

Review Article

Health Care Waste: Avoiding Hazards to Living and Non Living Environment by Efficient Management

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Abstract

Healthcare profession is one of the most Nobel professions, but it generates a lot of waste material referred as health care waste (HCW) or Bio-waste. HCW is not only hazardous to human life, but also for all living organisms and whole of the environment if not properly handled and disposed. The HCW is composed of various fractions with variable dangers depending on their origin and content. The HCW cannot be treated as a general waste, but needs to be treated specially considering its danger to human and environment. There are various methods for disposing HCW which must be selected in view of the waste properties and suitability. Health care centers must design and follow appropriate waste management policies and methodologies to reduce and minimize deleterious effects on human and other living beings and environment.

Keywords: Health care waste; Infectious; Environment; Biohazard

1. Introduction

Health care profession is considered as one of the noblest professions intended to protect human beings against diseases, restore health and save lives. But it is also a major source of very specific type of waste that is very much proving to be a menace to the environment and human health if dumped in an environment without thoughtful considerations. Healthcare waste is the waste generated by healthcare providing centers and persons which includes chemicals, expired pharmaceutical products and radioactive items and sharps and infectious use and throw materials like bandages. These items can be toxic, pathogenic and environmentally adverse because of their non-biodegradable and/or reusable nature. Some non hazardous waste materials generated through healthcare include medication boxes, the packaging materials for medical and food items with unused food itself and also waste from

offices of these centers [1]. As the saying goes wherever there are human societies, there will be waste production. And wherever there are people, there will be health care system. Wherever is the health care system, there will be a generation of medical waste though it may vary in quantities. Some of the centers which generate medical waste are Hospitals and Nursing homes, Emergency care facilities, Veterinaries, Doctor and dentist offices, prisons, pathological laboratories, mortuaries, death care facilities, Blood banks, transfusion centers, dialysis centers, Ambulance [2, 3].

1.1 The major sources of healthcare waste

- Hospitals and other health care facilities
- Laboratories and research centers
- Nursing homes for the elderly
- Residents of chronic patients
- Mortuary and autopsy centers
- Blood banks and collection services
- Animal research and testing laboratories [4-6].

2. Types of HCW: Proportions and Hazards

Of the total health care waste generated more than 75% is basically similar to the domestic waste. Generally, this non hazardous fraction is referred to as Healthcare General Waste (HCGW). It is prominently made of common materials like paper, plastic packaging, food a remains and other waste, etc. that wasn't in direct contact with patients and can be considered non-infective. About 25% waste requires special attention and treatment as it is infectious and/or hazardous and poses risk to both population and the environment. This fraction is referred as Healthcare Risk Waste (HCRW) [7-9]. "If these two main categories of waste aren't handled carefully, divided and separated properly, the entire volume of HCW becomes HCRW. Therefore, it is important to set up a safe and integrated waste management system for HCW". The Exposure to HCRW can result in infectious disease or injury to humans and animals and contaminate environment with microbes and non bio-degradable materials posing a severe danger to both. The hazardous nature of HCW may be due to one or more of the following reasons [10-13].

- It contains various infectious agents and harmful microbes
- It contains hazardous chemicals or pharmaceuticals
- It contains dangerous materials generally called as sharps which may lead to injury
- It may contain harmful radioactive materials
- It may contain genotoxic waste.

The detailed classification of HCW is summarized in following Table 1

Healthcare waste	
Healthcare General Waste (HCGW) (>75%)	Healthcare Risk Waste (HCRW) (<25%)

<p>Not in direct contact with patients Generally non-infective Similar to domestic waste Includes paper, plastic packaging, food a remains and other waste</p>	<p>In Direct contact with patients Infectious Physiological Chemical and/or radioactive.</p> <hr/> <p>Types</p> <ol style="list-style-type: none"> 1. Infectious waste 2. Pathological and anatomical waste 3. Hazardous pharmaceutical waste 4. Hazardous chemical waste 5. Waste with a high content of heavy metals 6. Pressurized containers 7. Sharps 8. Highly infectious waste 9. Genotoxic / cytotoxic waste 10. Radioactive waste
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Table 1: Types of healthcare wastes.

High-income/developed countries generate more hazardous waste on average of per hospital bed per day while low-income countries generate comparatively less waste on the same basis. But health care waste management is not paid needed attention and HCW is often not properly separated into hazardous or non-hazardous wastes in these countries. This makes the real quantity of hazardous waste much higher in low income countries than developed countries, making it a major health and environmental risk. The 10-25%, the hazardous fraction of HCW are usually classified into the following waste groups and discussed in details [14, 15].

2.1 Infectious waste

The waste from healthcare centers, which contains pathogens and/or their toxins in sufficient concentration that may cause diseases to persons who come in contact with the waste. The examples of infectious waste include all the discarded materials or equipment, used for the diagnosis, treatment and prevention of disease. This waste is in contact with body fluids of patients, such as dressings, swabs, nappies, blood bags, etc. Liquid waste such as feces, urine, blood, pus or other body secretions such as saliva, sputum or lung secretions are also part of this type of waste.

2.2 Pathological and anatomical waste

Pathological waste is those waste products which contain organs, tissues, body parts or fluids such as blood. Anatomical waste is a sub-group of pathological waste and consists in recognizable human body parts, whether they

may be infected or not Even if pathological and anatomical waste may consist of healthy body parts, it has to be considered as potential infectious waste for precautionary and disposal reasons.

2.3 Hazardous pharmaceutical waste

Pharmaceutical waste includes unused, expired, spilt and contaminated Pharmaceutical products including drugs and vaccines. Discarded items used in the handling of pharmaceuticals like bottles, vials, connecting tubing, etc. are also included in this category.

2.4 Hazardous chemical waste

Hospital waste contains chemical waste consisting of discarded chemicals that are generated in a hospital during clinical procedures, disinfecting procedures or cleaning processes. Theses waste may be solid, liquid or gaseous and may be hazardous due to toxic, corrosive, flammable nature and must be used and disposed of according to the specification formulated on each container.

2.5 Heavy metal waste

Waste with high contents of heavy metals e.g. cadmium or mercury from thermometers or manometers and their derivatives are potentially highly toxic. They are considered as a sub-group of chemical waste but should be treated specifically because of their highly toxic nature.

2.6 Waste from pressurized containers

Many medical and surgical aids are packaged in pressurized containers. HCW consist of full or emptied containers or aerosol cans with pressurized liquids, gas or finely powdered solid materials. These also present a greater risk due to special component called as propellant.

2.7 Sharps

Waste that can cause cuts or puncture wounds on the body are generally categorized as Sharps e.g. syringes, needles, broken ampoules, blades, surgical aids, etc. Infected or not, they are considered as highly dangerous waste with potential to cause severe damage and infection. They must be segregated, packed and handled very carefully to ensure the safety of not only the medical and ancillary staff but also general public.

2.8 Highly infectious waste

Highly infectious waste includes body fluids and used medical materials of patients with highly infectious diseases. It also consists of microbial cultures and stocks of highly infectious agents from Medical Analysis Laboratories.

2.9 Genotoxic and cytotoxic waste

This type of waste originates from drugs generally used in oncology or radiotherapy units. It has a high hazardous mutagenic or cytotoxic effect. Waste including feces, vomit or urine from patients treated with cytotoxic drugs or chemicals should be considered as genotoxic. This is generated in specialized cancer hospitals and their proper treatment or disposal raises serious safety problems and must be dealt carefully.

2.10 Radioactive waste

Radioactive waste includes liquids, gas and solids contaminated with radio-nuclides including radioactive diagnostic material or radio-therapeutic materials which emit ionizing radiations having genotoxic effects. The ionizing radiations mostly used in medical practice include X rays and gamma rays as well as alpha- and beta- particles. The most important difference between these types of radiations is that X-rays are emitted from X-ray tubes only when the generating equipment is switched on whereas other radioactive materials generating gamma rays, alpha and beta particles emit radiations continuously.

The HCW is also classified into two broad groups based on their basic characteristics. These grouping may include parts of the aforementioned categories

- Biodegradable wastes: As much as 25 percent of the waste from a healthcare facility can be kitchen and food scraps. These can be composted or biodigested to produce compost and biogas, a renewable fuel and good manure.
- Recyclable waste: Waste like paper, plastic, metal and glass are the most widely recycled materials. Segregating, reusing, and recycling these wastes can make a significant difference to the economics of the facility waste disposal operation.

3. Risks associated with HCW

3.1 Health risk

HCW contaminated with pathogens pose a high risk of causing infectious disease [12, 15-18]. If the disease is contagious and the untreated waste is released in public area, it can cause a potential public health problem of large proportion. The reason to treat medical waste before disposal is to substantially reduce (actual goal is eliminating it) disease transmission. Diseases in humans may contract due to HCW include AIDS, cholera, tuberculosis, typhoid, Hepatitis B, SARS and also disease due to Radioactive materials. The HCW can be a major source of health related problems and infection or injury to the following section of the population. It can be direct or indirect.

3.2 Direct health risks

3.2.1 Medical professionals: This includes doctors, nurses, and hospital administrative and maintenance personnel.

3.2.2 Patients: In patients and outpatients who are receiving treatments for various health issues and their attendant. Patients are generally immune compromised and therefore at higher risk.

3.2.3 Hospital support staff and workers: Service and support staff such as sanitary staff, laundries, transportation services including ambulance services and waste handling personnel are also at high risk.

3.2.4 General public: General public if exposed to waste not disposed of properly are also prone to infection and injury. Children who may play with the waste material found outside hospital are at higher risk of infection and injury. The EPA says that, in general, the risks posed by HCW are greater for health care workers than for the general public as the maximum disease-causing risk is at the point of generation and diminishes over time.

3.3 Indirect health risks

Alongside infectious agents, medical waste also consists of other non-infectious hazardous components. These include materials that are deemed hazardous by their extreme pH, corrosiveness, reactivity, toxic or radioactive nature. These waste components also pose a threat to all living organisms affecting indirectly to their health.

3.4 Environment risk

Treatment and disposal of healthcare waste can cause health risks indirectly through the release of pathogens and toxic pollutants into the environment. HCW also contaminate the environment with biodegradable and non-biodegradable waste, fumes and plastics. The treatment of health care wastes with chemical disinfectants results in the release of chemical substances into the environment if those substances are not handled stored and disposed in an environmentally sound manner. The dumping of HCW in an uncontrolled manner in public areas can contaminate soil, air and water and have an indirect effect on health of living organisms in surrounding areas. For healthcare centers and health care workers daily concern is the disposal of biohazard waste. There are specific protocols they must be with them in order to keep themselves, colleagues and patients safe from any contaminants. This concern is an immediate type, but there are more concerns related to biohazard waste than just human interaction. In fact, this waste has a direct severe impact on the environment if it's not handled and disposed of properly. Detailed environmental effects are discussed below,

3.4.1 Water contamination: HCW is mainly disposed of landfills. Improper landfill construction or biohazard waste disposal in landfills can lead to escape of waste to the surrounding area. Sharps and syringes dumped into a regular landfill can easily rip into the lining. During rains the water logging will cause any contaminants in the landfill to filter into the exterior soil resulting in polluted contamination of drinking, surface, and groundwater. Chances of groundwater contamination are more even though the landfill is away from surface water, waste can leach into soil and contaminate ground water. Therefore landfills must be constructed carefully to enable them to keep waste in a controlled area. They should be lined with specific materials like geo-textiles, polymers and clay membranes to prevent their damage by HCW and contamination of nearby soil and water.

3.4.2 Air pollutants: Incineration is also one of the most used methods for HCW disposal in which waste is destroyed by completely burning it. However, improper and incomplete ignition of unsuitable materials can generate pollutants that are released into the air causing serious and severe air pollution releasing not only smoke but harmful

chemical fumes and ash residue. For example, chlorine based or treated materials when incinerated, generate gases like dioxins and furans, which are well known carcinogens and cause a range of adverse health effects. HCW with high metal content, especially cadmium, lead, mercury and arsenic can lead to the release and spread of these toxic metals in the environment. Airborne pollutants are generally considered worse than land-based pollutants because of their high spreading ability. These airborne pollutants enter into the body with breathing and can cause severe health problems. If the HCW is contaminated with infectious agents for airborne diseases, anyone who breathes the pollution could be affected.

Incineration facilities must therefore be designed to maintain a certain temperature efficiently in order to completely burning and destroying every bit of waste. Use of modern incinerators, operating at a temperature range of 850-1100°C and fitted with special equipment for cleaning released gas/fumes is always recommended. These incinerations comply with the international emission standards for different gaseous pollutants like dioxins and furans. It is advisable to employ alternatives to incineration such as autoclaving, microwaving, steam treatment integrated with internal mixing. These techniques minimize the formation and release of chemicals or hazardous emissions into the environment and should be given preference wherever and whenever there are adequate resources to operate and maintain these systems and dispose of the treated waste.

3.4.3 Radioactive pollution: Modern day hospitals and Doctors are increasingly using a large number of tools for diagnostic and therapeutic applications. Some of these items are based on radioactive agents as diagnostic tool in cardiology and oncology. This is leading to increased amounts of radioactive hospital waste. Radioactive substances give off particles that are dangerous to living organisms. When these items are not treated properly and carefully, radioactivity can enter other areas surrounding landfills. It is must to maintain strict protocol and comply with necessary guidelines when it comes to disposing radioactive waste of any kind. This waste should be disposed off strictly in accordance to the guidelines provided by the International Atomic Energy Agency (IAEA) and national agencies set up by the respective countries. Health care centers (HCC) should focus and undertake a coordinated effort in line with the National legal framework and ensure that the radiation exposure to humans and environment remains within the permissible safe limits. Safe disposal of the radioactive waste is a crucial element of this effort [18].

3.4.4 Wildlife and HCW: As discussed previously HCW can pollute water, soil and air in the surrounding area. Improperly handled HCW can end up in dumping close to wildlife habitat for birds and various fauna like lakes, parks and other areas. Medications, either in solid or liquid-form, are curious items to wildlife. Due to their attractive appearance and odor animals and birds get attracted to HCW and consume them out of curiosity leading to hazardous effect that can eventually injure the animal or kill it outright.

4. HCW Management

The process of waste management and treatment should be primarily focused on protecting the healthcare workers

and the general public and minimizing direct or indirect impacts from environmental exposures to HCW. Considering the hazardous potential of HCW, its management must be consistent and stringent from the point of generation to the point of final disposal. For ease and prompt implementation of management procedure, the path between these two points can be subdivided schematically into following eight steps [16, 19-27].

4.1 Waste minimization

This is the first step which comes prior to the production of waste. It primarily aims at utilization of means for reducing the amount of HCW generation to a maximum possible extent. This can be achieved by setting up an efficient purchasing policy and having a good stock management which will enable hospital to proper select and utilize materials so as to reduce HCW production.

4.2 HCW generation

This is the functioning point where HCW is produced. The operating of healthcare system should be planned in a way that there will be a least generation of waste, especially due to unused materials including chemicals and pharmaceuticals.

4.3 Segregation

Different facilities in HCC have different activities and accordingly different kind and volumes of waste is generated. Segregation means separation or division of the HCW in different categories. Waste segregation is an effective procedure for reducing risks associated with HCW and minimizing waste disposal costs. Segregation is most effective when done at the site of generation of the waste. The correct segregation of waste at the point of generation depends on a clear protocol for the identification of different categories of waste and their separate disposal accordance with the categorization chosen. Persons producing waste at the ground level in HCC need to know what the category is and where to keep the waste. It is not necessary that every health care facility should use the same waste categories, but consistency yields good results. It is a best management practice to stick with the categories wherever and whenever possible and not change them often. Here are some examples of categories, these are not exclusive, but can provide examples for categorization

- Compostable waste (e.g. food waste)
- General solid waste (Civic waste)
- Recyclable waste (cardboard, paper, aluminum cans, glass bottles)
- Waste for autoclaving
- Waste for encapsulation
- Radioactive waste
- Hazardous waste

Categorization helps in reducing treatment and disposal costs and prevents any one type of waste from getting too big in volume. The disadvantage is it needs a large number of containers and cause confusion in employees making them putting waste in the wrong container.

4.4 Containerization

To encourage and facilitate segregation at source, reusable waste containers or baskets with liners of the correct size and thickness should be placed as close as possible to the point of generation. They can be properly color-coded and have specific symbols marked on them, e.g. yellow or red for infectious waste with clearly marked international infectious waste symbol. The color coding for segregation of bio-medical waste has been recommended by the recent guiding principle is shown in Table 2.

Bag color	Container type	Waste to be stored	Treatment options
Red	Disinfected container/plastic bag	Waste which is hazardous and will later be incinerated is segregated in this bag. Used Syringes (without needles), soiled gloves, catheters, IV tubes etc should be disposed off in a red colored bag.	Autoclaving/Micro waving/Chemical Treatment/Incineration
Yellow	Plastic bag	All dressings, bandages and cotton swabs with body fluids, blood bags, human anatomical waste, body parts are to be discarded in yellow bags.	Incineration/deep burial
Blue	Cardboard box with marking	Glass vials, ampoules, other glass ware is to be discarded in a cardboard box with a blue marking/sticker	Autoclaving/Micro waving/shredding
White	Puncture Proof Container (PPC)	White translucent puncture proof container are used to disposed of Needles, sharps, blades etc	Autoclaving/Micro waving/Chemical Treatment and destruction/shredding
Black Bags	Plastic bag	These are to be used for non-bio-medical waste. In a HCC, these includes stationary, vegetable, fruit , leftovers, packaging including that from medicines, disposable caps, disposable masks, disposable shoe-covers, disposable tea cups, cartons, sweeping dust, kitchen waste etc.	Disposal in specially secured landfill.

Table 2: Color Coding for segregation of Healthcare waste.

5. Storage and Transport

5.1 Intermediate storage

It is necessary that the accumulation and decomposition of the waste must be prevented for this; it must be collected on a regular or daily basis. When the containers are 3/4 full, the liners should be closed properly and placed into larger containers or liners at the intermediate storage areas. In this area the relatively larger containers are kept before removal to the central storage area. They should both be close to each specialized areas and wards and must have restricted access to unauthorized people such as patients and visitors. Workers and all involved personals should appropriate care during handling of waste like use of latex gloves when handling infectious waste.

5.2 Internal transport

After storage in individual/intermediate areas the HCW need to be transported to the central storage area. This is usually performed using a wheelie bin or trolleys which are easy to load and unload, have no sharp edges that could damage the plastic waste bags or containers and be easy to clean. Ideally, the trolleys and wheelies should also be marked with the corresponding coding colors. The transport of general waste must be carried out separately from the collection of healthcare risk waste (HCRW) to avoid potential cross contamination or mixing of these two main categories of waste. Care must be taken that the collection and its route should be planned in such a way that it reduces the passage of loaded waste container through patient in-house facility and other clean areas.

5.3 Centralized storage

For proper handling waste produced in different areas of health care centre, centralized storage area is must. Depending on the size, the volume of waste generated and the frequency of collection the central storage area should be designed and sized in the health care centers. The central facility should also have separate facility for storing segregated waste so as to avoid mixing and cross contamination. The facility should be situated away from medicine and food stores or preparation areas and its access should always be limited to authorized personnel only. The facility should also be easy to clean, have good lighting and ventilation. It should be free from and prevent entry of rodents, insects or birds. The activities of waste management should be planned in such a way that waste storage time should never exceed 24-48 hours especially during warm and humid climate.

5.4 External transport

The collected waste in the central facility needs to be transported to specialized areas for further treatment and disposal this is considered as external transport. External transport should be carried out using dedicated vehicles. Transporting vehicles should be smooth or blunt edges as sharp edges have danger of wear and tear of waste bags and spillage of waste. The transporter must be easy to load and unload waste by hand, easy to clean and disinfect. The waste carrying vehicle must be completely enclosed to prevent any spillage and contamination in the hospital premises or on the road during transportation. The transportation should always be properly and correctly documented and all vehicles should carry a consignment note from the point of collection to the treatment facility.

6. Treatment and final disposal

The HCW especially infectious waste can be disposed off with different treatment options. Many HCC like hospitals and laboratories have their own in-house resources for internal waste treatment. This not only reduces the volume of the medical waste but also decontaminates infectious waste so that it can be disposed of as non-infectious. Methods used commonly for waste treatments are generally classified as on-site medical waste treatment and off site waste treatment. These methods are discussed in detail in following section.

6.1 On-site medical waste treatment

6.1.1 Autoclaving: Application of heat is one of the simplest, most classical and widely used methods of sterilization. Heat treatment is typically used for sharps and certain other types of infectious waste. This is generally carried out using an instrument called as autoclave. Sometimes heating oven is also used. Autoclave resembles large pressure cooker that uses steam at high temperatures (300°C) to deeply penetrate all materials and kill any microorganisms. The autoclave comes in various sizes that can vary from as small as the top of a desk to twenty-five feet long and ten feet high depending on the type and amount of waste need to sterilize. Automated modern autoclaves minimize human involvement and thus reduce needle-stick injuries and contamination. Decontaminated sharps and other medical waste that's been autoclaved can be disposed of as non-infectious waste. However, medical wastes such as chemical waste, including chemotherapy waste, as well as pharmaceutical waste can't be decontaminated using autoclave.

6.1.2 Chemical treatment: Chemical treatment is one of the most important and effective on site method to decontaminate or deactivate certain types of HCW. Packaging and transporting of HCW to a separate facility is avoided and waste disposal is relatively fast. The liquids are highly susceptible to spills during transport and should be treated as close to the generation site as possible. Chemical treatment is frequently used to treat and deactivate liquid waste. It can also be applied to some non liquid infectious wastes which are shredded finely to ensure that all portions of the waste are exposed to the chemicals for adequate disinfection. Depending on the type of waste, chemicals like chlorine, sodium hydroxide, calcium oxide or Ethylene oxide can be used. Chemical treatment has to be executed carefully and by knowledgeable staff as these chemicals may often produce undesirable byproducts, as well as off-gas dangerous Volatile organic compounds (VOCs).

Mechanical waste handling systems are very useful in reducing particle size and volume or increasing surface area of the solid waste pieces before subsequent chemical or heat treatment. This process is called shredding or mashing. This is a tricky process as one mistake or wrong step can lead to one more item to be decontaminated. Furthermore, mashing or shredding of solid waste generates fine particulate dust, which if becomes airborne, can be a threat to the environment and result in severe workplace hazard. Therefore all mechanical waste treatment equipments should be

kept in a closed housing or under a hood, at slightly lower than ambient air pressure to avoid spread in surrounding environment.

6.1.3 Microwave treatment: A microwave is very efficient instrument for heat treatment, similar to an autoclave but based on different mechanism. Microwave systems work best for waste that is not 100% dry or solid, moisture allows the heat to penetrate deeper, enabling the generated steam and heat to sterilize efficiently. Therefore, it is highly recommended that before microwaving, medical waste should be shredded and moistened with water to achieve the efficient sterilization. After microwaving the waste can be treated as no infective waste.

6.1.4 Radioactive waste disposal: Radioactive waste generation is a expensive affair as the cost of disposing of radioactive waste is more than ten times that of disposing of all other types of HCW. The radioactive waste disposal systems is guided by and designed on the principle of "confine and contain". Waste must be treated in such a way that, when placed in final disposal, it will not leak, leach, or get fragmented. Most radioactive waste from health care facilities are generally disposed of in specially designated and permitted low-level radioactive waste landfills, The other rarely used less preferred philosophy, is "dilute and disperse" method. In this case low level radioactive material is released over a large geographic area so that the final concentration of radionuclides contamination is low and at safe level in surrounding environment. There are specialized places for disposal of low level waste (LLW). It is comparatively expensive but enables HCC to outsource radioactive waste disposal to someone who will take your radioactive waste and bury it in approved landfills with waste management department in HCC need not to bother about it anymore.

6.2. Off-site medical waste disposal

6.2.1 Incineration: Incineration in simple words means burning the waste. Incineration is highly recommended and normally used for infectious pathological and pharmaceutical waste. In many countries incineration is mandatory procedure for disposing off HCW as per the laws. The best thing about incineration process is that it kills 99% of microorganism load and leaves very minimal residue if any. Incineration of medical waste should be performed in a specialized controlled facility to ensure complete combustion and minimizing any negative effects on the environment.

6.2.2 Land disposal: In land disposal method HCW is dumped in a deep pit away from easy access to animals and humans. It is typically used for waste which is properly shredded, treated and decontaminated. In certain cases, it can also be used for hazardous waste or other untreated waste that cannot be decontaminated by other means. Landfill sites reduce the risk of environmental pollution, especially soil and water contamination by confining waste to specific site and allowing it decomposition and provide a safe space for medical waste disposal.

7. Essential steps in waste management

It's important for every person in HCC to be aware and responsible for biohazard waste handling. If a common error is being observed, such as soiled linens or physiologic material entering a regular trash can, the person who has noticed need to speak up, prevent and correct the error and prevent it from repeating in future. It's everybody's collective responsibility to protect our environment from improper biohazard waste disposal. The Earth and its resources cannot be protected unless all the persons, whatever is their position care for the environment. In general lot of emphasis is given on methods and technologies for HCW treatment, but that is only one part of the waste treatment system. For efficient waste management, planning, monitoring, budgeting and training are also important for consistent and long term effect. Following steps can aid greatly in doing so.

7.1 Waste management policy

Healthcare facilities should have a well defined waste management policy and a proper waste management plan. The policy sets directives for overarching priorities of waste management and the plan goes in to more detail about implementation of the policies. Training of personnel, establishing standard operating procedures, and other guidelines set out the clear-cut roles and responsibilities for every employee undertaking different waste management tasks in each step. These are particularly important during the creation or upgrading of a waste management system based on need of HCC.

7.2 The waste management committee

To effectively undertake and monitor waste management every HCC should have the waste management committee. it is the responsibility of waste Management Committee to create and execute the policies and plans for waste management and making sure that the facility follows them and complies with all legal obligations. The committee should include representatives from all sections like senior management, procurement, finance, medical divisions, laboratories, housekeeping and maintenance to the waste workers themselves. One person should be nominated as the Waste Manager and coordinate with all those involved in waste generation and management inside and outside the facility. Wherever possible the HCC should go beyond the minimum requirement as per laws and set and aim to meet the best achievable standards. It is better to have appropriate methods in HCC for recognizing and rewarding excellent behavior for curbing inappropriate or hazardous actions and promoting good cleaning practices.

Waste management should be monitored regularly. While setting up a new waste disposal system, the baseline assessment of existing methods is very important in providing reference data as the basis of the new plan. Some monitoring data may be required by the regulatory authorities while other data can show up the successes and failures in the systems so that practices can be improved. Reporting of financial aspects can clearly show the benefits of waste reduction and segregation and sale of recyclable materials to the HCC.

The HCC through waste management committee should set targets for waste management. The targets may include the amount of waste to be recycled, reducing the number of incidents and/or accidents associated with waste

handling and the limit on the amount of hazardous materials to be purchased in a particular period. These targets and waste management policies should be reviewed and revised at specific time periods for achieving continuous improvement.

7.3 Scheduling

Scheduling is time bound planning of various steps in waste management. Depending upon the size and operation of HCC schedule is fixed for all activities related to HCW management, i.e. from the collection, segregation to disposal.

7.4 Auditing

In a large HCC auditing of the HCW management system is must to keep track and find and improve any weak area. Auditing also helps in predicting and finalizing financial aspects of HCW management. This also makes persons to fill data and maintain proper bookkeeping system for regulated waste, especially radioactive and RCRA hazardous waste. So HCC can abide by rules and face regulatory authority with documented evidence.

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