transportation inside and outside health-care establishments, treatment and final disposal. In 2004, the seventh Conference of the

²² See UNEP/CHW.6/40, decision VI/20.

Parties adopted a guidance paper on hazard characteristic H6.2 (infectious substances), which is intended to assist in determining whether a given waste displays the characteristic to a degree sufficient to render it hazardous.²³

68. In practice, the Basel Convention is rarely invoked to ensure the sound management and disposal of hazardous medical waste, since this type of waste is mostly treated within the country where it is generated.

B. Stockholm Convention

69. The Stockholm Convention seeks to protect human health and the environment from the harmful impact of persistent organic pollutants. It was adopted on 22 May 2001 and entered into force on 17 May 2004. As at 10 June 2011, 173 parties had adhered to the Convention.

70. Persistent organic pollutants (POPs) are highly hazardous chemical pollutants that remain intact in the environment for long periods, become widely distributed throughout the environment, accumulate in the fatty tissue of living organisms and are found at higher concentrations at higher levels in the food chain. They can be divided into three categories: (a) pesticides; (b) industrial chemicals; and (c) by-products. They are toxic to both humans and wildlife. Specific effects of these pollutants can include cancer, damage to the nervous system, reproductive disorders and disruption to the immune system.

71. Article 5 of the Stockholm Convention requires parties to take all appropriate measures to reduce the unintentional release of the chemicals listed in annex C, with the goal of continuing minimization and, where feasible, their ultimate elimination. The annex applies to dioxins and furans that are unintentionally formed and released from thermal processes as a result of incomplete combustion or chemical reactions. Medical waste incinerators are included in the list of industrial source categories that can result in significant emissions of these chemicals into the environment. Open burning of waste, including burning of landfill sites, is included in the list of other source categories that may generate dioxins and furans.

72. In 2007, at the third meeting of the Conference of the Parties to the Stockholm Convention, participants adopted guidelines on the best available techniques and provisional guidance on best environmental practices relevant to article 5 and annex C to the Convention (decision SC-3/5). According to the guidelines, dioxin emission levels in the air no higher than 0,1 ng/m³ are associated with best available techniques. Under normal operating conditions, emissions lower than this level can be achieved with a well-designed waste incineration plant equipped with appropriate air pollution control devices.

C. World Health Organization

73. WHO has elaborated a number of policy, management and advocacy tools to minimize the risks that the improper management of health-care waste pose to health-care workers, patients, waste handlers, the community at large and the environment, and to facilitate the establishment and sustained maintenance of a sound system of health-care waste management. These include a policy paper on safe health-care waste management (2004)²⁴ and core principles for achieving safe and sustainable management of health-care waste (2007).²⁵ WHO has also developed a handbook on the safe management of health-

²³ See UNEP/CHW.7/33, decision VII/17.

²⁴ World Health Organization, *Safe health-care waste management* (see footnote 5).

²⁵ World Health Organization, *WHO core principles* (see footnote 8).

care waste,²⁶ a policy document to facilitate the elaboration of a national plan of action on health-care waste management,²⁷ as well as specific guidelines for the safe management of particular categories of medical waste, such as solid health-care waste,²⁸ syringes²⁹ and mercury-containing equipment.³⁰

74. WHO has elaborated a number of information tools to raise public awareness of the risks associated with the unsound management and disposal of hazardous medical waste and on the measures to eliminate or mitigate these risks, including fact sheets on health-care waste management,³¹ wastes from health-care activities³² and injection safety.³³

D. International Atomic Energy Agency

75. An important part of the mandate entrusted to IAEA is to elaborate and promote advisory international standards and guidelines on nuclear safety, radiation protection, radioactive waste management, the transport of radioactive materials, the safety of nuclear fuel cycle facilities and quality assurance.

76. IAEA safety standards provide a system of fundamental principles, requirements and guides for ensuring safety. They reflect an international consensus on what constitutes a high level of safety for protecting people and the environment from harmful effects of ionizing radiation. A number of safety standards and requirements, such as the Fundamental Safety Principles (2006) and the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (1996), are applicable to all facilities and activities generating radioactive waste. Others, such as the safety guides on the decommissioning of medical, industrial and research facilities (1999) and on the management of waste from the use of radioactive material in medicine, industry, agriculture, research and education (2005), refer to specific activities carried out by nuclear medicine departments in hospitals and research centres.

77. Additionally, IAEA has issued several technical reports that aim to supplement the information offered in safety standards and guides, some of which relate specifically to radioactive medical waste. They include the reports on the management of radioactive waste from the use of radionuclides in medicine (2000) and on the decommissioning of small medical, industrial and research facilities (2003).

E. National legislation

78. Only a limited number of countries has developed, or is in the process of developing, a national regulatory framework to respond to the challenges that the management and disposal of hazardous health-care waste pose to human health and the environment. These initiatives include the adoption of specific legislation on the safe and

²⁶ World Health Organization, *Safe management of wastes from health-care activities* (Geneva, 1999).

²⁷ World Health Organization, *Health-care waste management: guidance for the development and implementation of a national action plan*, policy paper (Geneva, 2005).

²⁸ World Health Organization, *Management of solid health-care waste at primary health-care centres: a decision-making guide* (Geneva, 2005).

²⁹ World Health Organization, *Management of waste from injection activities at district level: guidelines for district health managers* (Geneva, 2006).

³⁰ World Health Organization, *Replacement of mercury thermometers* (see footnote 14).

³¹ World Health Organization, *Health-care waste management* (see footnote 12).

³² World Health Organization, *WHO core principles* (see footnote 8).

³³ World Health Organization, *Injection safety*, fact sheet No. 231, 2006.

environmentally sound management of health-care waste and the development of national waste management plans, policies and guidelines to facilitate its implementation.

79. In most developing countries and economies in transition, the lack of adequate technical resources for the safe and sound management of health-care waste, the limited funding for health-care waste management and the inadequate awareness of the direct and indirect risks posed by health-care waste constitute the main obstacles to the development of a comprehensive regulatory framework on health-care waste management and to its effective implementation.

V. Conclusions and recommendations

80. **The Special Rapporteur is of the view that time is ripe to give to the impact that the improper management and disposal of medical waste continue to have on the enjoyment of human rights the attention it deserves. He therefore calls on all relevant stakeholders, including States, international organizations and mechanisms, the donor community, public and private health-care facilities, the pharmaceutical industry and civil society to strengthen their efforts to achieve safe and sustainable management of medical waste.**

81. **The establishment of a safe and sustainable health-care waste management system requires the adoption of a number of legislative, administrative, policy and educational measures. In order to assist the international community in identifying and prioritizing its action in the field of health-care waste management and disposal, the Special Rapporteur recommends the adoption of the measures below.**

A. Awareness-raising

82. **The lack of comprehensive information on the risks that hazardous medical waste pose to human health and the environment has hampered the efforts made to date at the national level to protect individuals and communities from the adverse impact of toxic and dangerous health-care waste on their human rights, including the right to life, the right to health and the right to a safe environment. He therefore recommends that States take all appropriate measures to raise awareness of the problems, especially among policymakers and communities living in the vicinity of sites where medical waste is incinerated or landfilled. Non-governmental organizations working in the field of public health or environmental protection should include the promotion of sound health-care waste management in their advocacy and conduct programmes and activities that contribute to sound health-care waste management.**

83. **In some cases, a healthy lifestyle represents the most efficient way to avoid medical treatment and the waste it generates as a by-product. Access to adequate health-related education and information is, in the Special Rapporteur's view, an essential precondition for the enjoyment of the right to adequate health. He therefore calls on States to disseminate appropriate information relating to healthy lifestyles, nutrition and the state of the environment so that people may make informed choices about their health.**

B. National legislation and policy on health-care waste management

84. **The Special Rapporteur recommends that States that have not yet adopted a specific law on health-care waste management to protect human health and the environment from the adverse effects of improper management and disposal of hazardous medical waste consider doing so. Such a law may have a stand-alone nature or be part of more comprehensive legislation on hazardous waste management. Relevant international and regional agreements, human rights standards and relevant**

principles of international environmental law, such as the precautionary and the “polluter pays” principles, should be taken into account when drafting such legislation.

85. A law on health-care waste management should, as a minimum:

- (a) Provide a clear definition of health-care waste and its categories;
- (b) Define clearly the duties and responsibilities of each actor involved in the health-care waste management process;
- (c) Identify the national authority responsible for overseeing the implementation of the law and its enforcement;
- (d) Impose appropriate penalties for contravention.

86. In addition to legislation, States should develop, in accordance with WHO recommendations, a national policy outlining the rationale of safe health-care waste management and its objectives, and a comprehensive strategy identifying the steps to be taken to achieve those objectives. States should also develop technical guidelines for the implementation of the law.³⁴ This legal package should specify approved methods of treatment and disposal for different waste categories; identify safe practices for the minimization, segregation, collection, storage and transport of medical waste; and outline the responsibilities of public health authorities, the national environmental protection body, managers of health-care facilities and managers of private or public waste-disposal agencies.

C. Occupational health and safety

87. The Special Rapporteur recommends that States strengthen their legal framework on hospital hygiene and occupational health and safety, and provide adequate human, technical and financial resources to national authorities responsible for its enforcement. He also recommends that health authorities organize educational programmes and training opportunities to raise awareness about health, safety and environmental protection issues relating to medical waste management.

88. In view of the fact that persons working within and outside health-care establishments often receive limited information and training opportunities on the occupational risks to which they are exposed and on the correct procedures for handling waste in a safe manner, the Special Rapporteur urges relevant national health authorities to include waste management in the curricula of future medical practitioners and nurses, to provide appropriate information on the occupational risks to which medical and paramedical staff may be exposed, and to organize training opportunities on safe health-care waste management for staff handling medical waste.

89. The Special Rapporteur calls on health-care establishments to take all appropriate measures to improve health and safety conditions for those handling medical waste in and outside health-care establishments. Such measures should include:

- (a) Access to information on the specific occupational risks to which different categories of workers are exposed, and the safety measures to minimize such risks;
- (b) The provision of appropriate personal protective equipment for persons handling hazardous health-care waste;

³⁴ World Health Organization, *Health-care waste management* (see footnote 32).

(c) Access, on a voluntary basis, to vaccination against such common infectious diseases as tetanus and hepatitis;

(d) The organization of training opportunities and safety workshops designed for and targeting different categories of hospital personnel (such as medical doctors, nurses, hospital cleaners and waste handlers);

(e) Regular drills in emergency prevention, preparedness and response procedures.

D. Funding and technical support

90. In many developing countries, the main obstacle to the safe and sound management of medical waste is the limited funding available to public health authorities. The Special Rapporteur recommends that States take all appropriate steps, to the maximum of its available resources, to allocate adequate financial resources to all public and private institutions and bodies responsible for the safe and environmentally sound management of health-care waste. These include health authorities, the national environmental protection body, managers of health-care facilities and managers of private or public waste-disposal agencies.

91. The Special Rapporteur wishes to emphasize that, in accordance with the Charter of the United Nations, international cooperation for the realization of civil, cultural, economic, political and social rights is an obligation of all States. He therefore calls on the donor community, international and regional organizations, financial institutions and the private sector to provide developing countries with technical assistance and financial support to help them achieve safe and sustainable management of medical waste. Technical assistance should include the transfer of scientific and technological knowledge, as well as state-of-the-art technologies for the safe disposal of hazardous medical waste, such as autoclaving and non-burn technologies.

92. The Special Rapporteur also encourages relevant international organizations, and in particular WHO, to continue to provide developing countries with technical assistance and support in the design and implementation of their regulatory and policy frameworks on health-care waste management.

E. Health-care waste management

93. The safe and sound management of medical waste generated by health-care facilities requires the elaboration of appropriate health-care waste management plans at all relevant levels. Waste management plans should be elaborated in all health-care facilities, taking into account their size, the amount of medical waste they generate on an annual basis and their technical, financial and human resources.

94. The Special Rapporteur recommends that the following principles be taken into account while drafting and implementing such health-care waste management plans:

(a) **Prevention/minimization.** The Special Rapporteur calls on States, health-care facilities and the private sector to take all appropriate measures, including educational programmes and improved production processes, to ensure that the generation of hazardous medical waste is reduced to a minimum. Hospitals should, whenever feasible, replace hazardous chemicals/products (for example, mercury-containing devices) or disposable instruments (such as scissors and kidney dishes) with alternative products or reusable products. Prescription practices should also be changed so that unnecessary injections in cases where effective oral medical is available may be avoided;

(b) Separation/segregation at source. Hazardous medical waste, which only constitutes 20 to 25 per cent of the total medical waste stream, should be properly separated from non-hazardous medical waste. Segregation should be carried out as close as possible to the point of generation. Sharps should always be collected in puncture-proof containers to prevent injury to and infection of workers handling them. If properly segregated, the amount of medical waste requiring special treatment can be reduced to 1 to 5 per cent of the waste generated in health-care establishments, and the cost for waste treatment can be reduced accordingly;³⁵

(c) Packaging and labelling. The use of internationally recognized symbols and signs is essential to ensure the safe handling of hazardous waste. A common system of labelling and coding of packaging should be used in all health-care establishments and be part of the waste management instructions for hospital workers who handle hazardous waste. Medical waste should be packaged in resistant and sealed bags or containers to prevent spilling during handling and transportation. If shipped abroad for treatment, medical waste should be labelled in accordance with international agreements (such as the Basel Convention);

(d) Handling, transportation and storage. Medical waste should be handled and transported in such a way as to prevent unnecessary exposure to staff and others. Handling and transportation should be minimized to reduce the likelihood of exposure to the waste. Medical waste should be held in storage areas that are identified as containing infectious waste. Such areas should always be fitted with a lock in order to prevent access by unauthorized persons;

(e) Recycling. Waste segregation at source is a basic requirement for the recycling of non-hazardous components of health-care waste. Some kinds of hazardous waste can also be recycled. Unused or waste chemicals, for example, can be returned to the supplier for re-processing;

(f) Disposal. The choice of disposal methods depends on a number of factors, including the type and amount of hazardous medical waste generated by the health-care establishment; the existence of appropriate sites for waste treatment and disposal (for example, space on hospital premises and distance from the nearest residential areas); and the availability of human, financial and material resources. Large health-care facilities, for example, may produce amounts of waste sufficient to justify the purchase of a relatively sophisticated health-care waste treatment unit (for example, a medical waste incinerator), but are often located densely populated areas. Furthermore, environmentally friendly and safe options used in high-income countries (such as autoclaving) may not always be affordable or possible to implement (owing to, for example, lack of electrical supply) in developing countries.

F. Incineration

95. The Special Rapporteur recommends that, in so far as practicable, incineration as a disposal method of hazardous medical waste be substituted with more environmentally-friendly and safe methods of disposal. Autoclaving, for example, is an environmentally sound method to treat infectious waste that requires relatively low investment and operating costs.

96. The Special Rapporteur also recommends that developing countries be provided with adequate financial and technical assistance to design, construct, operate and manage non-incineration medical waste treatment facilities.

³⁵ UNEP/CHW.6/40, decision VI/20, p. 2.