A Review on Healthcare Waste Management in Dhaka City

A project submitted

by

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Dedicated to my parents

Certification Statement

This is to certify that the project titled “A review on Healthcare waste management system in Dhaka city” submitted for the partial fulfillment of the requirements for the degree of Bachelor of Pharmacy from the Department of Pharmacy, BRAC University constitutes my own work under the supervision of **Mesbah Talukder**, PhD, Associate Professor, Department of Pharmacy, BRAC University. All through the project, I have given proper credit where I have used the verbal, ideas or writings of others.

Signed

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Counter signed by the supervisor

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Abstract

This study reviews the existing condition of healthcare waste administration and practices in Dhaka, Bangladesh. The aim of this study is to evaluate the collection, handling, storing, and treatment and final disposal system of healthcare waste in Dhaka city. We composed existing evidence through an Internet search using the keywords 'Hospital Squander Management,' 'Health Exposures,' 'Management of healthcare hazard,' and 'Dioxin emission'. Medical trashes that are predisposed in exposed places in the city are precarious and toxics. Moreover, trash administration and practices were found to be quite in dangerous situation. Healthcare wastes are risky because of its hazardous contamination might be responsible for horrible illnesses like hepatitis B and HIV/AIDS. Besides it poses severe fears to ecological health, which require specific action and administration prior to its final destruction. Deprived people accumulate the waste and sell it for recycling. Almost 85.0% of sharp wounds are triggered between their usage and subsequent destruction. More than 20.0% to them who carried them encounter "stick" damages. There is no initiative for current Medical waste management structure by administration or NGOs, and no solid rule has been established yet. Few scientists and NGOs tried to solve the problems but it was not sufficient. Waste pickers and waste cleaners are defenseless because they handle the trash with bare hands; revealing them to infection with HIV or hepatitis B and other illnesses. It is apparent from the complete study that it is essential to accept some vital strategies and followed by its implementation must needed to attain an effective medical waste administration system in Dhaka city.

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HCW: Health Care Waste.

HWM: Hospital Waste Management.

WHO: World Health Organization.

EPA: Environmental Protection Agency.

HMIWIs: Hospital/medicinal/infectious waste incinerators.

BW: Biomedical Waste

HIV: Human immunodeficiency virus

E.coli: Escherichia coli

HCE: Health Care Establishment

AIDS: Acquired Immune Deficiency Syndrome

PRISM: Project in Agriculture, Rural Industry, Science and Medicine

NGO: Non-Governmental Organization

CIDA: Canadian International Development Agency

DG Health: Directorate General of Health

DNCC: Dhaka North City Corporation

DCC: Dhaka City Corporation

RCRA: Resource Conservation and Recovery Act

UNDP: United Nations Development Program's

DoE: Department of the Environment

BPEO: Best attainable environmental option

EEE: Electronic and Electrical Equipment

CDDs: Chlorinated dibenzo-p-dioxins

TCDD: Tetrachlorodibenzo-p-dioxin

IARC: International Agency for Research on Cancer

PAC: Powdered activated carbon

PVC: Polyvinyl chloride

1. Background:

Hospital wastes are standout amongst the most assorted and complex wastes produced in institutions, and constitute a hazard to public health if handled inappropriately (Freeman, 1998). In developing nations, restorative thrasher has not gotten much consideration and discarded together with local waste (Almuneef & Memish, 2003). Inappropriate health care waste administration is shocking in Bangladesh and it represents a genuine danger to general wellbeing.

1.1 Categories of hospital waste:

In Hospitals of Dhaka City, various types of restorative techniques (i.e. Therapy of Cobalt, dialysis, medical procedure, delivery, resection of gangrenous tissues, dissection, biopsy, Para scientific test, infusions and so on.) are completed and outcome in the generation of irresistible trashes, sharp protests, radioactive trashes and biochemical wastes (Prüss, Giroult & Rushbrook, 1999). Aggregate sum of waste created by health-care activities, around 85% is general, non-dangerous waste equivalent to local waste. The staying 15% is viewed as hazardous material that might be irresistible, chemical or radioactive (World Health Organization, 2013)

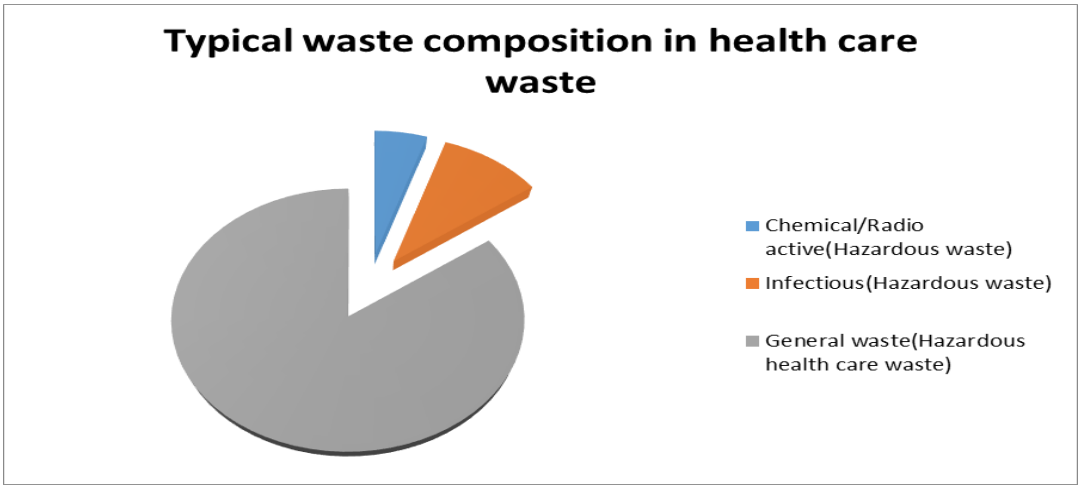

Figure 1.1: Category of Health Care Waste (WHO, 2013)

- **Infectious Waste:** When working with human or creature tissues, blood and other organic liquids, plant and creature pathogens, or recombinant DNA, you are likely going to have some irresistible waste. This implies the waste is (or conceivably is) polluted and can spread diseases, infections, microbes, and different things that represent a wellbeing hazard.
- **Pathological Waste:** Pathological waste is a classification of bio hazardous waste. The parent class incorporates irresistible creature bedding/defecation, human and additionally creature pathogens and expendable things sullied with human blood or body liquids. Pathological waste is set in a biohazard holder fixed with a red sack.
- **Sharps Waste:** syringes, needles, disposable scalpels and blades, etc.
- **Chemical Waste:** Includes solids, fluids or vapors having or contaminated with any of the following, combustible diluents (e.g., acetone, alcohols), leachate poisonous tools (e.g., heavy metals, pesticides), corrosives (e.g., HCL, potassium hydroxide pellets), irritable such as oxidizers, cyanides, explosives, unsteady materials and water-reactive things (e.g., Na metal), poisonous materials including mutagenic, cancer-causing, acute or chronic poisonousness things (e.g., chloroform), polychlorinated biphenyls (> 50 ppm concentration), non-returnable vapor containers (University of Toronto, 2017).
- **Pharmaceutical Waste:** Pharmaceutical waste is conceivably created through a wide assortment of exercises in a social insurance office, counting however not restricted to intravenous (IV) readiness, general compounding, spills/breakage, halfway utilized vials, syringes, and IVs, stopped, unused preparations, unused unit dosage repacks, patients' close to home prescriptions and obsolete pharmaceuticals (Pines, 2006) .
- **Cytotoxic Waste:** Squander containing substances with genotoxic properties (i.e. exceptionally perilous substances that are, mutagenic, teratogenic or cancer-causing, for example, cytotoxic medications utilized as a part of malignancy treatment and their metabolites.
- **Radioactive waste:** Radioactive squanders are the scraps from the utilization of nuclear materials for the generation of power, determination and treatment of sickness, and

different purposes (Chavan, Jadhav & Ranveer, 2015). In other words, products defiled by radionuclides including radioactive indicative material or radio therapeutic materials.

- **Non-hazardous or general waste:** Squander that does not represent a specific natural, compound, radioactive or physical hazard.

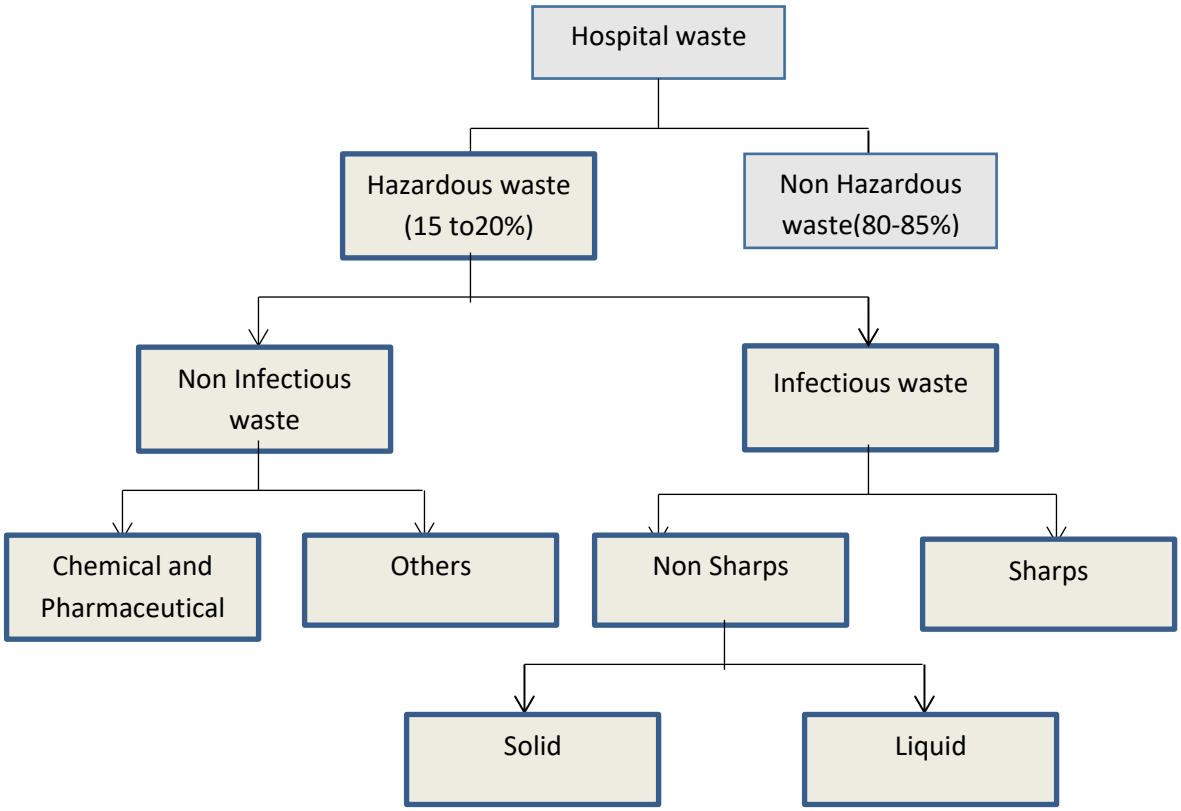

Figure 1.2: Categories of Hospital waste (WHO, 2013)

1.2 Strategy of Hospital Waste Management:

There are a few strategies that are utilized by biohazard waste transfer organizations to crush restorative waste and each is intended to hold fast to EPA principles (Neller, 2016). Those strategies are:

- **Incineration:** It is the controlled consuming of the therapeutic waste in a committed medicinal waste incinerator. Among industry experts, these units are frequently alluded to as Hospital/medicinal/infectious waste incinerators (HMIWIs). Cremation has the advantage of diminishing the volume of the waste, disinfecting the waste, and wiping out the requirement for pre-handling the loss before treatment. But also incinerators got an awful reputations as a result of the air contamination they made and on the grounds that the base fiery debris, or sinter, was difficult to monitor (Crean, 2018).
- **Autoclaves:** This strategy utilizes what is essentially a high temperature "Pressure cooker" to enter the surface of restorative executes and slaughter microorganisms. After which, the cleaned leftovers are frequently discarded in a customary landfill. Autoclaving has existed for a considerable length of time as an approach to purge certain medical equipment's, for example, sharps and others sorts of apparatuses (Neller, 2016). Autoclaves are best for squanders that are probably not going to create ignition or generous off-gas. One issue with autoclaves is that the procedure can aerosolize synthetic concoctions introduce in the waste, prompting the potential for release of materials you would want to not discharge. This can represent a peril to human administrators and to some degree the environment (Crean, 2018).
- **Mechanical/Chemical Disinfection:** This method is utilized to sanitize fluid restorative waste. It is finished by including a chlorine based synthetic into the fluid pulverize the biohazards ("Disposal of,"2013). The substance sterilization is joined with mechanical disinfection, for example, destroying, to guarantee that the synthetic substances are presented to all aspects of the restorative waste. Water is frequently added to the procedure, to cool the gear utilized as a part of the destroying procedure, and in addition to trick the synthetic concoctions. The misdirected synthetic concoctions are then

disposed of in the sewage framework. Mechanical/compound purification is done in the offices and reusing organizations are not required.

- **Irradiation:** This strategy sanitizes medical waste by presenting it to gamma rays. These beams are deadly to microbes. Illumination is utilized less regularly than different techniques because of its staggering expense (Neller, 2016).
- **Microwave:** Microwave decimation is a recently acquainted strategy with clean therapeutic waste. The procedure begins with destroying of the waste, which decreases its volume altogether. After the destroying is done, the waste is blended with water and set into a microwave unit. The units can be situated in the office or it can be brought by a reusing organization ("Microwave," 2013).

1.3 Destructive impact of biomedical waste:

Bio hazardous squander, otherwise called irresistible or biomedical waste, is kind of waste that contains infectious materials or conceivably irresistible substances, for example, blood, of specific concern is sharps, for example, surgical tool cutting edges, needles, glass pipettes, or some other waste material that may cause damage amid taking care of. Biomedical squander must be dealt with as per strict government, state and neighborhood controls. Misused biohazard squander represents a danger not exclusively to social insurance experts, patients, and nearby network individuals, it additionally represents a noteworthy risk to environment (MedPro Disposal, 2017).

- **Natural life and Pharmaceuticals:** Health care squander that isn't discarded legitimately can wind up in lakes, parks, and other wildlife asylums where winged creatures and fauna live. Natural life is extremely inquisitive about pharmaceuticals. It is thought they are pulled in to the fragrance or shade of pills and fluid prescription. This interest brings about processing of medication, which can harm or even execute the creature (MedPro Disposal, 2017).
- **Groundwater:** Open dumping is very basic in developing nations because of low financial plan accessible for squander transfer and furthermore postures genuine risk to groundwater (Srigirisetty, Jayasri &Netaji, 2017). Much idea and exertion has been

taken to guarantee landfills are worked to ensure the earth around them. Most are worked with an exceptional covering so close-by soil and groundwater can't wind up debased. Misused biohazard waste can trade off even the best landfill outline. Syringes and other sharp protests can without much of a stretch tear the covering. As rain falls, contaminants in the landfill can leak out to the outside soil, and the groundwater wind up dangerous (MedPro Disposal, 2017).

- **Radioactive Pollution:** Keeping in mind the end goal to precisely analyze patients, specialists should here and there utilize radioactive instruments. At the point when discarded dishonorably, radioactivity can enter landfills and different zones. These substances produce particles that are perilous to individuals. Inordinate presentation to radioactivity can bring about genuine ailments. This contamination prompts numerous sorts of negative symptoms. For instance, radioactive iodine which has a tendency to aggregate in the thyroid reason thyroid tumor, Skin malignancy gets created because of the aftereffect of prolonged UV exposure, hereditary mutations. Besides the skin and thyroid, radioactive contamination additionally influences numerous different parts and organs of the body including the bone marrow, the gonads, the digestion tracts and the cells also. A portion of the less genuine impacts of being presented to radioactive contamination incorporate regurgitating, sickness, loss of hair, loose bowels, wounds because of draining and so forth (The New Ecologist, 2018).
- **Airborne Pollutants:** Certain therapeutic waste can be pulverized by incineration. In any case, if not touched off appropriately, poisons can travel through the air. Airborne contamination's can be more awful than arrive based composes in light of the fact that they can spread far and wide and rapidly. A therapeutic waste incinerator discharges into the environment a extensive assortment of poisons including dioxin and furans, (for example, Pb, mercury and Cd), particulate issue, corrosive gasses (HCl, SO_2) CO and NO. These emanations have unfavorable results on general wellbeing and the earth. Dioxin is a known cancer-causing agent that has been connected to birth deserts, resistant framework issue and other hurtful wellbeing impacts. Mercury is an intense

neurotoxin that can cause formative deformities and mischief the cerebrum, kidneys and lungs (Krishna, 2008).

The best concern with respect to dishonorably took care of therapeutic waste includes exposure to infectious pathogens. Those presented to medicinal waste can be contaminated through punctures of the skin, and additionally through inward breath or ingestion. While HIV and Hepatitis B and C exhibit the most serious hazard, anti-infection safe E.coli and different perilous microscopic organisms can likewise be wellsprings of contamination. Due to the potential for sharps to exchange pathogens by means of cuts or scraped area, edges, hypodermic needles, and other comparable materials are considered as a larger amount of threat and should be gathered by means of red sacks for handling and transfer. As per WHO, on account of the extreme results related with introduction to therapeutic waste, it is vital to limit hazards and take after legitimate conventions. Educating specialists, doctor's facilities, and human services laborers on the risks of uncalled for therapeutic waste expulsion and transfer can help keep associations agreeable. What's more, squander administration experts should constantly screen activities and work tenaciously to keep their waste administration framework running easily and productively (Losurdo, 2017).

1.4 Origin of Medical waste:

As per (WHO, 2013) the primary origin of therapeutic waste are University, General and region hospitals, Clinics, Emergency medicinal care services, Healthcare, centers and dispensaries, Research labs/dialysis center, Plasma banks and blood collecting services, Nursing institutions for the old. General, non-dangerous waste from HCE represents indistinguishable perils from general strong waste, however restorative or clinical waste stances altogether expanded risky. The most evident of these is the transmission of irresistible ailments (e.g. Hepatitis B and HIV/AIDS) through direct contact with contaminated waste things, for example, utilized needles, disposed of dressings and human tissues or liquids. Non-coordinate dangers incorporate malady transmission by vectors and contamination of water sources and nature. Less regular potential dangers incorporate the danger of disease, consume and skin aggravation from radioactive waste or dangerous synthetic concoctions (Harvey, Baghri and Reed, 2002). Transmission Pathways of these

medicinal squanders are through direct contact, contact through vector, airborne transmission, contamination of water sources, pollution of the environment, contamination of soil (dump/transfer site). Medical experts/staffs, Medicinal waste specialists/handlers, waste pickers/sanitation labors, children (around the transfer locales), Medication addicts (who scrounger for utilized needles and arranged pharmaceutical), Patients/guests/overall population are more prone to expose to these.

1.5 Present Scenario of medical waste administration in Bangladesh:

Globally, HCW issues have been truly considered, numerous endeavors have been given and several activities have been as of now taken at global level to limit dangers related with HCW (Muduli and Barve, 2012). But in several developing nations incorporate Bangladesh, therapeutic waste administration has not gotten adequate consideration (Hassan, Ahmed, Rahman and Biswas, 2008). However, if the waste administration framework in Bangladesh isn't arranged legitimately it could be perilous and give extra hazard particularly for the specialists and patients. At the point when dangerous medicinal services squanders are not appropriately overseen, exposure to them could prompt infections, infertility, genital deformations, hormonally activated cancers, mutagenic dermatitis, asthma, Aids and so on. From that point forward, diseases from the waste additionally can spread any microbes, viral parasites and growths particularly for the patients (Aziz, 2011).

In Bangladesh, legitimate medical waste administration is another wonder, the legislature is endeavoring to build up another, and current way to deal with manages the medicinal waste appropriately. PRISM Bangladesh (Project in Agriculture, Rural Industry, Science and Medicine), a rumored national NGO in Bangladesh, with the money related help from Canadian International Development Agency (CIDA) has as of late built up a transfer office for ease medicinal waste treatment and administration in Dhaka City (Shareefdeen, 2012). There is no exact national policy on restorative waste administration in Bangladesh. For a legitimate and logical administration of therapeutic waste, the legislature should give need in detailing an arrangement

(Dana, 2011). Appropriate administration of health care squanders can anticipate cross contamination, and spread of plagues of irresistible infections. Shockingly, this perspective is totally disregarded in Bangladesh. There are no appropriate medical squander administration offices in the legislature segment and in the meantime there is additionally absence of accessible spending plan to actualize the plans of gathering, treatment and transfer of healing center squanders independently (Rahaman and Rahman, 2010).

This review paper aims to evaluate the overall procedure of hospital waste management of developing countries compared to developed countries as well as the scenario of it in Bangladesh and followed by the analysis to minimize the lacking's.

2.1 Research Methodology:

This review has done on literary information presented on various sources. A wide data mining was taken out from numerous texts including peer reviewed papers and some websites of the concerned Topics. The Databases like Medline, Science direct, PubMed, Scopus and Google Scholar were examined. We used the therapeutic subject titles biomedical waste and health care trash for documentation and classification. The terms biomedical trash administration, health care squander administration for recent practices and recent advances in the administration of these wastes was investigated.

The following data bases were searched,

- Pubmed
- Science direct
- Medline
- Scopus
- Science.Gov
- Scirus etc.

Keywords: 'Medical Waste', 'Types of Waste', 'Medical Waste Administration', 'Waste Administration NGOs', 'Biomedical Trash', 'Management of Waste', 'Policies and laws', 'Biomedical squander' etc.

3. Segregation of Hazardous and Non-hazardous hospital waste in Dhaka City compared to developed countries:

Medical and clinical waste originated from health care facilities like clinics, nursing homes, pathology and hospitals are managed by the section of medical waste management. Successful healthcare trash administration includes the generation, management, storing, elimination, transference and devastation or safe disposal of biomedical trash(http://www.wisegeek.com). It has been found that maximum HCEs stock their hazardous wastage in the same reservoir of non-hazardous wastage and for this inappropriate segregation practices the authorities are not getting any regulating measures.

3.1 Healthcare waste management system in developed nations:

In numerous developed nations, exact laws and legislations have been performed together with references for supervision HCW. There are recently several HCW expertise and accounted dissociation rehearses which have been positively accepted in developed states (Ciplaka & Kaskuna, 2015).

3.1.1 Healthcare waste management system in Korea:

The greatest restorative trash administration exercise for therapeutic facilities is to anticipate and limit the waste production. Nonetheless, the potential for trash counteractive action and decrease during the point of production are recognized to be fairly constrained in view of the nature of the trash stream (e.g. the pathogenic qualities) and the expanded utilization of single-utilize expendable things. Figure 2.1, shows the recent paths for the administration of medicinal trash in Korea (Jang, Lee, Yoon,& Kim, 2005).

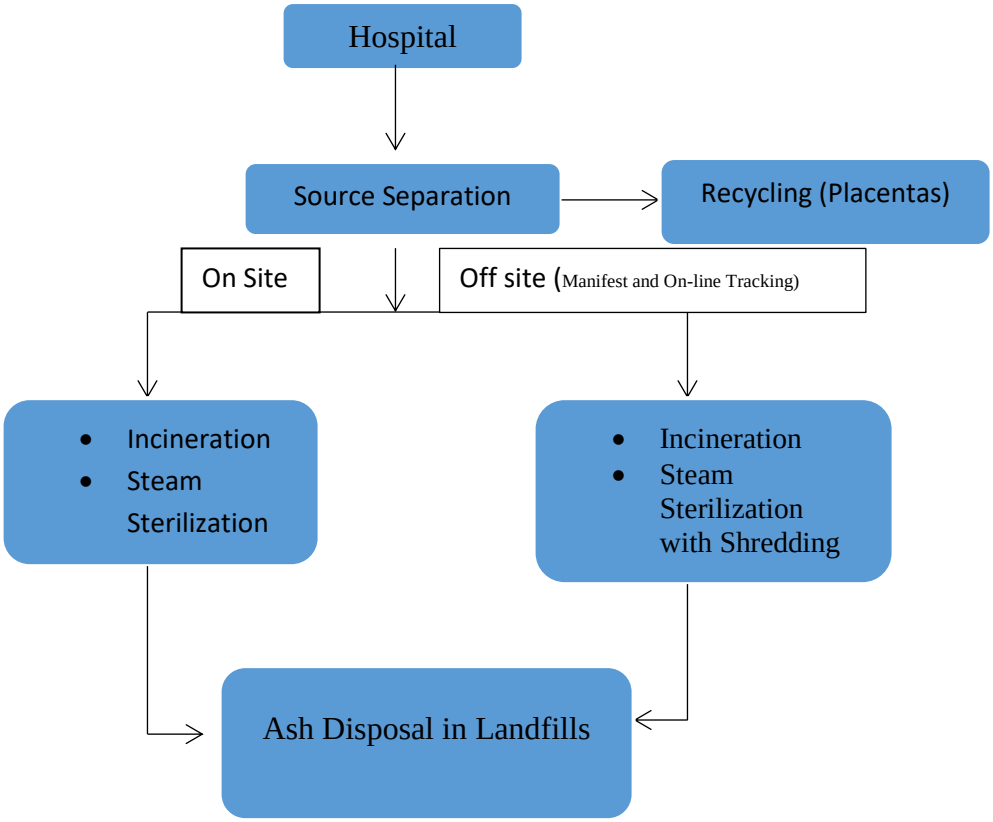

Figure 3.1: The management of healthcare waste in Korea. (Ciplaka & Kaskuna, 2015)

3.1.2 Hospital waste management system In United Kingdom:

The waste association framework is beneficial. This examination uncovers that in the country, there is a national sanctioning for the control of focus abuses. Every clinical waste are collected in yellow compartments while nuclear families are in dull plastic sacks. There is a name on either the pedal holders or plastic sacks. WHO [3] recommends that most proper method for seeing the classes of human administrations abuse is by organizing the misfortune into shading coded plastic sacks or holders.

- There are written systems for every one of the means in hospital squander administration and the staff is prepared to take after these systems. Sharps ought to be disposed of straightforwardly into clearly checked sharp holders (Figure 3.2). When throwaway

sharp vessels are full and must be fixed, they are put into the therapeutic excess vessels (Ngounou, 2004).

Figure 3.2: Sharp Holders. (Ngounou, 2004)

- Trashes are removed from clinical districts and ward a couple of times each day by watchmen when they are full. Moreover, the individual versatile garbage containers is wheeled or gone up against trolleys or in reason gathered structure to store squander. The capacity zone is dry, lockable, secure against rodents, have dreadful little animal controls and appropriate wash-down and cleaning alternatives (Figure 3.3).

Figure 3.3: Storehouse Region in ward. (Ngounou, 2004)

- They grasped burning option for the treatment of contaminated waste, and the slag is taken to the landfill site. An extensive bit of the healing centers don't get incinerator on area anyway everything is proficient in a way that there are commonplace incinerator plants (Ngounou, 2004).
- They use elective alternative to landfills which will deal with the issue of draining to some degree is called clean landfill. They are all the more perfect, certain an efficient way, and are depicted by the controlled and dealt with store of misuses, which is then anchored routinely (consistently) by the staff show nearby. A fitting building arranging of the site and an awesome land setting (giving a repression of misuses from the earth) are required.
- To get the best-preferred standpoint from misuse minimization by reusing, suitable isolation - at source is practiced and comprehended by all staff. Normal items, which may have the ability to be adequately reused, consolidate paper from administrative working environments, records and stores Departments (repositories clearly stamp as "perfect paper for reusing" taken to fundamental issue when full), cardboard holders in which distinctive clean stores are gotten and aluminum jugs (Ngounou, 2004).
- They carried out appropriate training with clinic employees to create awareness to wellbeing, care and natural matters (Mohee, 2005). If the conception of healthcare excess destruction approaches is increased, health care excess management system will be significantly strengthen.

3.1.3 Hospital waste management system In China:

The separation practices of the picked hospitals in China were equivalent to the therapeutic waste organization performs declared in the compositions (Tsakona et al., 2007). In 80% of the human services, arranged staff accepted accountability of the social occasion activity, while in 20% of the healing facility they did not. The separation exercises have been administered as follows: pathogenic waste was gathered in yellow sacks, civil trash was gathered in dark sacks; sharps were collected in plastic containers and cytotoxic medicines were gathered in their unique bundling.

- After squanders of clinics are isolated and gathered, the staff moves them from the area of age to impermanent storage in china, in view of the present directions. The transitory capacity area, storage containers and storage administration directly affect the subsequent ecological and wellbeing dangers at the medicals, which must be all around disinfected and secured for entree to just to approve workers (Prüess, 1999).
- They carried out training with clinic representatives to create awareness of wellbeing, security and ecological matters (Mohee, 2005). If the conception of healthcare trash removal methods is improved, biomedical trash administration will be greatly strengthen .Of the hospital reviewed, 93.3% gave training to staff sooner or later, while just 20% of the clinics had continuous preparing and instruction. The review demonstrated that training programs in regards to medicinal waste administration for specialists, attendants and professionals were restricted in China. (Birpinar, 2008)
- Following to Action 380, China has established a dominant destruction system for hospital excess. The medicals have the governor for giving in-site transfer of hospital trash, while offsite disposal corporations carry out transfer to the main dumping site. These organizations are also in control of the last destruction of hospital squander in China. Hospital squanders are moved over pre build routes, which involve specific passage and elevators on every floor, and are accurately used to transfer waste from the intermediary storage to the finishing storerooms in the underground of the medical (Askarian, 2004).
- Centralized destruction of HCW has been executed in China since 1997. Following Act of 380, medicals are not authorized to destruct of their own excess. Some private discarding organizations, Huifeng and Jingzhijie, are accountable for squander disposal originated from the medicals in China. The EPA is in charge of checking the transfer of all restorative waste. The restorative waste created from every single chosen clinic was transfered to the incorporated disposal agency. The handover expenses of restorative waste is around five hundred eighty US$/ton (Abdulla, 2008). There are a few medical waste transfer techniques, for example, burning, steam disinfection (or sanitation), microwave hygiene, concoction purification, dry warmth cleansing, and sanitization with

super-heated vapor. Just incineration advances have been actualized by the three disposal organizations in China (Jang, 2006).

3.2 Hospital waste management system In Dhaka city, Bangladesh:

Bangladesh is a standout amongst the most densely populated south Asian nations with more than 150 million populace overburdened with therapeutic squanders, mechanical squanders, municipal squanders, sanitation clog, lack of water supply, air contamination, and with each of the, an evident unsustainable environment (Biswas, Amanullah and Santra, 2011). As indicated by the Directorate General of Health (DG Health), Government of Bangladesh, there are in excess of 1200 HCEs arranged in Dhaka city, producing an expected 200 tons health center waste a day and 40 tons of which are infectious squander. Also, just 377 HCEs arranged in DSCC area and creating 26 tons/day where 19 tons/day are non-hazardous and near7 tons/day are hazardous and just 635 HCEs arranged in DNCC region is producing 22 tons/day where 17 tons/day are nonhazardous and around 5 tons/day are hazardous (PRISM Bangladesh, 2013). Conventional medical squander management is a new experience in here and the government should carry out establishing a novel and advanced method to deal with the health care excess correctly. By getting monetary support from CIDA, PRISM Bangladesh, a national NGO has currently established a disposal opportunity for low cost healthcare Squander treatment and administration in Dhaka City (Shareefdeen, 2012). But there is no exact state strategy on medical excess handling in Bangladesh. For a perfect and technical administration of healthcare waste, the authority should give importance in establishing a strategy (Dana, 2011). The current situation of healthcare waste administration in Dhaka city is given underneath,

- There has not been discovered right segregation rehearses in a large portion of the HCEs. There has additionally been discovered that most extreme HCEs store their hazardous waste in similar holders of the general waste, and for this inaccurate isolation practices the experts are not getting any controlling measures. It is watched that a portion of the HCEs utilize 3 to 4 distinct shades of container to isolate their waste; and it has been discovered that aggregate 5 unique shades of container are utilized for isolating the

squanders, for example, black container for general waste; yellow receptacle for irresistible, neurotic and anatomical; red receptacle for sharps with utilized or unused needles and syringes; blue canister for fluid waste and green container for recyclable. There has not been discovered any shading coded canister/compartment for isolating the radioactive waste (Figure 3.4 & Table 3.1). The DG Health and WHO select silver shading coded receptacle for radioactive waste, which has not found in any HCEs (Rumi, 2014).

Figure 3.4: Different colors of container used by HCE. (Rumi, 2014)

Table 3.1: Different Colors of waste containers. (Rumi, 2014)

Color of Containers	Category of waste
Black	General waste/non-hazardous
Yellow	Infectious, Pathological, Anatomical /highly hazardous
Red	Sharps, needles and syringes
Blue	Liquid waste/chemical /hazardous
Green	Recyclable /non-hazardous

- The storage where the clinic squander is kept before transporting to DCC canister is named as an impermanent waste storage (PRISM Bangladesh, 2005). The present investigation found that the majority of the HCE has no anchored impermanent capacity framework. Without couple of, a large portion of the HCE put away their waste incidentally in open space inside or outside of the healthcare facilities, clinics, diagnostic focuses and little medicinal centers (Figure 3.5). Despite the fact that it is watched that the greater part of the overviewed HCE has impermanent storage system, however the system is not perfect (Rumi, 2014).

Figure 3.5: Temporary storage outside of healthcare. (Rumi,2014)

Figure 3.6: Recyclable squander was handled by the waste handler. (Rumi,2014)

- It has been discovered that the second most elevated age rate is recyclable waste (add up to 2633kgs/day), which are gathered by squander pickers and poor scavengers without taking any defensive measure (Figure 3.6). It is very nearly a noteworthy danger to therapeutic waste handler and scavengers, however activity isn't taken by the specialist or administration, and at present no office has been set up for working with appropriate program for correct reusing. Although, any association or specialist has chosen no

additional shading coded holder, the greater part of the overviewed HCE gathered their recyclable waste together with general waste compartment (Rumi, 2014).

- The greater part of the waste from the HCE has been gathered regular two times. The DCC is in charge of gathering the greater part of the general/non-hazardous waste from HCE in every morning (Figure 3.8). The PRISM Bangladesh gathers just the clinical waste from 70% HCE in evening every day (Figure 3.7). Their own representatives gather just 5% of HCE squander.

Figure 3.7: Waste carried by PRISM Van and DCC Van. (Rumi, 2014)

- The DCC is additionally in charge of off-site transport of all broad waste for final transfer by possessing van. It is noticed that PRISM Bangladesh (NGO) is currently capable just for clinical waste and furthermore off-site transport by PRISM's uncommon secured van to Matuail plant their dump site for conclusive transfer. The on location transportation has been finished by the HCE itself and the on location transportation has been finished by two distinct techniques, for example, physically also, truck/trolley. The PRISM Bangladesh is in charge of all treatment and transfer of clinical waste from HCE as they gathered from chosen HCE. They have unique disposal plant in Mutuail dumping

site. Their diverse treatment and transfer techniques are autoclave, incinerator, synthetic sanitization, profound internment and shredding (Figure 3.9).

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Figure 3.8: Disposal and treatment technique used by PRISM Bangladesh. (Townsend, 2009)

4.1 Global Policies and laws for hospital waste management:

The administration of healthcare trashes is a judiciously novel phenomenon; even in the most progressive structures in the greater income, industrialized nations, developments are still gradually being prepared in order to deal with the approaches which are being established for the finding, surgery and the handling of patients. A nationwide policy is the chief and key stage in generating a maintainable healthcare leftover administration system for any nation. First, the policy should be intended to take account of all worldwide contracts that the country has signed up to; and secondly, it should address the international ideologies announced for ecological safety as well as of the health and safety issues that are mandatory to protect human wellbeing and the atmosphere. The strategy should be planned to ensure that informed decision-making is presented at a political level, and to entail that the policy is passed out at all levels in the civic. The policy should be reread at consistent intervals and should take into account the step of growth that has been extended and the development that should be made by setting attainable objectives in an iterative procedure (Townsend, 2009).

- In Europe, wastes are legitimately disengaged at the season of production, in spite of the fact that the leeway is expensive. Dirtied things are singed at source, albeit new instruments, for example, microwave cleaning, and so forth are picking up notoriety. For successful residual administration, the European Commission, in 1990, under the Environmental Protection Act, executed strict controls and set up sacred obligations. Ignorance or insubordination of these jars outcome in extreme punishments and custodial endorse (The Indian Express, 2011). In 1995, direction on incinerator plants to coordinate waste control was exhibited. After 1996, the European Commission pivoted their care to dispose of minimization by reuse, reusing, seclusion, and better organization with slightest effect on the environment and biological system. They are ordering strict standards to achieve and control healing center wastes.
- In Latin America, there are no particular laws and control for the administration of healing facility squander however customarily, mind has been given to clinical rubbishes, yet more exertion should be done to decrease introduction by squander works.

A decent understanding vanished of the home of pathogenic, synthetically dubious, and standard strong rubbishes inside a wellbeing office. Direction as a rule needs nearby cremation, however frequently offices are flawed, and rubbishes may wind up in various cells in a clean landfill (Pruss, Giroult and Rushbrook, 1999).

- The U.S. Ecological Safety Agency has conventions and systems, yet genuine guideline is done at the national level. Most human services junks are singed in center burners; however these are additionally discarded in landfills and network sewers. Other taking care of strategies involve steam or gas refinement, light, and substance sterilizations. The exclusive comforts contend to deal with wastes. Some novel instruments, for example, bio-oxidation, gas-pyrolysis, plasma-treatment apparatus, microwave purifying, autoclaving, and so on are rehearsed now days. EPA controls household, mechanical, and designing strong and unsafe wastes underneath the Resource Conservation and Recovery Act (RCRA). RCRA's targets are to shield us from the perils of waste transfer; save vitality and characteristic resources by recouping and recuperation; diminish or expel waste; and tidy up junks what may have spilled or been deficiently discarded.
- In India, the government delivered the Biomedical Waste Administration and Handling Guidelines, 1998, which summaries how clinics should gather and passage waste, as well as suitable disposal methods. Despite this regulation, most of the medical squander in India is discarded in the open and collected with the common waste. Unfortunately, the Indian media often reports cases in which clinics are closed down or are not following guidelines for trash disposal (Kumar, Duvvuri and Bakki, 2007). India reviews typical complications with medical trash administration; operators are out to possible contaminations from lowly class apparatus castoff for treating the therapeutic squander (include continual use of scarfs), research laboratory do not isolate squander conferring to the compulsory color hinted structure, but place all kinds of trash in one basket (counting sharp items), waste storing zones remain unsafe.
- The United Nations Development Program's (UNDP) Worldwide Healthcare Waste Mission is exploring techniques to help Sub-Saharan Africa enhanced mastermind of therapeutic misuse. The greater part of the countries overviewed needed approved

administer for medicinal junk organization and needed proper clean landfills. For instance, Eritrea, Lesotho, and Ghana have no control for medicinal services overabundance overseeing, while Kenya, Nigeria, and Gambia are members to the Stockholm Convention and have some related guidelines on the records.

- In 1995, the Local Office for South-East Asia of the WHO made a survey of healthcare trash management in some states in the area with significant reactions from Indonesia, Myanmar, Srilanka and Thailand. Results of the survey shown that most healthcare institutions do not have any squander-management strategy or process. In several nations, there is no regulation at all. There is also a lack of trash-administration guidelines. The replies on the types and isolation of wastes seem to specify only a incomplete safe administration of trashes with plenty of possibility for mix-ups and disposal into the community dustbins. In Indonesia and Thailand, where regulation is in place, did improve on most accounts. In November 1996, WHO set a regional discussion at Chiang Mai, Thailand, for drawing an act plan and for enacting regulation on waste administration.
- In UK, general policy on hospital squander administration is contained in the Department of the Environment (DoE) circular on trash controlling licensing (now 'environmental permitting'). This states; The Administration's policy is that: a subject to the best attainable environmental option (BPEO) in all case, waste administration should be based on a pyramid in which the order of inclination. In addition, the Government distributed a Waste administration policy for England in May 2000 setting out its processes for maintainable waste controlling. The Tactic recommends the hierarchy and sets goals for waste repossession. A reviewed approach for England was published on 24 May 2007 which underpins the principle of controller through the waste hierarchy, while strengthening many goals. The Health and Safety at Work etc. Act 1974 sets out common desires in relation to care at work. An important characteristic of the Act is that all personnel who are at job are given legal protection (Townend, 2007).

Table 4.1: Policies and acts for hospital waste management in England. (Townend, 2007)

Legal Frame graft	Objectives	Year
The Health and Safety at Work etc. Act	Hazardous substances management	1974
The Control of Pollution (Amendment) Act	Transportation of waste	1989
The Environmental Protection Act	The responsibility of care for trashes and hazardous rubbishes	1990

- Government of Canada has established many policies, laws and act to confirm the maximum safe, well-organized and inexpensive ecological administration of all sorts of leftover. To pay to the conservation of ordinary capitals and the decrease of contamination over solid leftover reduction programs, electronic and electrical apparatus (EEE) trash reuse creativities, and active and environmental hazardous leftover administration rehearses and to stop the release of insistent perilous trashes into the atmosphere by decreasing the amount of dangerous ingredients that CSC establishments use and by storing them in a safe way. Confirm that the risky leftover produced by CSC actions obeys with the requirements of appropriate federal, provincial and community principles.

Table 4.2: Policies and acts for hospital waste management in Canada. (Townend, 2007)

Name of the Act	Year
Canadian Ecological Protection Act,	1999
PCB Policies,	2008
Federal Halocarbon Policies,	2003
National Building Code of Canada	1985
Transportation of Dangerous Goods Act,	1992

4.2 Policies and laws for hospital waste management in Bangladesh:

Hard work for development in managing MW has started in the Bangladesh since the beginning of 2005. Numerous development actions have been take on MOHFW and correlated other Ministries/Association/Agencies for appropriate MWM in the nation, although many extra efforts are essential for carrying out of country-wide MWM. Management (through Section of Environment) has confirmed Therapeutic Waste (administration and treating) Rule by November, 2008, which aids as the key existing complete code to be monitored by all alarmed agencies for correct discarding of MW and thus protection the atmosphere. Onward efforts to monitor the program have to be started for confirming standard MWM in the nation. Officials of 34 regions and 108 upazila received teaching as trainers to orientate MWM to other Health labors in 2009. Some of the health care services including both public and private (maximum of them in Dhaka, with some growth in Khulna and Jessore) follow the SOP for proper MWM, protecting the atmosphere. Some NGOs (mainly PRISM, Bangladesh) have established proficiency for conveying training and for last transportation and disposal (with support from MOHFW and DCC) of MW. In emergency obstructive Care (EOC) facility of MCWC locally prepared incinerators are used for scorching of MW. In spite of all the beyond expansion efforts a main portion of HFC dump the non-segregated solid MW into the wayside City Corporation/Pourashav

garbage can, fluid MW in the drainage system/water bodies, which lead to pollution o (MINISTRY OF HEALTH AND FAMILY WELFARE, 2011).

Table 4.3: Policies and laws available in Bangladesh. (WHO, 2017)

Name of the Act	Year
Medical Waste Management and Processing Rules	2008
National Guideline for Medical Waste Management	2016
National Environmental Policy	1992
The Environment Conservation Act 1995	1995
Environment Conservation Rules	1997
Environment Court Act	2000
The Private Hospitals and Laboratories	1982
Private Hospital, Clinics and Diagnostic Centers Administration Rules	2016

5. Incinerator hindered environmental condition (Dioxin & Mercury emission):

Most medicinal squander is burned, a training that is brief due to natural contemplation's. The consuming of strong and managed restorative waste produced by healthcare makes numerous issues. Medicinal waste incinerators emanate harmful air poisons and dangerous fiery remains deposits that are the real wellspring of dioxins and mercury in the earth. Therapeutic waste has been recognized by US Environmental Agency as the third biggest known wellspring of dioxin air emanation and benefactor of around 10% of mercury outflows to nature from human exercises (Prüss, Giroult & Rushbrook, 1999).

Figure 5.1: Incinerator Emission. (Prüss, Giroult & Rushbrook, 1999)

5.1 Impact of Dioxin

Dioxins are a gathering of organic concoction exacerbates that are comparative in structure and are poisonous to people. As per the U.S. Ecological Protection Agency (EPA), dioxins can be arranged into three related classifications: Chlorinated dibenzo-p-dioxins, or CDDs, Chlorinated dibenzofurans, or CDFs, Some Polychlorinated biphenyls, or PCBs. The dioxin exacerbate that is viewed as most harmful of all is tetrachlorodibenzo-p-dioxin, or TCDD, which is the one that was discharged in the Seveso calamity. TCDD is a cancer-causing agent, or disease causing substance. Dioxins have been connected to malignancy, invulnerable framework disorders, diabetes, birth absconds and disturbed sexual development. When dioxins enter the body, they keep going quite a while in light of their biochemical steadiness and their ability to be consumed by heavy tissue, they are then put away in the physique. Their half-life in the body is evaluated to be seven to eleven years. In the earth, dioxins have a tendency to aggregate in the natural foodstuff order. The advanced a creature is in the natural pecking order, the advanced the centralization of dioxins (WHO, 2016). Here and now introduction of people to abnormal amounts of dioxins may bring about skin sores, for example, chloracne and sketchy obscuring of the skin, and modified liver capacity. Long haul exposure is connected to disability of the immune system, the creating nervous system, the endocrine framework and reproductive capacities. Constant exposure of human being to dioxins has brought about a few sorts of tumor. TCDD was assessed by the WHO's International Agency for Research on Cancer (IARC) in 1997 and 2012. In light of animal data and on human the study of disease transmission information, TCDD was grouped by IARC as a "known human cancer-causing agent". In any case, TCDD does not influence hereditary material and there is a level of introduction underneath which cancer hazard would be negligible. The embryo is most touchy to dioxin introduction. Infant, with quickly developing organ frameworks, may likewise be more defenseless against specific impacts. A few people or gatherings of individuals might be presented to larger amounts of dioxins in view of their eating routine, (for example, high purchasers of fish in specific parts of the world) or their occupation (WHO, 2016).

5.2 Impact of Mercury:

Mercury is a standout amongst the most harmful toxins existing in man's biological community. It is brought into this system, as most different poisons, also by normal as by anthropogenic forms. Characteristic mercury sources begin essentially from volcanic emissions and volatilization from water, soils, vegetation. Anthropogenic discharges result primarily from the ace duction of metals and from incineration (coal, municipal squander, sewage slime and wood). The rate of discharge is assessed to be in the scope of 630-6,800 t for every year. The normal of the latest estimations is roughly 4,500 t for each year. The aggregate arrival of mercury from normal and manmade sources into the biosphere, involving the environment, surface waters and soil, is in this manner in the request of 10,000 t for every year (Velzen, Langenkamp & Herb, 2002).. Amid burning mercury passes for all intents and purposes for 100% in the fuel gas. Once in the earth, mercury can be changed by microorganisms into methylmercury. Methylmercury at that point bioaccumulates (bioaccumulation happens when a living being contains higher groupings of the substance than do the environment) in fish and shellfish. Methylmercury additionally biomagnifies. For instance, expansive savage fish will probably have abnormal amounts of mercury because of eating numerous littler fish that have obtained mercury through ingestion of microscopic fish. Individuals might be presented to mercury in any of its structures under various conditions. Be that as it may, presentation mostly happens through utilization of fish and shellfish defiled with methylmercury and through specialist inward breath of basic mercury vapors amid mechanical procedures. Cooking does not wipe out mercury. Basic and methylmercury are lethal to the focal and fringe sensory systems. The inward breath of mercury vapor can create destructive consequences for the apprehensive, stomach related and immune system, lungs and kidneys, and might be deadly. The inorganic salts of mercury are destructive to the skin, eyes and gastrointestinal tract, and may initiate kidney danger if ingested. Neurological and conduct issue might be seen after inward breath, ingestion or dermal presentation of various mercury mixes. Side effects incorporate tremors, sleep deprivation, memory misfortune, neuromuscular impacts, migraines and psychological and motor dysfunction. Gentle, subclinical indications of focal sensory system danger can be

found in laborers presented to a basic mercury level in the quality of 20 μg/m3 or more for quite a while. Kidney impacts have been accounted for, running from expanded protein in the urine to kidney failure (WHO, 2017).

5.3 Developed countries strategy for monitoring incinerator emission:

Incinerator is controlled consuming at temperatures commonly more than 850^{o}C within the sight of air to guarantee the demolition of pathogens (e.g. fungi, bacteria and infections) and risky contamination's (e.g. unstable organics). It is a compelling innovation generally utilized as a part of waste treatment which can lessen the volume of metropolitan strong waste (MSW) and medical center waste. Developed nations like Canada, japan and UK utilize modern incinerator requires legitimate process control and contamination decrease and gas cleaning frameworks with a specific end goal to keep away from the discharge of poisons, for example, corrosive gases, oxides of nitrogen, dioxins, substantial metals and mercury. Advanced incinerators receive propelled process control measures to advance the ignition procedure. Such measures incorporate long habitation time and high turbulence to guarantee finish ignition of MW to destroy every single natural toxin and keep the creation of new poisons. Modern day incinerators are additionally introduced with advanced gas cleaning and contamination decrease gear (e.g. texture channels, scrubbers and actuated carbon powder infusion framework) which can viably control the arrival of poisons and meet the most stringent discharge guidelines embraced universally.

Dioxins are produced by all ignition sources, both man-made and normal. They are profoundly harmful and must be appropriately controlled to limit the outflows. The fuel gas coming about because of the burning procedure is raised to a temperature of 850^{o}C for no less than 2 seconds in the ignition chamber with the goal that the dioxins created from the cremation of MW will be finished annihilated. Notwithstanding, dioxins may change in the energy recuperation system in follow amount when the temperature drops to the scope of 400^{o}C to 200^{o}C. To limit this dioxin reconstruction, the fuel gas is chilled off rapidly to underneath 200^{o}C. Heater tubes are additionally cleaned frequently to keep the development of fly cinder which can fill in as an impetus for dioxin transformation. Dioxins, if changed in

the energy recuperation framework, are adsorbed onto a powdered activated carbon (PAC) infusion framework which works in parallel with the alert cautioning framework to catch any dioxins transformed. The utilized PAC is then joined with the fly ash remains for adjustment before transfer at landfill.

Mercury exists in the trash stream in little sum and is volatilized inside the ignition chamber. While other volatilized substantial metals gather onto the fly fiery remains particles, mercury remains in the vaporous state. Mercury is consumed by the PAC, and the utilized PAC is gathered with the fly fiery remains for adjustment before transfer at the landfill.

Figure 5.2: Modern Incinerator Plant. (Protea, 2000)

5.4 Dhaka City Monitoring Strategy for incinerator emission:

Observing of incinerator discharges is a requesting application for Continuous Emission Monitoring Systems. Incinerator discharges are very destructive, a portion of the gases is solvent and, in light of the fact that the waste being burned continually, the subsequent stack gas temperature fluctuates broadly. There are no laws and directions to screen incinerator discharge in Bangladesh which is hampering natural arrangement of Dhaka city day by day. A NGO name PRISM began taking a shot at it alongside DCC. What's more, as of late they are managing modern incinerator which will fairly limit the incinerator outflow. There are a

few kinds of Incinerators and Thermal Oxidizers as of now utilized as a part of Dhaka city (Protea, 2000), the list of company serving incinerator in Bangladesh is given underneath;

- **Santes Incinerator:** SANTES has been specific on cremation innovation since 1990 and has Bureau Veritas Certified ISO 9001:2008 quality administration framework. SANTES expects to fabricate the most productive and possible incinerators while keeping up the natural quality and manageability.
- **Dutch Incinerators BV:** Dutch Incinerators BV is a Western Europe based organization giving turn-enter arrangements in warm waste preparing, squander to-vitality arrangements and related waste taking care of framework. Fundamental focal point of Dutch Incinerators BV is to give rotational oven incinerators to the treatment of perilous (substance) and restorative squanders with different waste-to-vitality alternatives.
- **Atlas Incinerators A/S:** The ATLAS Incinerators product offering has been available since 1974 and in excess of 9000 units have been introduced worldwide inside the Marine and Offshore Industry, and for Land Applications, for example, Power Plants, Hospitals, Airports, and as Transportable Containerized Incinerators for different purposes.
- **Haat Incinerators India Private Limited:** HAAT offers Consultancy and Engineering Services in the above fields sponsored by more than 40 long periods of experience. The key concentration territory of the organization has been the idea of a clean environment. The creation hardware accessible incorporate CO2 self-loader welding machines, bend welding transformers and rectifiers, profile cutting machines, TIG welding, unmanageable blender, moving machine, air plasma cutting machine, water powered shear, material taking care of gear, diesel generator, coarseness impacting and painting (Expert Environment, 2017).

6. Poverty Lead to improper disposal of hospital waste:

The growth of the healthcare sector in developing countries such as Bangladesh is very rapid, resulting in massive rise in the amount of medical trash produced especially by medicals, clinics and other healthcare establishments. On an average medical waste produced by a developing country ranges from .5 to 2.5 kg per bed per day; although the amount may vary due to various factors. The increasing quantity of medical wastes is having a negative influence on both community health and the atmosphere. This is mainly due to improper disposal methods, lack in physical resources and inadequate research on medical excess management. The predominant method of disposing medical excess in Bangladesh is land filling (Zafar, 2018).

Figure 6.1:Inappropriate Clinical waste Disposal. (Zafar, 2018)

Through several studies conducted in Bangladesh, lack of financial investment in the overall condition of the health sector seemed to be a key factor behind poor waste management. It is evident that there is absence of mutually understanding and attention in harmless leftover disposal by most health labors. Staffs are not receiving proper training, although they do receive exercise on test center analysis, it is completed in an ad hoc method. Therapeutic officers however are usually conscious that medical leftover could create a problem, but most assumed the situation was being handled satisfactorily. On the other hand, Harbors, laboratory specialists, and aya's (maids') had no preparation (formal or non-formal) on how

to handle or dispose waste. Moreover, many hospitals cannot afford to appoint supervision of clinic sanitary labors and scavengers who operate without any vaccination. Untreated and contaminated waste is unlawfully reused, leading to further wellbeing hazards. Overall, due to lack of financial support, medical waste management in developing countries is not efficient and faces numerous experiments. Proper trash administration practices can play a vital role in decreasing the injurious effects of hospital trashes (Ali, Chaudhry, wang & Geng, 2017).

Dr. Salim Rashid (1996) and his apprentices from North South University directed a survey to study Therapeutic Waste Disposal in Dhaka City. The outcomes of the survey were shocking, government clinics were found to dump all their trashes in open bins, which are reachable to the common community. The trashes were left in the open until a municipal lorry would eliminate them after two or three days. Sale of therapeutic rubbishes was found to be a basis of earnings for hospital authority, tokai (waste picker) and even cleaners. Therapeutic trashes, such as used syringes saline stacks, x-ray liquid, slides, empty boxes and jugs were collected and were re-sold for twenty Tk/kg at maximum medical and clinics visited. The prime source of earnings for the majority of the urban underprivileged depends on the sale of such wastes.

The trashes pickers (scavengers) sort over leftover at site, usually exposed dumps, and sell anything that can be reused to agents of organization. In a poverty stricken country like Bangladesh, it is not feasible to provide neither training nor safety clothing or equipment to the waste pickers. They are forced to rummage through wastes which may potentially get them seriously injured or sick with no special protection. In many cases there is no proper disposal of expired drugs. Poverty also leads to the children working as scavengers to attempt to resell expired drugs from waste piles this may effect in expired medicines being redirected to local pharmacies for resale and misapplication. The adverse side effects of expired medicine can range from mild allergies to even being fatal.

For a developing country like Bangladesh, where stray animals are not monitored; wastes attract scavenging animals and bats. Fermentation of wastes attract and provide favorable

conditions for fly feeding that may contaminates both water and air. Local animals that are free to graze in open landfills can act as vectors and there is an extremely elevated risk of restoring infectious microorganisms into the nutrition chain. Wastes from any health care establishments are highly capable of introducing disease to the public either over direct interaction or indirectly by infectivity of mud, liquid and air. There is also a possibility of spread of pathogens through windblown dusts from these open landfills or dumps (Akter, 2000).

Healthcare trashes therefore pose a danger to persons, publics, and the atmosphere if not sensibly handled (Akter, 1998) specially in a third world country like Bangladesh were most of the population is below a financial margin.

7. Recommendations:

The present rehearses of hospital leftover administration in Dhaka city was watched and some tricky areas were identified. In light of these researches, it can be seen that there is possible to enhance the clinical excess administration in the community. To conquer these problems, a few references are displayed for various parts of medicinal excess administration.

- **Generations**

✓ A medicinal squander control administration system ought to be executed to lessen the measure of restorative waste produced by medicals (Mohee, 2005).

✓ Separately from the heaviness, the sorts, bases, and the qualities of restorative leftover produced ought to be observed in light of the data system.

✓ There is a essential to deal with the life-cycle of each sort of drug in clinics, which comprises of buying, utilizing, gathering, isolation, transport and final transmission.

- **Segregation and collection**

✓ Correct exercise ought to be given to everybody engaged with the leftover administration procedure in regards to fitting isolation performs and the possible dangers related with inappropriate methodology, for example, dealing without defensive measures (Tsakona, 2007).

✓ A scheme of paint coding or category of waste vessels/bags agreeing to the necessities of the International standard should be castoff constantly.

- **Storing**

✓ Exacting regulator of short-term storing zones should be applied. Only therapeutic trash managers should be allowable to go in these zones.

✓ Appropriate sites of short-term storing spaces should be imposed, i.e., not here but in other serviceable zones, such as community trash storing regions

✓ There is a need to keep the storage zones clean.

✓ Decent class logistics vessels should be obtained.

- **Training and education**

✓ Exercise and teaching packages for all workers should be directed; teaching of fresh staff and cleaning labors should be accentuated.

✓ The efficiency of exercise and instruction platforms should be occasionally assessed.

- **Transference**

✓ An obvious online scheme should be applied to screen transport routing of therapeutic excess.

✓ Secure timetables for passage should be defined, thus decreasing the difficulty of therapeutic waste managing.

✓ Decent worth carriage vessels/wrapping for therapeutic leftover should be used.

- **Disposal**

✓ In request to make ecological benefits, it is important for Dhaka city to rebuild removal plant and the innovation of medicinal waste disposal. New elective disposal advances that are more environmentally friendly ought to be executed (Diaz, 2005). Professional training of workers should be strengthened, especially regarding how to deal with ash.

✓ Professional preparing of laborers ought to be reinforced, particularly in regards to how to manage ash.

✓ Ash and air contaminants produced from healthcare trash ignition, such as HCI, Cd and SO2 should be dignified.

✓ Some progressive administrators for restorative waste removal ought to be presented from different urban communities or abroad to make market rivalry of Dhaka.

✓ The monitoring scheme should be upgraded by fixing air contamination regulator structures.

- **Public awareness**

✓ The support and eagerness of the overall population and their acquaintance into therapeutic leftover ought to be upgraded by utilizing different methods, for example, propaganda sheets, the web and general public welfare ads.

✓ A restorative waste methodology in Dhaka ought to be assessed by investigating general society's attention to therapeutic waste administration.

- **Enforcement of medical waste management regulations**

✓ There must be obviously stipulated rules that apply to all people who create, gather, get, store, transport, treat, discard, or handle therapeutic waste in any shape and this will maintain occupational and general wellbeing.

✓ It will be the obligation of each generator of medicinal waste (which incorporates a healing facility, nursing home, center, dispensary, veterinary doctor's facility, animal house, pathological research facility, blood donation center) to find a way to guarantee that such waste is dealt with no antagonistic impact to specialists and the earth.

✓ Restorative waste will not be blended with different squanders, and will be isolated into very much well-labeled holders or packs at the purpose of generation preceding its stockpiling, transport, treatment and transfer. Aside from the labeled, travel holders containing medicinal waste will likewise bear data on the date of generation, the waste classification/class/depiction, the sender's/collector's name and address (telephone/fax numbers) and the contact individual if there should arise an occurrence of crisis. The name will likewise be set apart with images, for example, the all-inclusive biohazard or cytotoxic danger image, and cautioning signs, e.g. "handle with care" (US Federal Register, 1995).

✓ Untreated medicinal waste will be transported just in an unique vehicle possessed by a skilled specialist, as indicated by the legislature

✓ Every generator/occupier/administrator will present an answer to the recommended specialist consistently, to incorporate data about the classes and amounts of restorative

squanders took care of amid the previous year. The endorsed specialist will aggregate this data for future reference.

- **Environmentally preferable purchasing**

✓ Purchase items and services that are less harming to word related wellbeing and the earth.

✓ Five zones have been recognized as central focuses for EPP. They include: items containing mercury; items containing polyvinyl chloride (PVC); reprocessed and reusable items; green building items; and more secure items for laborers.

✓ Waste minimization practices can be actualized by buying items with lessened packaging and the obtainment of things that are promptly recyclable or potentially made of reused content are profoundly suggested.

- **Medical surveillance programs for health care workers**

✓ Medical reconnaissance programs must be intended to achieve the accompanying objectives: to exhibit that laborers are fit to play out their employments securely and dependably; to give continuous affirmation that entrance and hazard controls constrain specialist exposure; and to consent to word related wellbeing directions.

✓ A far reaching medicinal observation projects ought to be composed and actualized by an accomplished and qualified occupational health doctor or analyst with inputs gave by laborers, mechanical hygienist, and in addition wellbeing and security experts.

8. Conclusion:

Isolation of medicinal squanders is a growing natural issue in Bangladesh. Recently, the administration of medical trashes has gotten little consideration regardless of their potential ecological hazards and general wellbeing risks. The paper has endeavored to measure distinctive medicinal squanders produced from various HCE in the investigation region. The overviewed HCE created around 77.4% of non-hazardous squanders and around 22.6% of hazardous squanders. The average waste age rate for the overviewed HCE is 1.9 kg/bed/day. This paper demonstrates that all the HCE don't isolate their created squanders and they discard their local waste at the same site from typical municipal waste.

The generation of therapeutic waste in Dhaka has been expanding in amount and variety, because of the wide acknowledgment of single-utilize disposable things. In the ongoing past, therapeutic waste was regularly blended with family unit waste and discarded in civil strong waste landfills. Recently, expanded concerns over inappropriate transfer of medicinal waste have prompted a development to control the waste all the more deliberately. Efforts must be made for minimization and reusing of some therapeutic squanders prior to last transfer, if not infected or sullied. Advanced incineration could be utilized as a part of medicinal waste treatment until another basic treatment strategy and steam sanitization is accessible in not so distant future. In this manner, dangerous substances, for example, dioxin and mercury outflows at therapeutic waste incinerators ought to be nearly checked to lessen potential dangers to people and the surrounding atmosphere (Jang, Lee, Yoon & Kim, 2006).

Absence of awareness, proper arrangement and laws, and lack of care are in charge of inappropriate administration of medicinal waste in Dhaka City. The procedure of accumulation, isolation and transfer of health care waste isn't performed by suggested standards, and concerned individuals are presented to the risk of such squanders. Safe transfer of health care waste is fundamental and is dealt with in an exceptionally proficient manner in numerous nations. The modern medicinal waste administration framework presently serves a set number of HCE. Novel facilities should be developed in different portions of the city or the current facility should be prolonged.

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