EVALUATION OF HOSPITAL WASTE MANAGEMENT IN HOLY FAMILY HOSPITAL RAWALPINDI

Researcher

Sumaira Iqbal.

Reg #: 11/FBAS/MSES/F07

Supervisor

Dr. Rashid Karim.

Department of Environmental Sciences

Faculty of Basic & Applied Sciences

International Islamic University Islamabad

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DATA ENTERED

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Sumaira Iqbal
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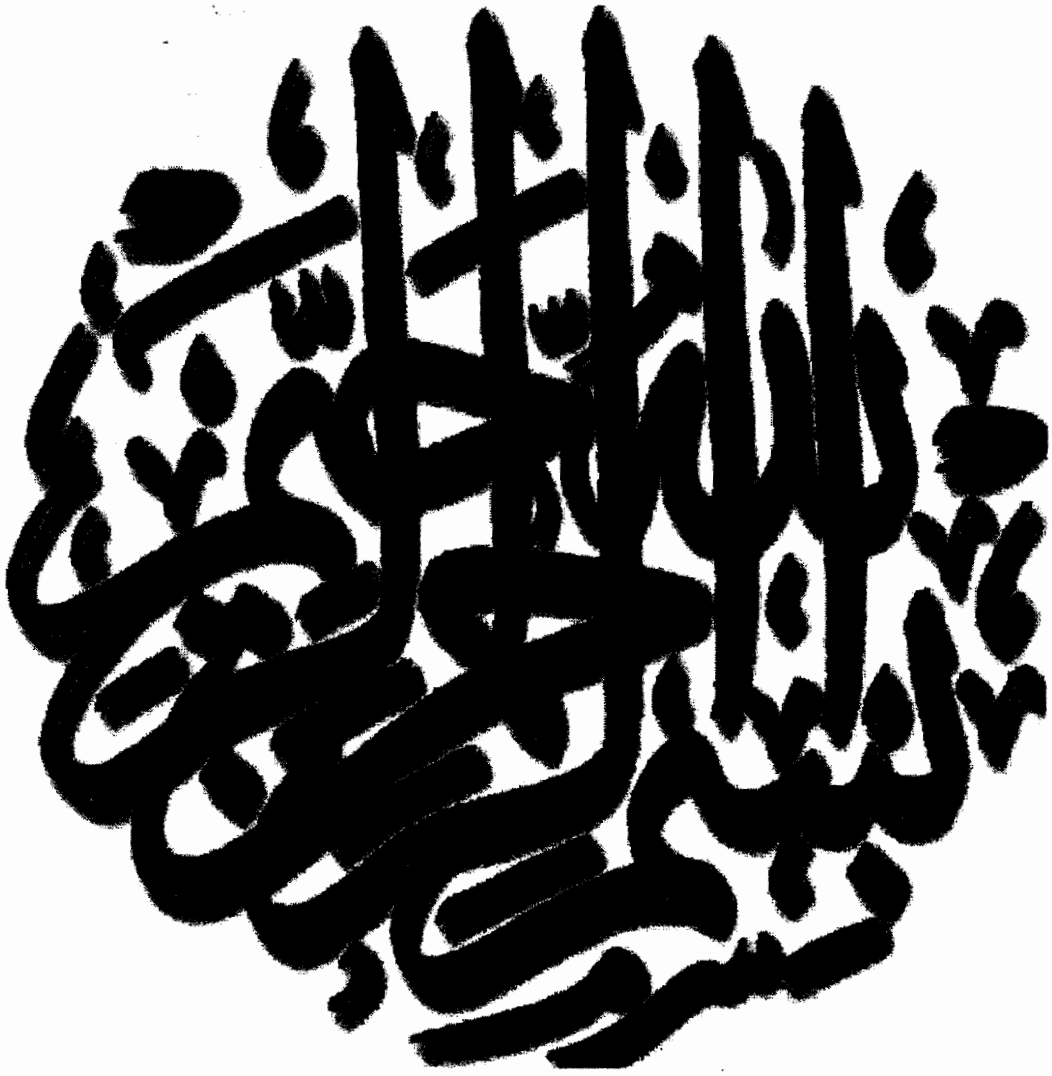
Submitted in partial fulfillment of the requirements for the Masters of Sciences in Environmental Sciences at the Department of Environmental Sciences, Faculty of Basic and Applied Sciences, International Islamic University Islamabad.

Supervisor: Dr. Rashid Karim. **Oct 30, 2009**

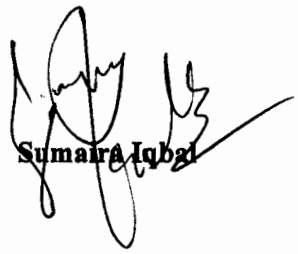


Verily, when He intends a thing, His Command is, "be", and it is!

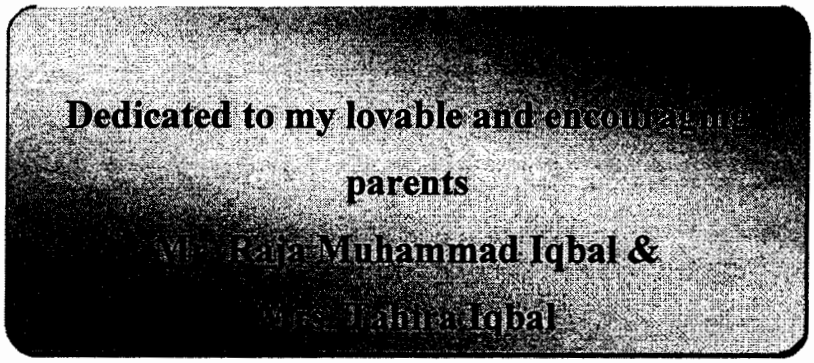
(Ya-Sin: 82)

DECLARATION

I hereby declare that the work presented in the following thesis is my own effort, except where otherwise acknowledged, and that the thesis is my own composition. No part of the thesis has been previously presented for any other degree.



Sumaira Iqbal


Dedicated to my lovable and encouraging
parents
Muhammad Iqbal &
Tahira Iqbal

Evaluation of Hospital Waste Management in Holy Family Hospital Islamabad

Name of Student: **Sumaira Iqbal**

Registration No.: **11-FBAS/MSES/F07**

Accepted by the Department of Environmental Sciences International Islamic University Islamabad, in partial fulfillment of the requirements for the MS in Environmental Science.

Viva Voce Committee

Chairman/Head

External Examiner

Supervisor

Member

(30th October, 2009)

ABSTRACT

Hospital waste management is an ongoing problem in Pakistan. Medical waste disposal has posed more difficulties with the appearance of medical waste in the garbage. The waste has bad effects on the environment by contaminating the land, air and water resources.

Hospital administration is not taking it as a serious matter. The waste produced by the medical care centers if disposed off improperly can pose greater threat then the original diseases themselves.

This report illustrates the condition and common practices of Holy Family Hospital Rawalpindi, regarding Hazardous waste management. Techniques and systems applied for segregation, storage, collection and disposal of waste generated in Holy Family Hospital are studied during this research.

It is observed that the management of health care wastes is not satisfactory in Holy Family Hospital. The general awareness of the health and environment risks resulting from poor health care waste management practices is limited at all levels of the management. A lack of knowledge about handling the waste, fate and effects of infectious and hazardous health care wastes by administrators, doctors, nurses, cleaners and waste handlers gives rise to serious problems in the city.

This report details the sources, generation rates, segregation approaches, storage arrangements, collection and disposal systems for health care waste management in Holy Family Hospital, Rawalpindi. Holy Family Hospital have incinerator for infectious waste but that have not proper emission control system and disposal of bottom ash.

A more organized approach to health care waste management is recommended and legislation as a mechanism for achieving common sustainable levels of service in Pakistan is also supported in the report. Proper planning with adequate resources should be allocated for improvement and condition of workers of health care waste management. Training of health care administrators, medical staff and workers is recommended as an important component for efficient Health care waste management.

ACKNOWLEDGMENTS

Words are bound and knowledge is limited to praise almighty ALLAH, the lord of the worlds, the Omnipotent, the Beneficent, the Merciful and the Gracious. My praise are for HAZRAT MUHAMMAD (S.A.W.W) from the deepest core of my heart, who is forever, a model of guidance and knowledge for the whole mankind, whose saying *Learn from Cradle to Grave*awakened the strong desire in myself to undertake this course of study right up to this menu script.

I am thankful to my parents who make it possible for me to earn higher Education and gave me the confidence to live strongly and face the hurdles of life wisely. My parents elder sister and brother guided me in all ups and downs of my life. They gave me their hands when I fall, cheered me when I was sad, and shared my laugh when I was happy. Thanks again to my parents, sister and brother for their enlightenment to my life.

I would like to thank advisor of this study Dr. Muhammad Irfan Khan for providing support and guidance in completing this thesis work for evaluation of Hospital waste management in Holy Family Hospital. The opportunity provided to me for this research was a great experience, which enhanced by exposure to waste management, and improved my writing skills. Due to affectionate help, constructive criticism, personal interest and analytical supervision of Dr. Rashid Karim and his keen interest, scholastic attitude, generous assistance and skillful guidance during this thesis writing, gave me confidence to do this research in depth.

I am grateful to whole staff of Holy Family Hospital and specially Dr Athar Tehsin, Chairman of Holy Family Hospital Rawalpindi and Dr. Nasir Mehmood, Medical Superintendent of the Hospital for their support. I am also thankful to sanitation workers and Maid who helped me during my visits to the Holy Family Hospital.

Sumaira Iqbal

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LIST OF ACRONYMS

HFH	Holy Family Hospital
CDA	Capital Development Authority
HWM	Hospital Waste Management
CSSD	Central Supply and Sterilization Department
CEHA	Central Environmental Health Activities, Jordan UN
WHO	World Health Organization
NEQS	National Environmental and Quality Standards
SOP's	Standard Operating Procedures
ICO	Infection Control Officer
ICN	Infection Control Nurse
Ayah	Maid of ward
CDA	Capital Development Authority
ISO	International Organization of Standardization
OT	Operation Theater
ICU	Intensive Care Unit
EPA	Environmental Protection Agency
EIA	Environmental Impact Assessment
GoP	Government of Pakistan
Paeds	Paediatrics Department
ER	Emergency Room
CCU	Coronary Care Unit
EHS	Environmental Health and Safety Department
ENT	Ear Nose and Throat Department

INTRODUCTION

"Hospital" includes a clinic, laboratory, dispensary, pharmacy, nursing home, health unit, maternity centre, blood bank, autopsy centre, mortuary, research institute, veterinary institutions, including any other facility involved in health care and biomedical activities as defined by HWM Rules, 2005 under 2 (1) (f).

"Waste Management" includes waste segregation, waste collection, waste transportation, waste storage, waste disposal and waste minimization and reuse as defined by HWM Rules, 2005 under 2 (1) (r).Therefore hospital waste management means the management of waste produced by hospitals using such techniques that will help to prevent diseases for spreading through it .(WWF-Pak, 2008)

The management of waste poses to be a major problem in most of the developing Countries, especially hospital waste. It is an ongoing problem for many poor countries. In recent years, medical waste disposal has posed even more difficulties with the appearance of disposal needles, syringes and other similar items. Pakistan is also facing this problem. It is estimated that round 250,000 tons of medical waste is annually produced from all sorts of health care facilities in the country. This type of waste has bad effect on the environment by contaminating the land, air and water resources. According to a report, 15 tonnes of waste is produced daily in Punjab. The rate of generation is 1.8 kilogram per day per bed. The province houses 250 hospitals with a total capacity of 41,000 beds.(WWF-Pak, 2008).

Holy Family Hospital Rawalpindi is one of the major hospitals in the province of Punjab. It is 850 bedded teaching hospital, and is attached to Rawalpindi Medical College. Hospital was started by the missionaries of Philadelphia at Murree Road, Rawalpindi and later shifted to the present premises in 1946.At the start it was 230 bedded hospital and later on bed strength was increased to 450 beds. In 1977 the hospital was taken over by the Punjab Health Department. A new teaching hospital PC-1 was made in 1986 and the bed strength was increased to 850 with the addition of many new departments. Now the building is fully taken over and a new teaching block of Rawalpindi Medical College has been added at the same premises.

Pakistan federal government made the rules for safe disposal of hospital waste called Hospital Waste Management Rules, 2005. The government advised all hospitals to follow Standard Operating Procedures (SOP's) to handle their waste safely.

The present study will focus on the analysis of the medical waste management practices in Holy Family Hospital Rawalpindi including medical waste policy, practice such as storage, collection methods, transportation and disposal methods etc and compliance with the standards prescribed under the regulatory framework and guidelines of WHO.

Based on current waste management practices the likelihood is that most of the diseases like typhoid, cholera, dysentery, infectious hepatitis and guinea worm may be connected with inappropriate contact with hospital waste .One of the study reveals that waste handlers involved in handling medical waste have 2.7 to 4 times more chance of getting infected by HIV compared to other staff working inside health care facilities and that's why they concluded that major issue is gross illiteracy of many waste handlers and their ignorance of risks . (Coker et. al., 2009)

In the light of all of the above, this study is taken and intended as case study at Holy Family Hospital, Rawalpindi, and evaluate the practices of medical waste disposal of the Hospital.

1.1 Aims and Objectives of the study

The specific objectives are to analyze the current situation of the hospital waste management at Holy Family Hospital Rawalpindi in order to identify the various issues and give suggestions for improvement.

The present study aims at avoiding human health suffering and environmental contamination, minimization of hospital waste and their proper disposal requirements. This study also aimed to analyze daily management issues, existing data and reuse and recycling practices.

This study aims to analyze the implementation of hospital waste management Rules 2005 and guidelines of WHO regarding safe Hospital waste management, causes of pollution, workers awareness, training and workplace safety, which are major aspects of this study.

This study will provide information on types and quantity of wastes, which are arising at each point of production, and methods of storage, handling, treatment and disposal.

1.2 Significance of the study

This study explains the present condition of hospital waste management in Holy Family Hospital Rawalpindi. Health-care waste management will discuss as a

significant problem in this study. The study will help to minimize the environmental burden resulting from the health-care institutions in Rawalpindi. Being aware of the significance of the subject, in this study the management of the health-care wastes, will analyze to create an integrated health-care waste management system in the city and regulations related to the procedures about the classification of the wastes, collection, transportation, and temporary storage of the wastes within the institutions and the transportation of waste to the final disposal area will also explain. With efforts to overcome the toxic waste's problem, side-by-side deficiencies, inconsistencies and improper applications will also reveal. This study will imply the principal remedial measures to ensure sound environmental protection.

It is expected that by the application and implementation of the research outcomes, the management of health-care wastes in hospitals and then in all over the city will be improved. At the end of the study it is intended to develop a health-care waste management plan. It is believed that it would be a basis of minimizing of risks to the health and well being of the people, as well as the environment. At the end of the study, the subjects undertaken within the scope of the research, the results obtained, and the points related to how health-care waste management should be conducted according to the HWM Rules 2005 and the best management methods for the healthcare institutions will be determined. The results obtained can also be used in other hospitals of country where there are similar environmental problems and strict budgets. (Alagoz, A.Z., 2008)

LITERATURE REVIEW

The following literatures were reviewed to identify past work that is used as references to resolve the issue of interest related to hospital waste management. The analysis of literatures reviewed was based on the information available through articles, Internet websites and books from past and ongoing work regarding hospital waste management.

The motive of this report is to provide information and recommendation for the best practice of hospital waste management, analyzing the environment policy to approach for pollution prevention. The actual data and methods used in writing this report is provided. In order to perform precisely, it's necessary to give greater emphasis to the background of the hospital waste management and their problems. It's an introduction to use the tools to make a contribution for the best waste management practice to avoid any degradation of the environment.

The literature used here for the purpose of this research that it is significant to examine and analyze the necessity of proper disposal of hospital waste for the betterment of environmental condition. All literature used in this research are appropriate to the subject concerned and were very helpful to complete the report.

The article "Medical waste management in Ibadan, Nigeria" by Coker A, Sangodoyan A, Sridhar M, Booth C, Hammond F and Olomolaiye P(2009) is major work on the hospital waste management, added to their research finding of hospital problems, collection of waste and disposal issues. Mr.Coker is associated with the Department of civil Engineering; University of Ibadan, Nigeria has long experience in this field.

Mr.Coker has explained in his article the disposal of hospital waste step by step and its solutions, he also mentioned all hazardous problems and ideas to control it that have not been investigated yet. The article summarizes the technical and regulatory issues associated with hospital waste management.

The article "Safer injections, fewer infections: injections safety in rural India" Kermode M, Holmes W, Langkham B, Thomson M and Giffard S (2005) discussed the unsafe injection practices, added to their research finding of structural, economic and socio-cultural factors. Mr. Kermode explained the injection safety by implementing the widespread use of disposable needles and syringes. He also discussed the difficult issues of safe healthcare waste management and recommended the ways to careful sharps waste disposal with the help of sterilization and

disinfections. At the end of study the article summarizes the factors contributing to unsafe sharp disposal practices.

The research article "Rules and management of biomedical waste at Vivekananda Polyclinic" by Gupta S, Boojh R, Mishra A and Chandra H (2009) explained the biomedical waste management in polyclinic including policy, practices for storage, collection, transportation and disposal. Mr.Saurabh is associated with the department of Geology, University of Lucknow, India. He also recommended training, education and commitment of the healthcare staff, management and healthcare managers within an effective policy and legislative framework for proper hazardous waste management.

The article "TQM approach to implementation of handling and management of hospital waste management in TATA main Hospital" by Das NK, Prasad S and Jayaram K (1998) is focused on proper disposal of hospital waste because of its infectious and hazardous characteristics and also provided specific steps to tackle the problem of hazardous waste disposal. Mr. Das mentioned some root causes of this problem and then discussed ways to overcome this problem by implementation of Total Quality Management concept.

RESEARCH METHODOLOGY

During the research, by a comprehensive survey on health-care waste generation sources and the types, current practices regarding health-care waste management in Holy Family Hospital Rawalpindi were reviewed and analyzed. During the field research, extensive documentation of the existing situation was envisaged. To check the reliability of the given information, site observations and interviews also included during the surveys. Interviews were adopted with the various employees in health care waste management to obtain actual, rather than theoretical information. To support and supplement the information gathered in the survey site visits were conducted and in obtaining information about the management of the biomedical waste interviews were helpful. From the records of the hospital, data on the quantities of waste generated by different wards were obtained.

Type of hospital; activities in the hospital (number of surgeries and births per month); number of visitors, doctors, nurses, sanitation, managerial and technical personnel; estimated quantity (kg/day) and type of solid waste generated; waste segregation, collection, labeling, transport and disposal practices; and hospital waste management policy and personnel involved during the surveys based on a detailed and relevant interviews that were used to collect available information for the analysis of the system.

All of the information regarding quantity of waste generation on daily basis has been obtained from databases designed by the administration of Holy Family Hospital Rawalpindi. Then personal interviews with the responsible authorities of the Holy Family Hospital Rawalpindi were conducted to obtain the data. (Sysr, J.M., 2008)

FINDINGS

4.1 Departments in Holy Family Hospital Rawalpindi

This study provides the sources of waste generation in Holy Family Hospital Rawalpindi and data for different floors of hospital, where different departments, wards and ancillary services are contained by each floor. Holy Family Hospital has 32 departments. All departments; as a source of waste generation along with their respective number of beds; are listed in the table 1 below

Table 1.1. Major Departments along with their respective number of beds

WARDS	NO. OF BEDS
Medicine unit-I&II	130
Surgical unit-I &II	120
Surgical OT	0
EYE ENT OT	0
Nephrology	28
ENT	35
EYE	32
CCU	18
Medical ICU	18
Surgical ICU	18
ER	45
Pathology	0
Burn Unit	6
New Private Block	29
Endoscopy	2
Labor Rooms-I&II	54
Gynae OT	0
Paeds ICU	9
Paeds NICU	32
Paeds Ward	24
Gynae Paeds ER	12
Neurosurgical ward no.131	26
Gynae ward no.132	23
Gynae ward no.136	19
Gynae ward no.137	37
Paeds ward no.231	34
Gynae ward no.232	36
Gynae ward no.236	34
Gynae ward no.237	29
TOTAL	**850**

4.2 Health care waste segregation and primary storage

Hospital staff in Holy Family Hospital, Rawalpindi is disciplined in the handling of health care wastes under strict monitoring of the infection control nurse in each ward. This leads to better segregation of different types of hospital waste. But on the whole the staff is unaware about the harmful effects of Health care wastes on their health as they only do their duties under the control and orders of infection control nurse. There are pots placed under patient's beds for the non-infectious waste and one sanitary employee has to collect that waste from each bed daily three times in a day, collect it on specific cart and transfer it to the provided CDA drum and in case if he finds any infectious waste then he has to segregate that from non-infectious waste and put that in to specific color coded containers although it's the duty of nurses, ward boys and maid to collect the infectious waste from each bed and then collect them in specific color-coded containers. In each ward two bins of different colors YELLOW and RED are present.

4.2.1 Yellow colored metal boxes

Sharps and other disposable plastic items collected in the yellow colored metal boxes, which are lined with plastic bags. The sanitary staff and sweepers immediately replaced the used bags and a container with new bags but some containers don't properly clean before new bags are fitted therein.

4.2.2 Red colored plastic buckets

Infected and soiled dressings and other infected items collected in red colored bins. These were lined by plastic bags, which were emptied regularly by the sanitary staff and dispose of to the waste drum. The yellow and red containers used in Holy Family Hospital has mentioned in plate 4.1 below

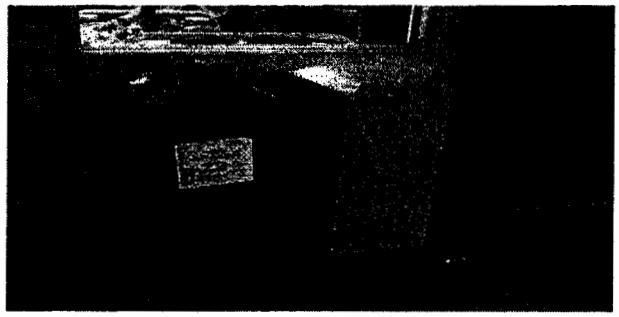

Plate 4.1: Red and Yellow bins use in Holy Family Hospital

During surveys syringe cutters were founded in each ward and it's the duty of nurses to cut the syringes properly on the spot. Syringe cutters uses by nurses for syringe cutting mentioned in plate 4.2 below

Plate 4.2: Syringe cutter uses in HFH for syringe cutting

Toxic instruments, clothes and bed sheets transfer to CSSD (Central Supply and Sterilization Department) every morning and sterilized during 8AM to 2PM so that those all sterilized instruments, apparels and bed sheets can be reused. The sterilization machine has mentioned in plate 4.3 below

Plate 4.3: Machine uses in HFH for sterilization

4.2.3 Shredder

Initially the waste collecting metal boxes were taken to secure rooms where shredder was installed and used syringes and other plastic disposable items were shredded into

small pieces. But they have stopped to use this process and now the syringes, plastic bags and drips are incinerated at hospital incinerator, while glass bottles are segregated and sent to the recyclers. After incineration now Holy Family Hospital Rawalpindi is trying to follow the guidelines of CEHA, i-e Firstly dip the wasted syringes, drips etc in to the bleach for one hour to disinfect them and then shred to send them for recycling. In this way CEHA wants to promote recycling in Pakistan and in all developing countries. The shredder uses by Holy Family Hospital Rawalpindi has mentioned in plate 4.4 below

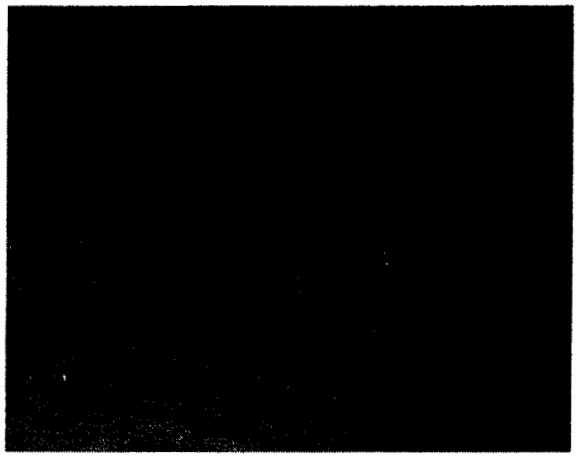

Plate 4.4: Shredder uses in Holy Family Hospital for shredding

The segregated waste is collected by two sanitation workers three times daily at morning, evening and at night from different wards .The collected waste then transfer to the storage site, which is adjacent to incinerator's room until, incinerated.

4.3 Primary collection of health care wastes

Sanitary workers of Holy Family Hospital collect the wastes stored in primary containers placed in each ward three times during each day, by the hand cart collected wastes are transported to the central storage area inside the vicinity of the hospital building. The report identified red and yellow containers, syringe cutters, shredder and incinerator in the hospital but side by side some deficiencies were also observed as waste's storage time is more than enough at central storage room, leakage from the primary storage containers in dialysis ward are regularly found, ashes from incinerator are not properly disposed of. At the Holy Family Hospital waste was incinerated, which was not properly burned, as small glass bottles and plastic syringes were found unburned in incinerator ash, which are highly risky to the workers and to the

neighborhood public as the incinerator ash is dumped in the backyard of the hospital, which requires serious attention of the hospital administration.

From sanitary staff of Holy Family Hospital Rawalpindi two sanitary workers collect the non-toxic waste from each ward, and then the waste is transported to the CDA drum for disposal. Ward nurses are responsible for collection of toxic waste from their wards, the toxic waste then transported to the cold central storage room by the sanitary workers with the help of trolley carts to an on-site incinerator. The trolleys have capacity to carry 10 to 15 bags at a time. The trolley uses by Holy Family Hospital Rawalpindi are mentioned in plate 4.5 and plate 4.6 below

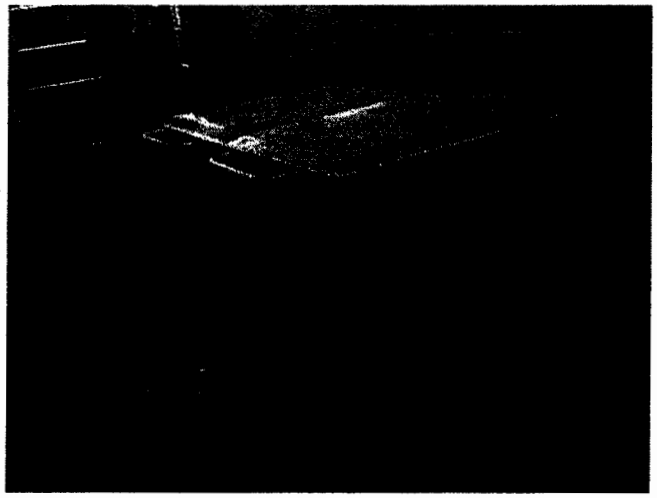

Plate 4.5: Waste transportation trolley uses by HFH

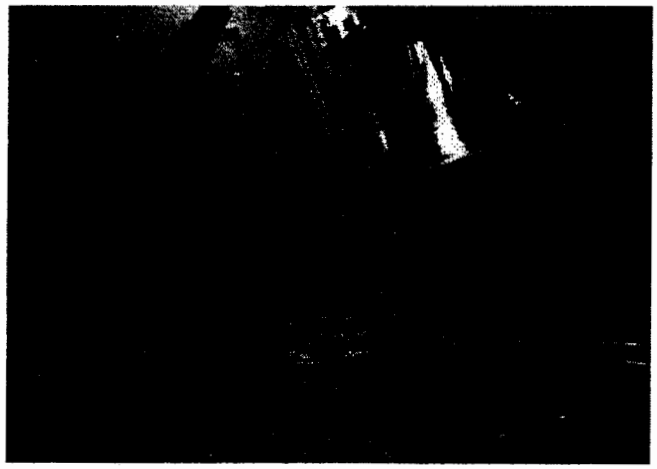

Plate 4.6: Trolley having capacity of 10-15 waste bags

The central storage room is designed for waste storage capacity for 1 to 2 days. Different companies used to receive placentas from Holy Family Hospital to separate

"Oxitosin" for medicinal requirements but now placentas are incinerated by Holy Family Hospital themselves.

4.4 Secondary storage of hospital wastes

Holy Family Hospital has a central storage area inside the hospital where waste is stored for 1 to 2 days before disposal. The waste storage room is fully air-conditioned. The room is leak proof and secured to avoid any outsider to enter the storage room. There are five trolleys for collection of wastes from each ward of Holy Family Hospital, and three are working and other two are placed in central storage room for any emergency. Two trucks of Holy Family Hospital collects waste from other hospitals and stored the waste in central storage room before they are incinerated. The central storage room of Holy Family Hospital is mentioned in plate 4.7 below

Plate 4.7: Central Storage Room of Holy Family Hospital for waste storage

For the non-toxic wastes CDA drum is provided by Capital Development authority and after every two days filled drum is replaced by empty drum. According to Holy Family Hospital they have secured management to protect scavengers to pick up recyclable waste from the drum. During visits there were some scavengers found on CDA drum who jumped the closed gate of Holy Family Hospital for collection of syringes and drips from the CDA drum. The municipality drum in the vicinity of HFH is mentioned in fig 4.8 below:

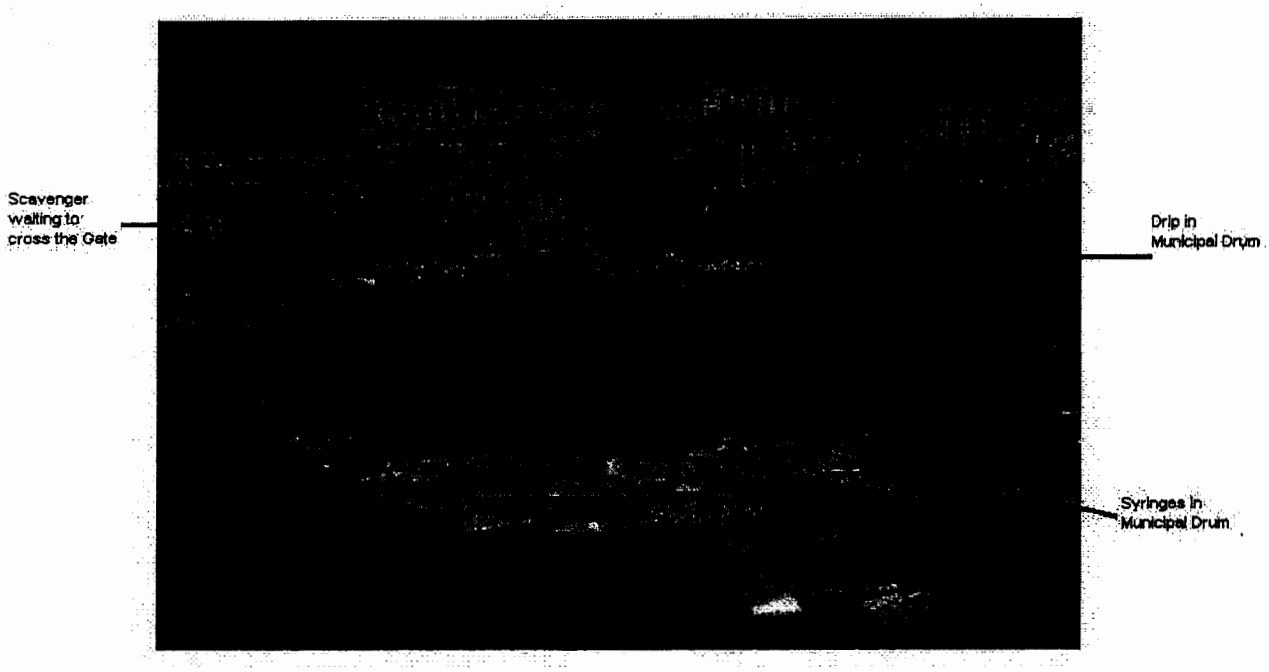

Plate 4.8: Municipality container in the vicinity of HFH

It was observed that incinerator of Holy Family Hospital is not burning all the materials properly. In fact general waste is contaminated due to poor waste segregation practices, Storage of hospital waste on-site is a well managed but leaking bag being common, that's why the storage area is hazardous, particularly to workers handling the wastes, and few precautions like against health risks personal protective equipments are taken to protect them.

Holy Family Hospital giving little attention and importance to waste management rules and WHO guidelines but still there is a requirement to pursue all those HWM Rules 2005 by HFH, which do not implemented by them.

4.5 Collection of wastes from Holy Family Hospital

General waste is collected by municipal solid waste services, which have provided one drum to Holy Family Hospital, and after two days municipal services replace filled waste drum by empty drum. One truck is provided by Municipal services to bring empty waste drum and receive filled waste drum. And in handling the non-toxic wastes no special precautions are taken by the municipal workers as some toxic objects were found in municipal drum during visits of Holy Family Hospital. Holy Family Hospital provided two trucks for collection of infectious wastes from other hospitals but the waste received from other hospitals is poorly segregated and the

worker of Holy Family Hospital spent most of the time to segregate the glass bottles and cans before incineration.

4.5.1 On-Site Burial

Holy Family Hospital did not use on-site burial as a disposal method but body parts and dead bodies of immature babies are given to the patient's relatives to bury. Holy Family Hospital dumps its incinerator ash at Hospital adjacent ground which is highly risky.

4.5.2 Incineration

Holy Family Hospital uses incinerator for disposal of infectious wastes. However, it reduces the quantity of hazardous, infectious waste and a safe method for disposal.

In Hoy Family Hospital Rawalpindi hazardous and infectious wastes, are incinerated on site in efficient incinerator named as INCINCO having burning range 850°C and having capacity 120 kg. This incinerator is properly designed for the disposal of clinical wastes and is operated by trained operators. Training was given to the operators by the company, which installed the incinerator at Holy Family Hospital. The supplier of incinerator has a contract with Holy Family Hospital to train their operators and maintain the incinerator efficiently. Holy Family Hospital Rawalpindi made their own SOP'S as action plan for waste management but they are still unable to follow all guidelines of WHO and HWM Rules 2005 which have been discussed in chapter of discussion.

Some other hospitals including PIMS, Bilal Hospital, District Head Quarter Hospital and the NGO named Nai Zindagi transport their waste to Holy Family Hospital for final disposal through Holy Family Hospital incinerator. Trained operators of Holy Family Hospital operate incinerator regularly and efficiently.

4.5.3 Ash disposal

After incineration another employ collects ash from incinerator and dumps on the adjacent ground of incinerator. During observation unburned small glass bottles, plastic drips and syringes were found in ash. The ash with unburned health care wastes was dumped haphazardly in hospital premises. The hospital waste management team does not take any special precautions in dumping ash and wastes. The collected ash in one wheeled trolley with unburned glass bottles is mentioned in plate 4.9 below:

Plate 4.9: One wheeled trolley with unburned glass bottles in ash

Holy Family Hospital's nursing school is adjacent to the Hospital waste dumping site and the hospital incinerator, which can cause harmful effects on student's health due to air pollution and ground contamination. The nursing school and ash disposal site is mentioned in plate 4.9 and 4.10 below:

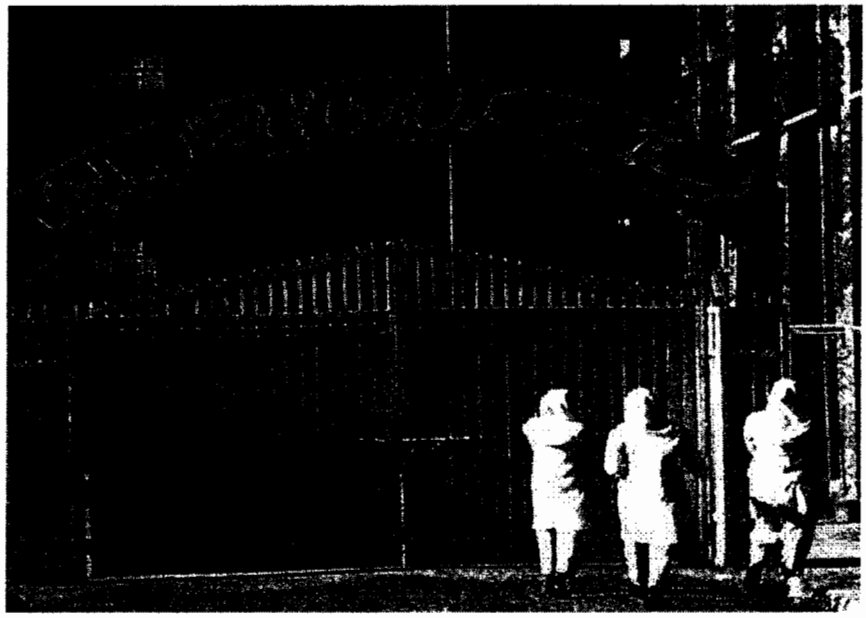

Plate 4.10: Nursing school at HFH

Plate 4.11: Ash dumping site adjacent to the wall of Incinerator's building

4.6 Attitude of health care workers

Regarding the protection of health and pollution the awareness among the staff of Holy Family Hospital was found missing. The common perception is that "Nobody is taking care for themselves so there is no danger if I am doing the same". As a protective measure the collectors and operators wear protective gears, such as shoes, mask and hand gloves. The sanitation staff working in hospital was given specific injections by the Holy Family Hospital for prevention from Hepatitis, AIDS, tuberculosis, malaria etc.

To improve the working conditions of the employees Holy Family Hospital is trying to create awareness among the staff/workers. Some EHS workshops are offered to the staff of Holy Family Hospital, organized with the help of World Health Organization (WHO) to make them aware regarding Environmental Health and Safety management. The sanitation staff has the awareness of segregating the hazardous, toxic and infectious waste from the general waste and few of them are aware about the effects of hazardous waste on human health. Other doesn't know well about the reasons of segregation and careful disposal of infectious wastes. Doctors are also unaware about significance of handling health care waste properly.

DATA ANALYSIS and RESULTS

5.1 Waste generation in each ward

The amount of waste generated is also given as mean values. The mean values calculated by statistical analysis with the help of ANOVA for critical analysis of generated waste among different wards of HFH over six months. It also helps in performing T-tests which have been used for the critical analysis of rate of waste generation month wise and wards wise. Calculated mean values are mentioned in table 5.1 below

Table 5.1: Calculated mean values of waste generation ward wise over six months

	October	November	April	May	July	August
WARD NO131	0.173913	0.176087	0.111801	0.086957	0.130435	0.149068
WARD NO132	0.088095	0.114286	0.071429	0.142857	0.109524	0.129252
WARD NO136	0.094444	0.102778	0.111111	0.069444	0.111111	0.142857
WARD NO137	0.090625	0.107813	0.075893	0.078125	0.082812	0.071429
WARD NO231	0.041379	0.051724	0.049261	0.086207	0.068966	0.096059
WARD NO232	0.036667	0.046667	0.057143	0.041667	0.076667	0.069048
WARD NO236	0.055	0.041667	0.071429	0.041667	0.083333	0.064286
WARD NO237	0.072414	0.065517	0.05665	0.12069	0.07931	0.086207
Burn Unit	1.45	1.475	1.28571	1.5	1.2	1.57143
CCU	0.283333	0.291667	0.345238	0.25	0.325	0.404762
Endoscopy	0.125	0.325	0.89286	1.25	1.4	0.89286
ENT & EYE	0.021429	0.023214	0.096939	0.071429	0.089286	0.071429
ER	0.144444	0.12	0.114286	0.122222	0.113333	0.209524
EYE &TNY	0	0	0	0	0	0
Gynae O	0	0	0	0	0	0
Gynae Paeds ER	0.279167	0.3375	0.404762	0.375	0.391667	0.404762
Labor Room I	0.219444	0.2	0.222222	0.305556	0.261111	0.309524
Labor Room II	0.195833	0.1625	0.172619	0.166667	0.2125	0.220238
Medical ICU	0.333333	0.345833	0.464286	0.291667	0.441667	0.535714
Surgical ICU	0.333333	0.266667	0.392857	0.291667	0.358333	0.464286
Medical unitI	0.128846	0.123077	0.10989	0.105769	0.105769	0.107143
Medical unitII	0.118519	0.127778	0.092593	0.074074	0.074074	0.10582
Nephrology	1.195	1.1975	0.47143	0.3	0.34	0.52143
New Private Block	0.054167	0.04375	0.071429	0.020833	0.091667	0.047619
Paeds ICU	0.361111	0.322222	0.444444	0.611111	0.294444	0.492063
Paeds NICU	0.174	0.17	0.16	0.22	0.162	0.188571
Paeds Ward	0.14375	0.15	0.130952	0.125	0.183333	0.178571
Pathology	0	0	0	0	0	0
Surgical OT	0	0	0	0	0	0
Surgical Unit I	0.075	0.07037	0.074074	0.083334	0.087037	0.116402
Surgical Unit II	0.074074	0.072222	0.087302	0.064815	0.077778	0.10582
TOTAL	6.362319	6.530839	6.638609	6.896757	6.951156	7.756173

Calculated mean values for total generated waste in six months (as mentioned in the table 5.1) are; the maximum level of waste generation is in August 2009 and minimum level is in October 2008. There's no specific reason for this difference in waste generation among these six months but according to one of the doctors the only possible reason may be that rate of diseases among people is more in summer as relative to winter. That's why number of patients increase in each ward during observed months. The difference is clearly found in August and October as mentioned in fig 5.1 below

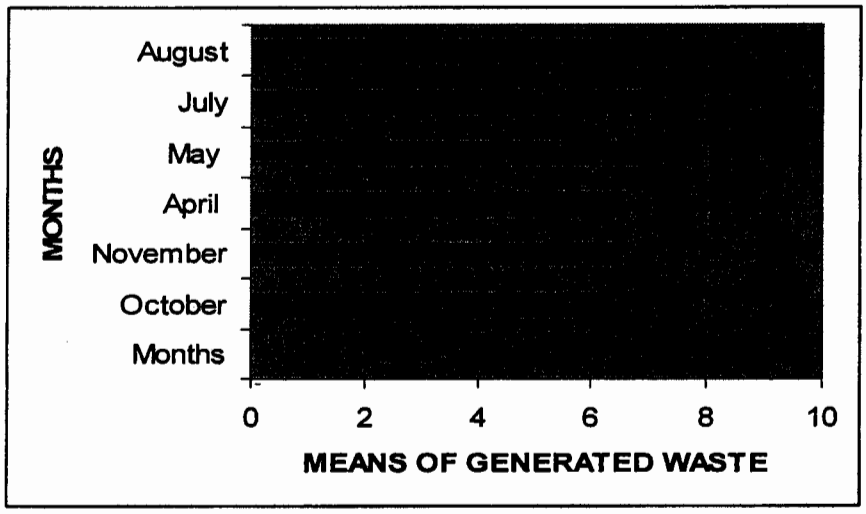

Fig 5.1: Month wise calculated Mean of generated toxic waste

5.2 PIE Chart representation of calculated mean values

The calculated mean values which have been mentioned in table 5.1 also help to represent data in the form of pie charts in which all wards with generated waste quantities have represented in different colors. It helps to observe easily about maximum waste generated wards and minimum waste generated wards within six months. Complete monthly data in the form of pie charts is mentioned below according to the months.

After the critical analysis, it was found that the burn unit and nephrology departments contribute the highest mean values of waste generation in month of October 2008, which are near to 1.45 and 1.195 while the EYE & ENT department, surgical OT, pathology and Gynae OT departments contributes the lowest mean values of waste which are near to 0. Some other departments; Surgical ICU, Medical ICU and CCU contributes highly in mean values of waste but less than Burn Unit and Nephrology. It is shown in fig. 5.2 below

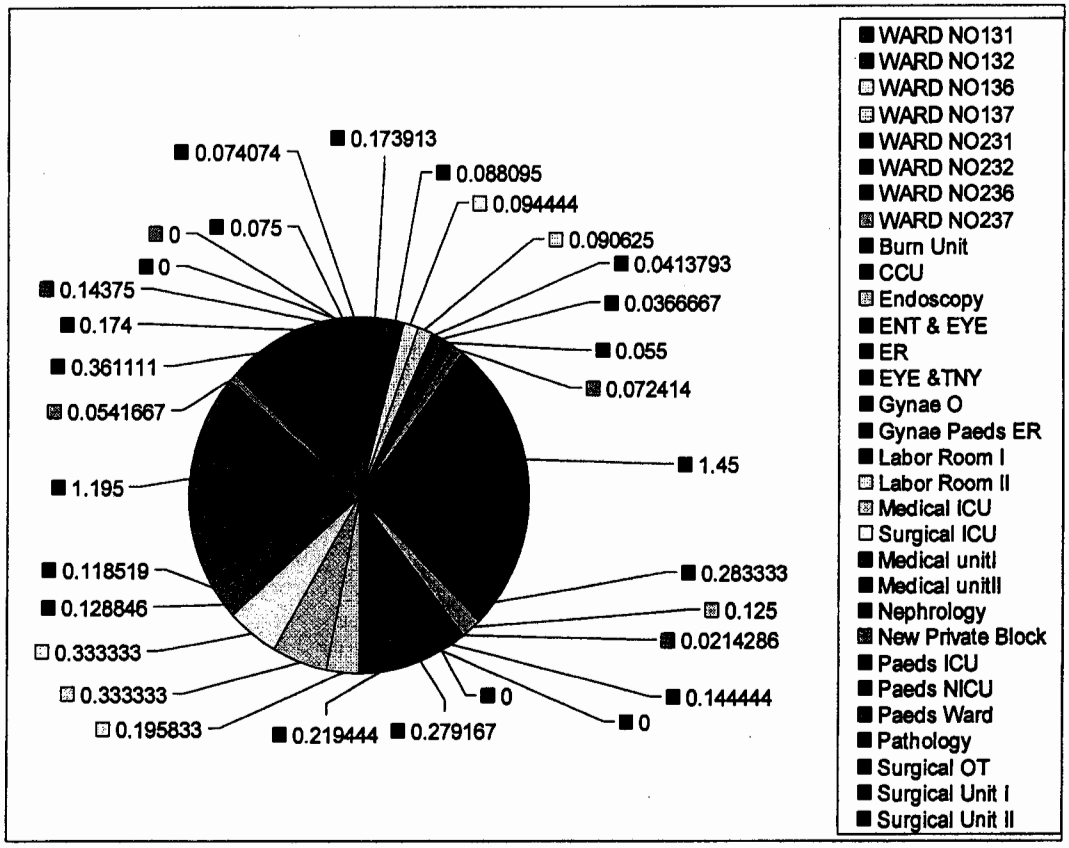

Fig 5.2: Rate of waste generation in October from each ward

The waste generated in month of November 2008 is also analyzed. In November the burn unit and Nephrology department contributes the highest mean values of waste. EYE & ENT, Pathology, Surgical OT and Gynae OT contributed the lowest mean values of waste. The Endoscopy, Paeds ICU, Medical ICU, Gynae Paeds ER and CCU departments contributed equally in waste generation whose mean values are near about 0.33 but less than highest contributing departments which includes burn unit i-e 1.475 and Nephrology Department i-e 1.1975 these values have been increased from calculated mean values of October 2008. The other difference in mean values among November and October, is in the Endoscopy department i-e the mean value has been increased from 0.021(October) to 0.325 (November) and is mentioned by dark yellow color, as shown in fig 5.3 below

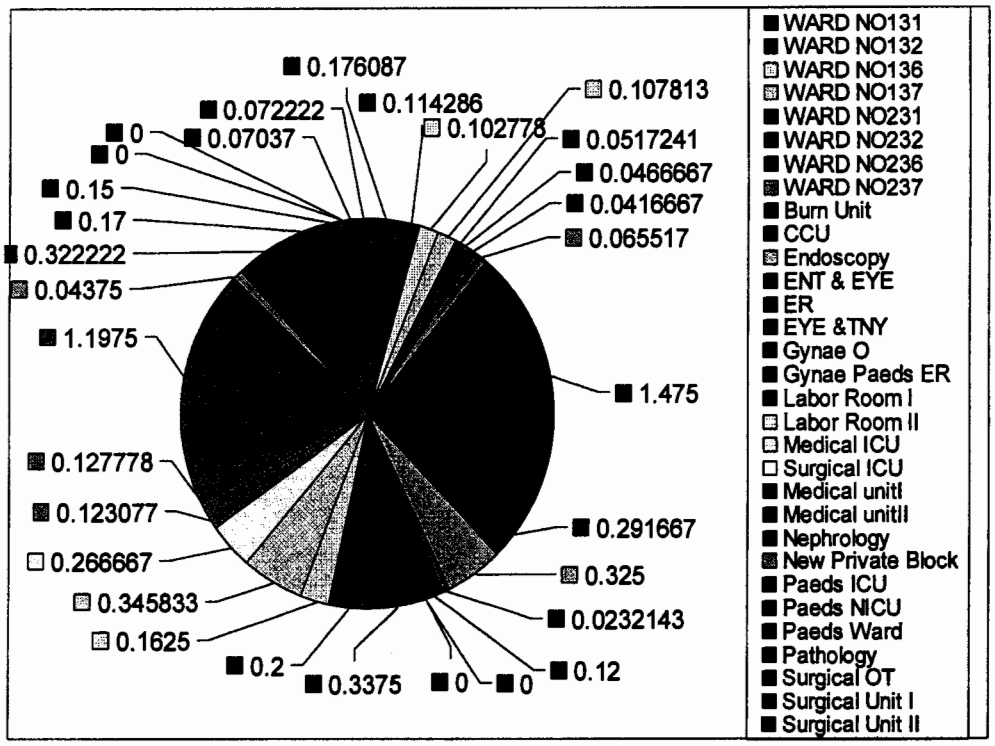

Fig 5.3: Rate of waste generation in November from each ward

The rate of waste generation in month of April has changed in some wards. In some specific wards mean values of waste generation has been increased while in other departments the mean values of generated wastes have been decreased. In the fig 5.4 mentioned below it is shown that in month of April burn unit has contributed in highest waste generation while Nephrology department has generated less waste, which was contributing equally with the burn unit in waste generation during month of October and November. In this month rate of waste generation has been increased from 0.0325 to 0.0969 by Endoscopy department. It means the rate of waste generation in Endoscopy department is increasing day by day while the rate of waste generation is decreasing in Nephrology department, which is shown in fig 5.4 below

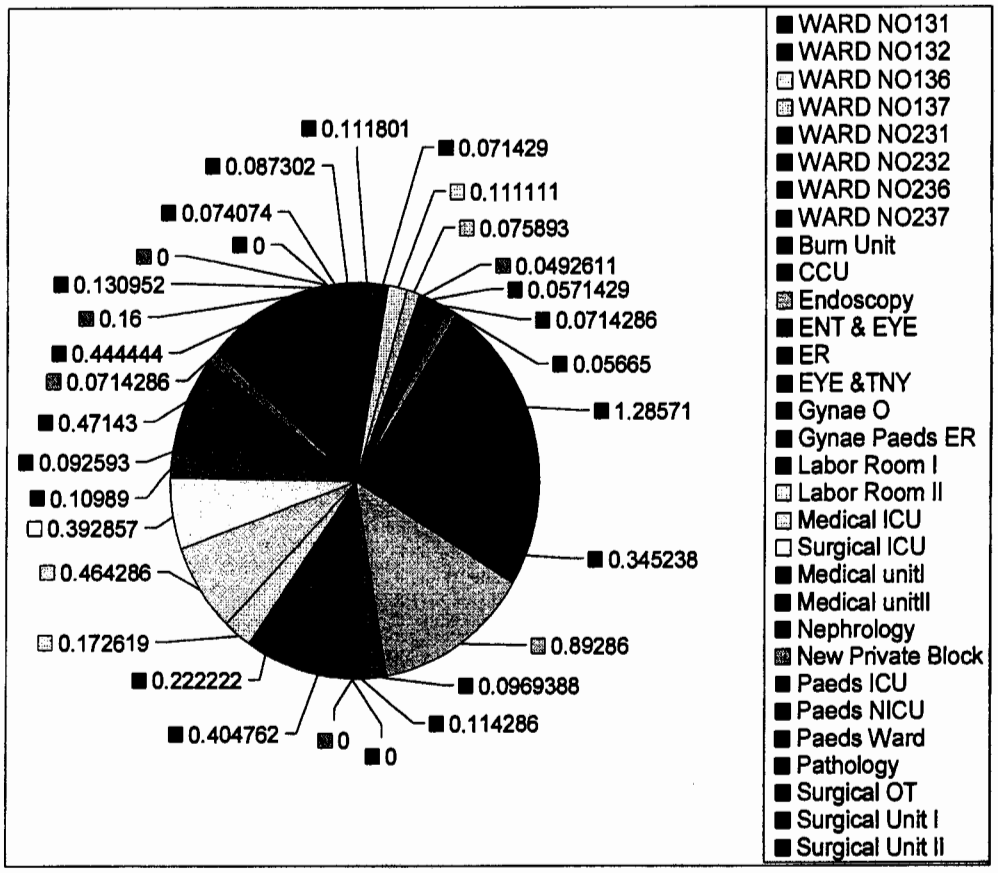

Fig 5.4: Rate of waste generation in April from each ward

Similarly the waste generation in the month of May is increasing in Burn unit i-e 1.5 and in Endoscopy department i-e 1.25, while in months of October, November and April the values of waste generation were less than 1. Whereas the medical ICU, surgical ICU, Nephrology and Paeds ICU are equally contributing in waste generation as shown in fig 5.5 below

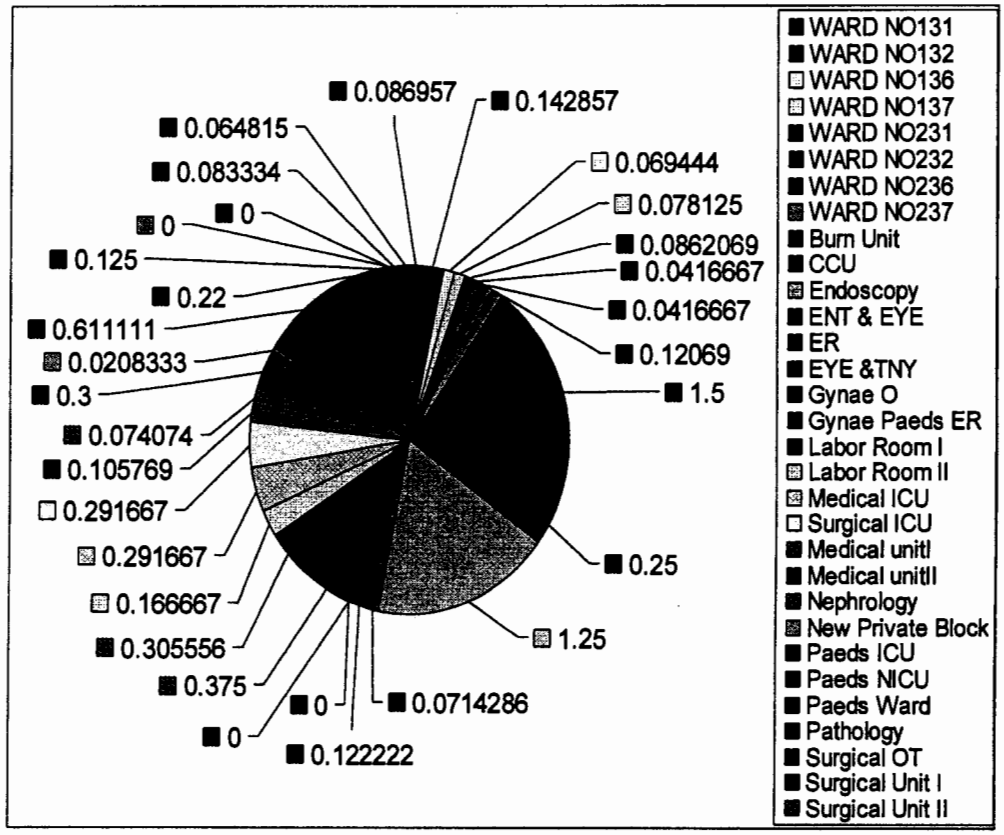

Fig 5.5: Rate of waste generation in May from each ward

The pie chart of month July is clearly showing that there are significant differences among mean values of waste generation of different wards. The mean values of Burn unit are falling in July from1.5 to1.2 and mean values of Endoscopy department are rising from mean value 1.25 to 1.4, while there's no change found in mean values of Medical ICU, surgical ICU and Nephrology department in July shown in fig5.6 below

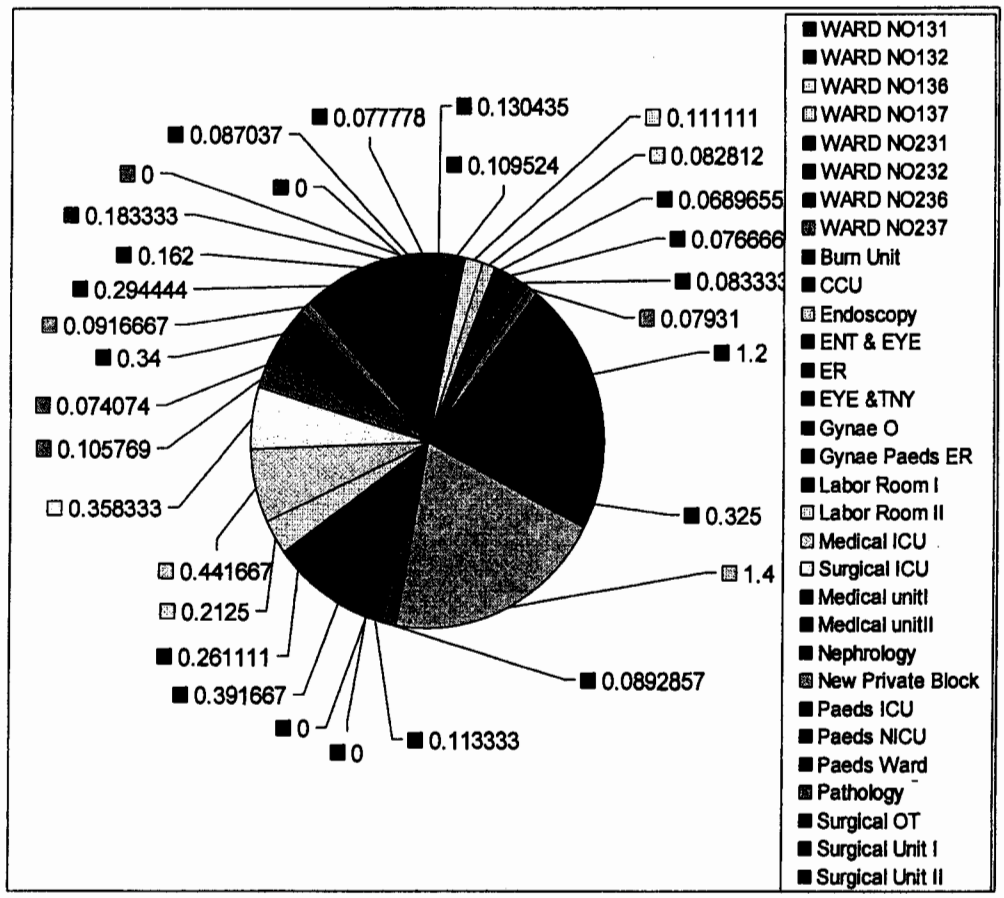

Fig 5.6: Rate of waste generation in July from each ward

As all wards are generating different quantities of wastes in different months similarly in August the variation is also found. Calculated means are determining that the Burn unit's mean value is again increasing from 1.2 to 1.57 whereas in Endoscopy department which was increasing the waste generation day by day; starts decreasing the quantity of waste generation in month of August. The nephrology department is still showing lower values of waste generation i.e. 0.52 and generates equal amount of waste like Medical ICU and Surgical ICU, whose values are 0.464 and 0.56 respectively as shown in fig 5.7 below

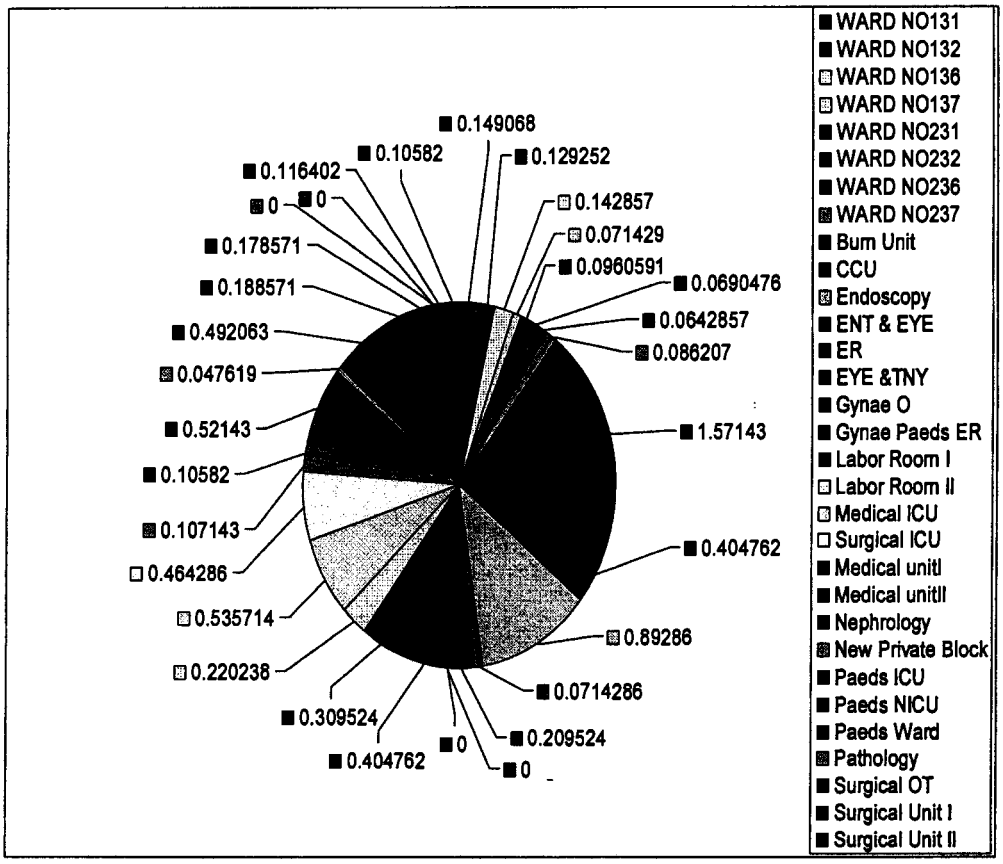

Fig 5.7: Rate of waste generation in August from each ward

The rate of waste generation is different in each ward in each month. The rate of waste generation varies in wards according to their type like Nephrology and EYE & ENT. In EYE & ENT ward, waste generation is usually round about 0 to 1% because in EYE department there's no requirement of drips, blood bags etc. In EYE and ENT department doctor just examines his patients but in Burn Unit the body tissues and burnt skin is considered as waste and in Nephrology department 5 to 6 cases of dialysis are handled by the doctors daily in which drips, blood bags, syringes and tubes are used. The amount of waste generated in each ward depends on several factors such as number of patients present at the time of measurement and type of services offered by each department. That's why the rate of waste generation varies in each department. According to all given pie charts the Burn unit and Endoscopy department generates more waste quantity.

5.3 Analysis of variance for waste generation

On the basis of calculated mean for monthly waste generation among all wards of Holy Family Hospital, average daily waste generation rate was also analyzed and no significant difference (df = 30, 5, F=0.57, 0.07, p=0.962, 0.996) was found with in Holy Family Hospital as mentioned in table 2 given below:

Table 5.2: Non significant variance found by ANOVA

Source	DF	MS	SS	F	P
WARDS	30	1.8408	0.0614	0.57	0.962
MONTHS	5	0.0393	0.0079	0.07	0.996
Error	150	16.0152	0.1068		
Total	185	17.8953			

5.4 T-Test of some wards for comparative study:

T-test is used in comparative study of different wards in their quantity of generated waste.

Results of T-test form box plot (graph) to show the variances among different wards. The Box plots mentioned below show the variances found after T-tests of different samples. The description of Box plot mentioned in fig 5.2 is shown below:

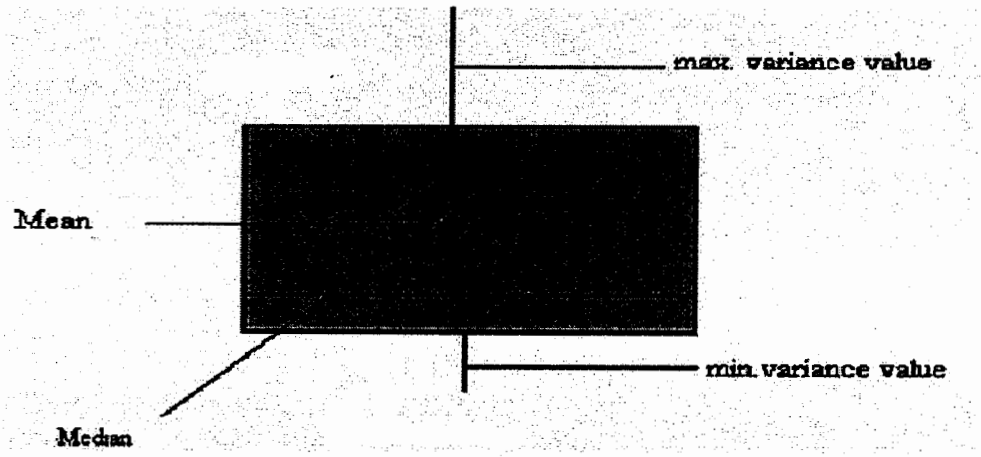

Fig 5.8: Description of Box Plot

The maximum variance value shows the maximum difference among two samples and minimum variance value shows the minimum difference level among two

samples. Median and mean positions show that most of the values lie near the minimum variance level or maximum variance level. T-tests have been conducted month wise and ward wise.

5.4.1 Month Wise T-Test:

5.4.1.1 Two-Sample T-Test: OCTOBER, NOVEMBER

Table 5.3: Two sample T-test for October vs. November

Months	Wards	Mean	St. Dev	SE Mean
October	31	0.205	0.317	0.057
November	31	0.211	0.321	0.058

Difference = mu OCTOBER - mu NOVEMBER

Estimate for difference: -0.0054

T-Test of difference = 0 (vs. not =): T-Value = -0.07

P-Value = 0.947 DF = 60

Since the P-value calculated by T-test is more than significance level so the result is non significant among both months as shown in Box plot graph mentioned in fig 5.3 below

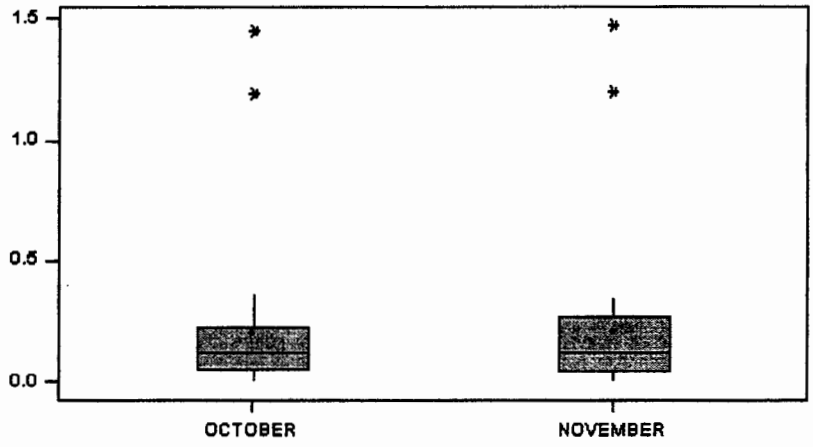

Fig 5.9: Generated waste among October and November

Although in box plot there's no clear difference in average waste production between October and November but statistically result is non-significant. There's a very small

variance in waste generation among both months as the maximum values of waste generation in October lie below 0.5 but area covered by it is smaller than Box plot of November, it means the waste generated in November is more than waste generated in October.

5.4.1.2 Two-Sample T-Test: APRIL MAY

Table 5.4: Two-sample T-test for APRIL vs. MAY

Month	No. of wards	Mean	St. Dev	SE Mean
APRIL	31	0.214	0.279	0.050
MAY	31	0.222	0.337	0.061

Difference = mu APRIL - mu MAY

Estimate for difference: -0.0083

T-Test of difference = 0 (vs. not =): T-Value = -0.11

P-Value = 0.916 DF = 60

Since the P-value is more than significance level so the variance is non significant among both months in waste generation as mentioned in fig 5.4 below

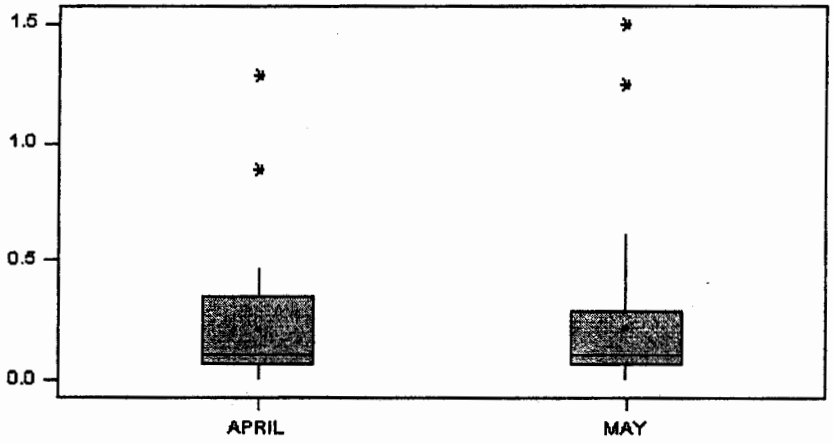

Fig 5.10: Generated waste among April and May

As mentioned in the above fig 5.4 the waste generation is non significant as the medians and means in both boxes are on the same level that's near 0, it means in most of the days, waste generated is round about 0. The position of median, size and

placement of box shows the variance among two samples, as shown in graph. The maximum variance level of box in April remains below 0.5 but in May waste generated is more than April as mentioned by maximum variance level that is above the value 0.5. Although in box plot there's clear difference in average waste production between April and May but statistically result is non-significant.

5.4.1.3 Two-Sample T-Test: JULY, AUGUST

Table 5.5: Two-sample T for JULY vs. AUGUST

Months	No. of wards	Mean	St. Dev	SE Mean
JULY	31	0.224	0.313	0.056
AUGUST	31	0.250	0.320	0.057

Difference = mu JULY - mu AUGUST

Estimate for difference: -0.0260

T-Test of difference = 0 (vs. not =): T-Value = -0.32

P-Value = 0.748 DF = 60

Since the P-Value is more than significance level (0.05) so the variance is non-significant. The variances among two months is mentioned in the fig 5.5 below

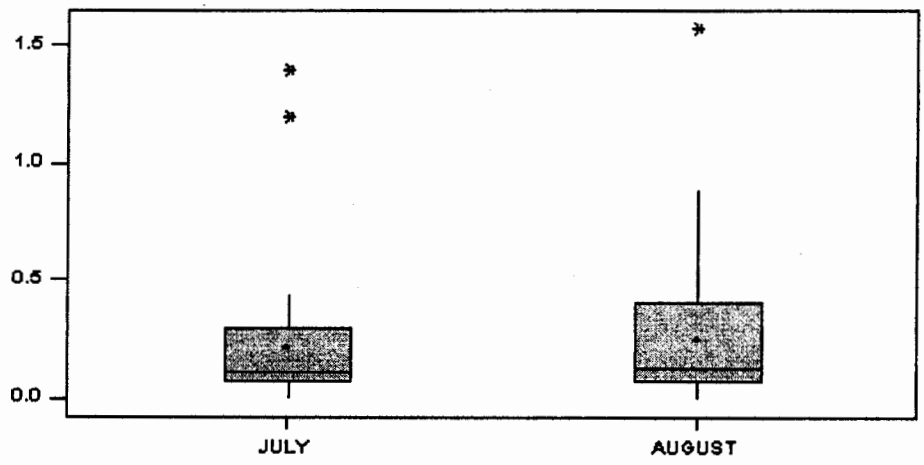

Fig 5.11: Generated waste among July and August

Although there's a difference in average waste production (mentioned in above graph 5.5) between July and August but statistically variance is non-significant. The most of the waste generated values lie near 0 in month of July and some lie near 0.5 but in

August the most of the waste generated values lie near the value 1.0. It means most of the maximum waste generated values lie near 1.0 in August and in July maximum waste generated values lie below 0.5.

5.4.2 Ward Wise T-test

5.4.2.1 Two-Sample T-Test: BURN UNIT, CCU

Table 5.6: Two-sample T for BURN UNIT vs. CCU

Wards	No. of Months	Mean	St. Dev	SE Mean
BURN UNI	6	1.414	0.141	0.058
CCU	6	0.3167	0.0545	0.022

Difference = mu BURN UNIT - mu CCU

Estimate for difference: 1.0970

T-Test of difference = 0 (vs. not =): T-Value = 17.77

P-Value = 0.000 DF = 10

Since the P value is less than significance level (0.05) so the variance among two wards is significant as mentioned in fig 5.6 below

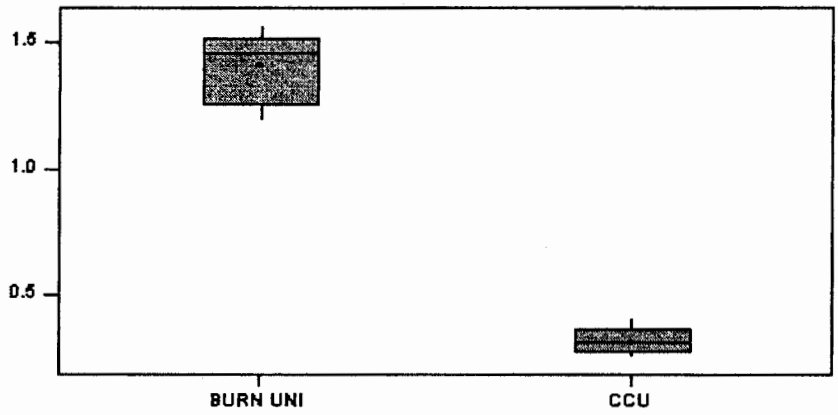

Fig 5.12. Generated waste among Burn Unit and CCU

The box plot formed by T-test mentions that there's a significant difference among two wards as the waste generation in Burn unit is more than CCU .In CCU the waste generation remains below 0.5 and in burn unit waste generation is more as box plot is near mean value 1.5 and median position is also near quartile 3, which shows the maximum difference in waste generation among two wards.

5.4.2.2 Two-Sample T-Test: ER, GYNAE PAEDS E R

Table 5.7: Two-sample T for ER vs. GYNAE PAEDS & E R

Wards	No. of months	Mean	St. Dev	SE Mean
ER	6	0.1373	0.0371	0.015
GYNAE PA	6	0.3655	0.0492	0.020

α =0.05

Difference = mu ER - mu GYNAE PAEDS & E R

Estimate for difference: -0.2282

T-Test of difference = 0 (vs not =): T-Value = -9.07

P-Value = 0.000 DF = 10

Since the P value is less than significance level so the variance among two samples is significant. The box plot formed after T-test shows much variance in waste generation of both wards. The clear variance shown in fig 5.7 is mentioned below:

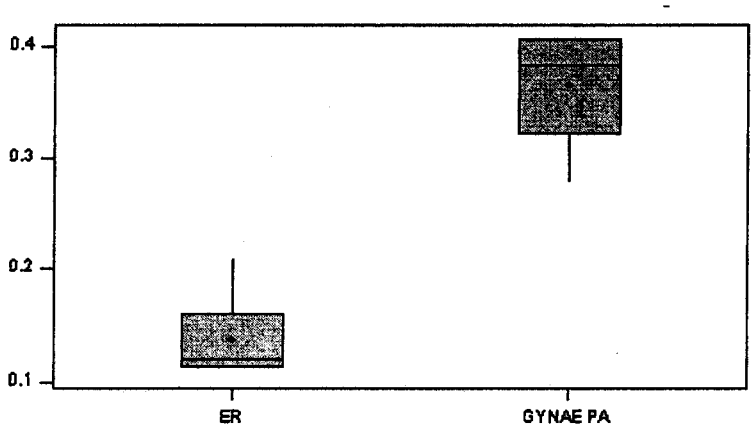

Fig 5.13.Generated waste among ER and Gynae Paeds

The waste generated in Gynae Paeds is more than ER as shown in graph that median and mean position is near quartile 3; box plot is of larger size and is of value 0.4, so there's a significant difference of waste generation between both wards. The maximum values in Gynae ward are between 0.3 and 0.4 and minimum values are below 0.3. The larger minimum variance values bar and median position in box plot of Gynae Paeds shows that the waste generation quantities lie round about 0.3. In ER the most of waste generation quantities lie near 0.1 and some extreme values are above 0.2, it means there's significant difference among both wards. So the variance

in waste generation among both wards is due to the more number of cases handled in Gynae ward daily than Emergency Room.

5.4.2.3 Two-Sample T-test: Labor room 1, Labor room 2

Table 5.8: Two-sample T-test for Labor room 1 vs. Labor room 2

Wards	No. of Months	Mean	St. Dev	SE Mean
LABOUR RI	6	0.2530	0.0467	0.019
LABOUR RII	6	0.1884	0.0247	0.010

Difference = mu LABOUR ROOM 1 - mu LABOUR ROOM 2

Estimate for difference: 0.0646

T-Test of difference = 0 (vs. not =): T-Value = 3.00

P-Value = 0.013 DF = 10

Since the P-value (0.013) is less than significance level (0.05) so the variance is significant among two ward samples. The clear variance shown in fig 5.8 mentioned below

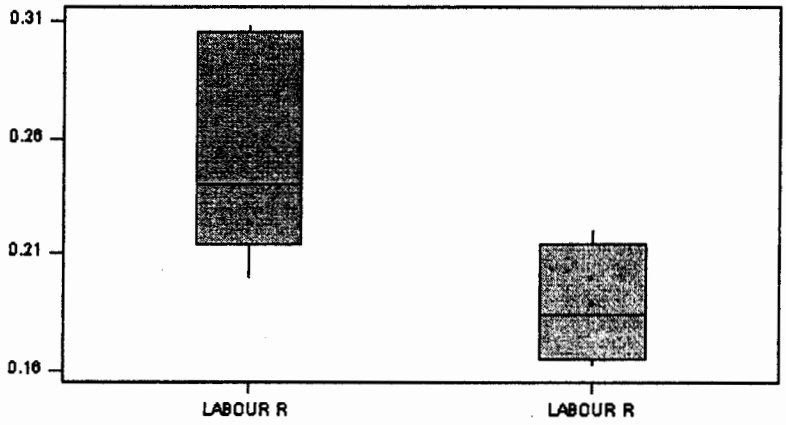

Fig 5.14.Generated waste among Labour Room I and II

The waste generation in Labor room I is much more than waste generation in Labor room II. The placement and area of box mentioned for Labor room I show that most of the mean values of generated waste are near 0.31 and some minimum values lie below 0.21. The most of the waste generation values are above 0.21 in Labor room I

but in Labor room II the maximum values lie below 0.21. While the minimum mean values in Labor room II lie near 0.16. So there's the greatest difference shown in quantity of generated waste among both wards.

5.4.2.4 Two-Sample T-Test: Medical ICU, Surgical ICU

Table 9: Two-sample T for Medical ICU vs. Surgical ICU

Wards	No. of months	Mean	St. Dev	SE Mean
MEDICAL	6	0.4021	0.0931	0.038
SURGICAL	6	0.3512	0.0715	0.029

Difference = mu MEDICAL ICU - mu SURGICAL ICU

Estimate for difference: 0.0509

T-Test of difference = 0 (vs not =): T-Value = 1.6

P-Value = 0.313 DF = 10

Since the P-value is more than Significance level so the result variance among both samples is non significant. That's shown in fig 5.9 mentioned below

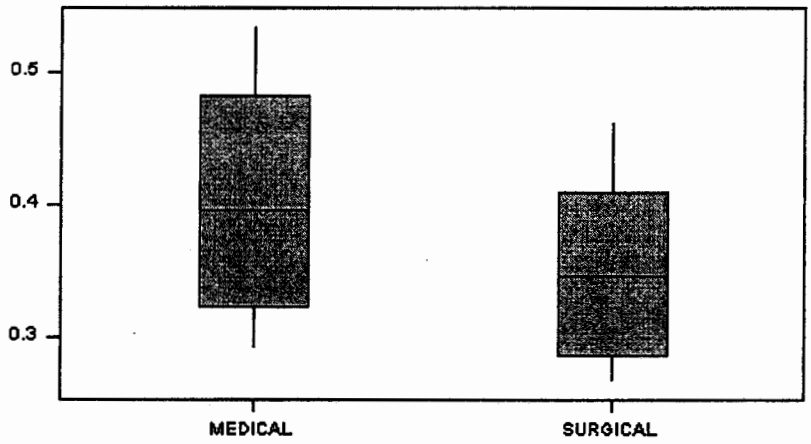

Fig 5.15.Generated waste among Medical ICU and Surgical ICU

Although there's a significant difference shown in fig 5.9 in average waste production between Medical ICU and Surgical ICU but statistically the variance is non significant.

The maximum waste generation values in medical ward lie above the value 0.5 and minimum waste generation values lie above 0.3 but in surgical ward maximum waste generation values lie below 0.5 and minimum waste generation values lie below 0.3 but in actual there's no significant difference among both samples.

5.4.2.5 Two-Sample T-test : Medical Unit 1, Medical Unit 2

Table 5.10: Two-sample T for Medical Unit 1 vs. Medical Unit 2

Wards	No of months	Mean	St. Dev	SE Mean
MEDICAL U I	6	0.1134	0.0100	0.0041
MEDICAL U II	6	0.0988	0.0225	0.0092

Difference = mu MEDICAL UNIT 1 - mu MEDICAL UNIT 2

Estimate for difference: 0.0146

T-Test of difference = 0 (vs. not =): T-Value = 1.45

P-Value = 0.177 DF = 10

Since the P-value is more than significance level so the variance is non significant among two wards. That's shown in fig 5.10 below

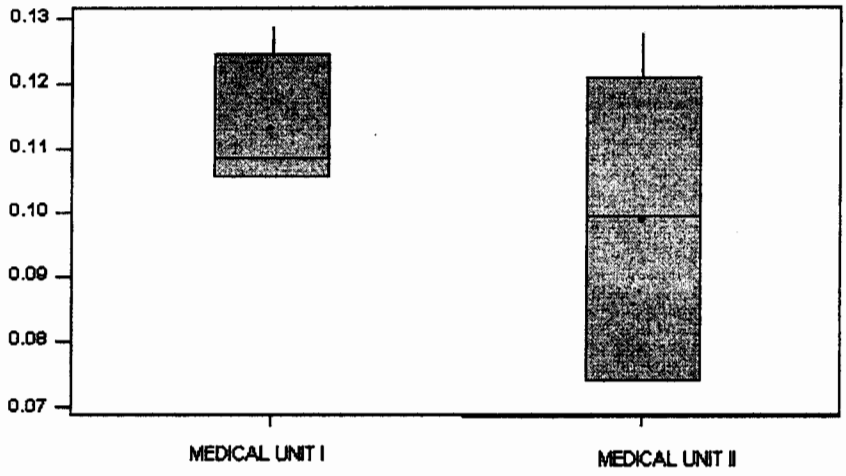

Fig 5.16.Generated waste among Medical unit I and Medical unit II

Although there is a difference in average waste production between medical unit -I and medical unit-II shown in fig 5.10 but statistically variance is non-significant.

The maximum values lie near 0.13 mentioned in box plot of medical unit I and minimum values lie near 0.11 while in box plot of medical unit II maximum values lie above 0.12 but less than 0.13 and minimum values lie below 0.08.

5.4.2.6 Two-Sample T-Test and CI: Paeds ICU, Paeds NICU

Table 5.11: Two-sample T for Paeds ICU vs Paeds NICU

Wards	No of Months	Mean	St. Dev	SE Mean
PAEDS ICU	6	0.421	0.119	0.049
PAEDS NICU	6	0.1791	0.0225	0.0092

Difference = mu PAEDS ICU - mu PAEDS NICU

Estimate for difference: 0.2418

T-Test of difference = 0 (vs not =): T-Value = 4.88

P-Value = 0.001 DF = 10

Since the P-value (0.001) is less than significance level so the variance among both wards is significance. The clear variance mentioned in fig 5.11 shown below

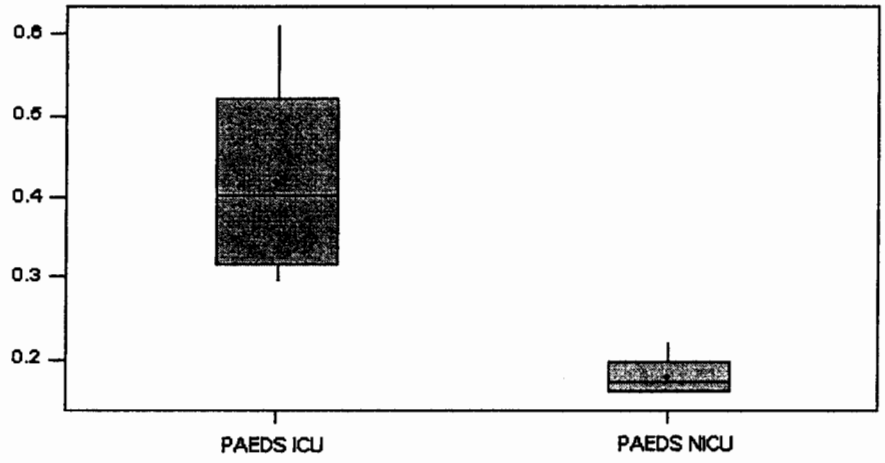

Fig 5.17: Generated waste among Paeds ICU and Paeds NICU

The waste generated in Paeds ICU is more than Paeds NICU as mentioned above in fig 5.11. The maximum values of waste generated in Paeds ICU lie near 0.6 and minimum values lie below the value 0.3 while in Paeds NICU the maximum values lie near value 0.2 and minimum values lie below value 0.2. This shows the major difference in waste generation variance of both wards. This variance is due to the

difference in number of patients. It's the common observation that number of Paeds in critical condition admitted in Paeds NICU ward, is much fewer than admitted in Paeds ICU ward.

5.4.2.7 Two-Sample T-Test: Surgical Unit 1, Surgical Unit 2

Table 5.12: Two-sample T for Surgical unit 1 vs Surgical unit 2

Wards	No of months	Mean	St. Dev	SE Mean
SURGICAL U-I	6	0.0844	0.0169	0.0069
SURGICAL U-II	6	0.0803	0.0145	0.0059

Difference = mu SURGICAL UNIT 1 - mu SURGICAL UNIT 2

Estimate for difference: 0.00403

T-Test of difference = 0 (vs. not =): T-Value = 0.44

P-Value = 0.666 DF = 10

Since the P-value (0.666) is more than significance level so the variance among both wards is non significant. According to T-test there's insignificant variance in waste generation of both wards mentioned in fig5.12 below

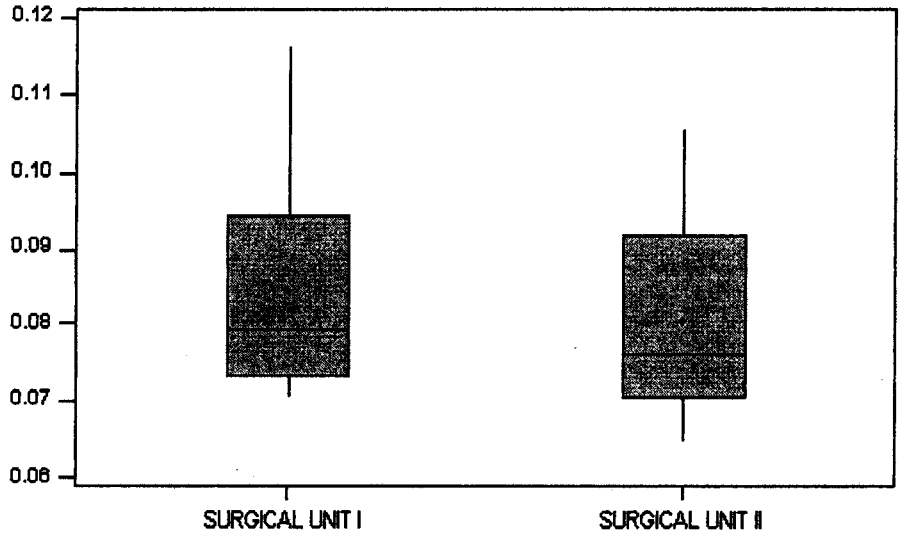

Fig 5.18.Generated waste among surgical unit I and surgical unit II

Although there is a difference in average waste production between surgical unit I and surgical unit II mentioned in fig5.12 but statistically the variance is non significant. In surgical unit I maximum values lie above 0.11 and near 0.12 and minimum values

of generated waste lie near 0.07 whereas in surgical unit II the maximum values lie below 0.11 and minimum values lie near value 0.06. It shows the minimum variance among waste generation of both wards.

DISCUSSION

Based on the current study it is found that Holy Family Hospital Rawalpindi has made its own SOP's and also following some of the Hospital Waste Management Rules 2005 as approved for the treatment and disposal of biomedical waste.

6.1 Comparison with HWM Rules 2005

The toxic waste means infectious waste, pathological waste, sharps, pharmaceutical wastes, genotoxic waste, chemical waste and radioactive waste as defined by HWM Rules, 2005 under 2 (1) (o).

The non toxic waste includes paper and cardboard, packaging, food waste and aerosols as defined by HWM Rules 2005 under 2 (1) (k).

Classification of Hospital wastes by HFH

Holy Family Hospital Rawalpindi classified Hospital wastes as

Clinical wastes

Several types of Clinical Wastes were identified, including infectious waste, pathological waste, sharps, pharmaceutical waste, geno-toxic waste, chemical waste, radio active wastes.

Non Clinical wastes

Several types of Non Clinical Waste were identified including paper, packaging, food waste.

6.1.1 Responsibility for waste management under rule 3

Every hospital is responsible for the proper management of the waste generated by the hospital till its final disposal in accordance with provisions of the Act and the rules 16 to 22.

Holy Family Hospital

Holy Family Hospital is trying to perform its duties regarding hospital waste management, efficiently as they constituted waste management team and waste management plan.

6.1.2 Waste Management Team under Rule 4

- Waste Management Team should constitute MS under 4(1)(a), Heads of all departments under 4(1)(b), Infection control officer under 4(1)(c), Chief Pharmacist under 4(1)(d), Radiology Officer under 4(1)(e), Senior Matron,

Head of Administration under 4(1)(f), Hospital Engineer under4(1)(g), Head of sanitation Staff under 4(1)(h), A public representative of district administration and Provincial Administration under 4(1)(i).

Holy Family Hospital:

HWM team lacks Hospital Engineer, Radiology Officer and any public representative of district Administration and provincial Agency by the Holy Family Hospital, Rawalpindi. The HWM team of Holy Family Hospital, Rawalpindi does not fulfill the requirements of rule 4(mention above). They have no radiology officer, Infection Control officer and public representative of district administration and Provincial Administration. According to one member of waste management team the District Coordination Officer and provincial agency didn't nominate any one as public representatives that's why these posts are empty.

- Under rule 4(2), in a hospital where the posts under sub-rule (1) do not exist, the Medical Superintendent shall designate member to perform the duties and responsibilities of the holder of such posts under rule 8 to 14.

Holy Family Hospital:

Medical Superintendent nominates Head of Administration to perform the duties of Waste Management Officer and Infection Control Officer at the same time.

6.1.3 Duties and Responsibilities of waste management team under rule 5

A waste management team shall be responsible for the preparation, monitoring periodic review, revision or updating, if necessary, and implementation of the waste management plan, and for supervision of all actions taken in compliance with the provision of these rules.

Holy Family Hospital

Waste management team constitutes 8 to 10 members and they have formed their own SOP's as a Waste Management Plan. The Waste Management Team implements these SOPs, which are supervised by Medical Director and Head of Administration according to HWM Rules 2005 under Rule 6.

6.1.4 Meetings of waste management team under rule 6(1)

The meeting of waste management team should be held at least twice a month.

Holy Family Hospital

Meeting among waste management team members held once in a month.

Under rule 6(2)

One third of the members of the waste management team shall constitute the quorum for a meeting under 6(2).

Holy Family Hospital

Almost all members attend the meeting.

6.1.5 Duties and responsibilities of medical superintendent under Rule 7(1)

A medical superintendent shall constitute the waste management team under 7(1)(a), designates the waste management officer under 7(1)(b), Facilitate meetings of the waste management team and ensure implementation of its decisions under 7(1)(c), Supervise implementation under, monitoring and review of the waste management plan and ensure that it is kept update under 7(1)(d), Arrange for the waste audit of the hospital by an external agency as may be designated for purposes by the government, involving analysis for the existing waste stream and assessment of existing waste management practices under 7(1)(e), Allocate sufficient financial and manpower resources to ensure efficient and effective implementation of the waste management plan under 7(1)(f) and Ensure adequate training and refresher courses for the concerned hospital staff under 7(1)(g).

Holy Family Hospital

A medical superintendent constituted the waste management team, designated the waste management Officer, Facilitates meetings of the waste management team and ensure implementation of its decisions, Supervise implementation, monitoring and review of the waste management plan and ensure that it is kept updated, arrangement for the waste audit of the hospital by Health Services Academy Islamabad, CEHA (Jordan, UN) and WHO, they also involves analysis for the existing waste stream and assessment of existing waste management practices, WHO and Govt. of Punjab allocates sufficient financial and manpower resources to ensure efficient and effective implementation of the waste management plan. WHO ensures adequate training and refresher courses for the concerned hospital staff .Medical Director and Head of Administration gives guidelines to the heads of departments for efficient and effective outcome of their waste management Plan.

6.1.6 Duties and responsibilities of the head of the departments under Rule 8

The heads of the departments shall be responsible for the proper management of waste generated in their respective departments and in particular shall:

a. Ensure that all doctors, nurses, clinical staff in their respective departments, is aware of, and where required properly trained, in waste management procedures under rule 8(a)

Holy Family Hospital:

WHO arranges workshops to train the doctors, nurses and clinical staff to improve the waste management practices among staff.

b. Arrange proper supervision of the sanitary staff and ensure that they comply with waste management procedures at all times under rule 8(b)

Holy Family Hospital

A member of waste management staff is responsible to supervise the sanitary workers from collection to the storage and also responsible to weight that waste on the spot and note down the readings ward wise.

c. Liaise with waste management Officer for effective monitoring and reporting of mistakes and errors in implementation of the waste management plan under rule 8(c)

Holy Family Hospital

As Head of Administration is performing the duties of waste management Officer and give them guidelines for proper waste management so heads of departments liaise with him for effective monitoring and reporting mistakes and errors in implementation of the waste management plan in meetings held among them monthly.

6.1.7 Duties and responsibilities of Infection control officer under rule 9

An infection control officer shall be responsible for:

a. Giving advice regarding the control of infection and the standards of the waste disposal system under rule 9(a).

Holy Family Hospital

Head of Administration performs his duties as Infection Control Officer as well so in monthly meetings he advises the members of waste management team regarding control of infection and specially infection control nurse is advised by

him to put keen observation on nurses regarding syringe cutting and daily she has to visit all wards and observe their regular attitude towards waste management.

b. Identifying training requirements for each category of the staff under rule 9(b)
c. Organization of training and refreshers courses on safe waste management procedures under rule 9(c)

Holy Family Hospital

WHO arranges workshops to aware all levels of Holy Family Hospital about safe practices of waste management. INCINCO, the company installed incinerator at HFH has been contracted with Holy Family Hospital to train their operators of incinerator and for the maintenance of incinerator.

6.1.8 Duties and responsibilities of chief pharmacist under Rule 10

A chief pharmacist shall be responsible for the sound management of the pharmaceutical stores and in particular shall:

a. Give advice regarding formulation of appropriate procedures for management of pharmaceutical waste, and coordinate implementation of these procedures under rule 10(a)
b. Ensure that the concerned hospital staff members receive adequate training in pharmaceutical waste management procedures under rule 10(b)

Holy Family Hospital

According to chief pharmacist they have usually no pharmaceutical waste because they have been contracted with pharmaceutical companies to bring back the provided medicines before expiry date and replace them with new one. But sometimes if they found little number of expired medicines, they burn them. Expired injections and syrups are drained out firstly, and then the glass bottles are crushed and in last buried in ground. The tablets without foil packaging are disposed of in municipal container and tablets with foil packaging are buried in the ground. Before some period of time they reuse glass bottles of disposed syrups after sterilization for urine collection but now they crush them and then buried.

6.1.9 Duties and responsibilities of radiology officer under rule 11

Holy Family Hospital

HFH have no Radiology Department so they don't designate radiology Officer.

6.1.10 Duties and responsibilities of senior matron and head of administration under Rule 12

A senior matron and head of administration shall be responsible for ensuring training of nursing staff, medical assistant, laboratory staff and sanitary staff and sweepers in waste management procedures and basic personal hygiene.

Holy Family Hospital

A senior infection control nurse visits all departments and observes the attitude and acts of nurses regarding waste management practices and gives guidelines to them on the spot. Infection Control Nurse informs the Head of Administration and Medical Director about observed weaknesses and gaps if any about waste management practices of nurses. Sanitary staff and nurses perform their duties efficiently but they are not aware about the hazardous effects of waste on their personal hygiene.

6.1.11 Duties and responsibilities of Hospital Engineer under Rule 13

Holy Family Hospital

They don't designate any Hospital Engineer

6.1.12 Duties and responsibilities of Waste management Officer under Rule 14

A waste management officer shall, in addition to his duties and responsibilities, be responsible for the day to day implementation and monitoring of the waste management plan and in particular, shall,

(a). For waste collection

i) Ensure internal collection of waste bags and waste containers and their transport to central storage facility of the hospital on daily basis under Rule 14(a) (i).

Holy Family Hospital

The member of waste management team who observes the waste collectors from collection to transportation informs the Waste management Officer about the performance of the waste collectors.

ii) Liaise with the supply department to ensure that an adequate supply of waste bags, containers, protective clothing and collection trolleys are available at all times under rule 14(a) (ii).

Holy Family Hospital

During visits in HFH the unavailability of gloves for the collectors was observed. They don't wear the long shoes, mask and apron while collection and transportation of waste. Only incinerator's operator wears the complete protective gears. Waste containers were found in most of the wards but without any logo.

iii) Ensure that sanitary staff and sweepers immediately replace used bags and containers with new bags and containers of the same type and where a waste bag is removed from containers is properly cleaned before a new bag is fitted therein; under rule 14(a) (iii)

Holy Family Hospital

The sanitary staff and sweepers immediately replace the used bags and a container with new bags but same containers aren't properly cleaned before new bags are fitted therein.

(b). For waste storage:

i) Ensure correct use of the central storage facility and that it is kept secured from unauthorized access under rule 14(b) (i)

Holy Family Hospital

The central storage room is adjacent to the room of incinerator and locked every time that's why the room and waste is secured from scavengers.

ii) Prevent supervised dumping of waste bags and waste containers on the hospital premises, even for a short period of time under rule 14(b) (ii).

Holy Family Hospital

Waste bags are stored in storage room, which is in the premises of hospital but that storage room is properly locked and air-conditioned. Waste bags stored at storage room until incinerate in incinerator.

(c). For waste disposal:

i) Coordinate and monitor all waste disposal operations and for this purpose meet regularly with the concerned representative of the local council 14(c) (i).

ii) Ensure that the correct methods of transportation of waste are used on site to the central facility or incinerator, if installed, and off site by the local council;

iii) Ensure that the waste is not stored on the hospital premises for longer than twenty-four hours, by coordinating with the incinerator operations and with the local council;

Holy Family Hospital

There's no any representative of local council as required in rule 14(c) (i) as a member of waste management team so the Head of administration as designated under rule 4(2) monitors waste disposal operations, waste transportation methods and storage of waste two or three times monthly under rule 14(c) (ii) and 14(c) (iii).

(d). For staff training and information under Rule 14(d)

i) Liaise with the heads of departments, head of administration and senior Matron to ensure that all doctors, staff, nurses, laboratory staff and medical assistants are fully aware of their duties and responsibilities under the waste management plan

ii) Ensure that sanitary staff and sweepers are not involved in waste segregation and that they only handle waste bags and containers in the correct manner;

Holy Family Hospital

Head of Administration and Medical Director provide guidelines to the heads of departments and Senior Matron and liaise with them in meeting held once in a month among all members of waste management team to ensure about the efficient performance of doctors, nurses etc. WHO arranges workshops to aware doctors, nurses, laboratory staff and medical assistants as required under 14(d) (i). The nurses are responsible for the segregation of waste while sanitary staff is responsible for the collection of waste from the bins as required under rule 14(d) (ii) and then loaded to the transportation trolley.

(e). For incident management and control under rule 14(e)

i) Ensure that emergency procedures are available at all times and that all staff members are aware of the action to be taken by them under rule 14(e) (i);

ii) Investigate, record and review all incidents reports regarding hospital waste management under rule 14(e) (ii);

iii) Record the quantities of waste generated by each department on a weekly basis under rule 14(e) (iii).

Holy Family Hospital

Not any incident is found in hospital record, except needle stick injuries and there's a duty of effected person to inform Infection Control Nurse and for that reason they vaccinated all sanitary staff as required under rule 14(e) against Hepatitis B while 20% sanitary workers left for vaccination are those who are designated as a new employee in hospital. There's no record found about the maintenance of incidents as required under rule 14(e)(ii). However, the Holy Family Hospital maintains the record about quantities of generated waste by each department on daily basis under rule 14(e) (iii).

6.1.13 Waste Management Plan under rule 15

1. A waste management plan shall be prepared by a waste management Officer for approval by the Waste Management Team, shall be based on internationally recognized environment management standards such as the international Organization for Standardization 14000 series.

Holy Family Hospital

Holy Family Hospital has been prepared their own SOPs and follows those SOPs as their waste management plan for waste management, waste collection, waste transportation, waste storage and waste disposal which are not completely based on ISO 14000 series as required under rule 15(1)

2. The waste management plan shall be include

(a) A plan of the hospital showing the waste disposal points for every ward and departments, indicating whether each point is for risk waste or non risk waste, and showing the sites of the central storage facility for the risk waste and the central storage facility for non risk waste;

Holy Family Hospital

As required under rule 15(2) (a) they have central storage room for the storage of risk waste and for the disposal of risk waste they installed incinerator in 2007 after the approval of PC-1 by the Govt. of Punjab and for the non-risk waste the CDA

container is placed in the premises of hospital and that is replaced with empty CDA container by the CDA truck daily.

(b) Timetables including frequency of the waste collection from each wards and department under rule 15(2)(b)

Holy Family Hospital

As required under rule 15(2)(b) waste is collected by the sanitary workers twice a day. It starts in morning at 8 am and in evening the time is 6 pm. The waste is stored in storage room for 24 hours and burnt in incinerator for a whole day. Next morning ash is removed from the incinerator and dumped in adjacent ground by the operator of incinerator.

(c) An estimate of the number of staff members required for waste collection under rule 15(2)(c);

Holy Family Hospital

Two workers are for waste collection and transportation, two ward nurses are in each ward for waste segregation on the spot and for syringe cutting, one worker works as incinerator operator and one is for maintenance and washing of storage room while one worker is for maintenance of temperature of incinerator and to start and stop the incinerator.

(d) Procedures for the management of waste requiring special treatment such as autoclaving before final disposal;

Holy Family Hospital

Holy Family Hospital doesn't follow the autoclaving procedure before final disposal as required under rule 15(1)((d). According to the guidelines of CEHA, disposable syringes and glass bottles should be dipped in bleach for one hour then shred them in shredder, by this process CEHA wants to promote recycling.

(e) Contingency plans for the storage or disposal of risk waste in the event of breakdowns of incinerators, or of maintenance or collection arrangements;

(f) Training courses and programs on waste management;

(g) Emergency procedures;

Holy Family Hospital

Their staff is trained in operating the incinerator and storage procedures as required under rule 15(2) (e). They are trained for any emergency procedures

by the Infection control Officer and Heads of departments as required under rule 15(2) (f). They have emergency procedure form but as they don't face any incident that's why there's no any record of incidents as required under rule 15 (2)(g).

3. A representative of a local council responsible for the collection and disposal of waste from the hospital shall be consulted in preparing and finalization of the waste management plan;

Holy Family Hospital

In the waste management team of HFH there's no any representative from local council as required under rule 15(3) so HFH only consults with WHO and CEHA for preparing and finalizing the waste management plan.

4. The waste management plan shall be regularly monitored, reviewed and revised and updated by the waste management team as and when necessary.

Holy Family Hospital

Head of Administration who is performing the duties of ICO and waste management officer and medical director monitor, review and revise the waste management Plan and discuss it with team members during meetings as required under rule 15(4).

6.1.14 Waste Segregation under rule 16

(1) Risk waste shall be separated from non-risk waste at the ward beside, Operation Theater, laboratory or any other room in the hospital where a doctor, nurse or other person, generates the waste.

Holy Family Hospital

Two colored containers yellow and red are placed in every ward for on the spot segregation of risk wastes and non-risk wastes by the ward nurses as required under rule 16(1).

(2) All disposal medical equipment and supplies including syringes, needles, plastic bottles, drips and infusion bags shall be cut or broken and rendered non reusable at the point of use by the person using the same, or in case any such used by such person.

Holy Family Hospital

Syringes rendered non-reusable at the point of use by the help of syringe cutter and that's the duty of ward nurses. According to the member of HFH, it's the duty of waste collectors to collect the needles from syringe cutter separately and then

mix those needles with cement in a small container and after some time buried it in the ground as required under rule 16(2).

(3) All risk wastes other than sharps, large quantities of pharmaceuticals, or chemicals, waste with a high content of mercury or cadmium such as broken thermometers or used batteries, radioactive waste shall be placed in a suitable container made of metal or tough plastic, with a pedal type or swing lid, lined with strong yellow waste bag. The bags shall be removed when it is not more than three quarters full and sealed, preferably with self-locking plastic sealing tags and not by stapling. Each bag shall be labeled, indicating date, point of production, ward and hospital, quantity and description of waste and prominently displaying the biohazard symbol. The bags removed should be immediately replaced with a new one of the same type.

Holy Family Hospital

According to the member of HFH usually no or very less waste is generated containing mercury or cadmium, and there's no radiology department at Holy Family Hospital that's why there's no radioactive waste generation in Holy Family Hospital. Toxic waste is collected in yellow colored container but lined with white colored polythene bag that's not of tough plastic as required under rule 16(3) and they are tied after three quarters full. But they don't label those bags as biohazard symbol, don't mention date and point of production, don't mention quantity and description of waste as required under Rule 17(3)(b).After collection they loaded them in transportation trolley that's with moveable lid. The sanitation workers replaced filled bags with the new one of the same type as required under rule 17(3)(c).

(4) Sharps including the cut or broken syringes and needles shall be placed in metal

or high density plastic containers resistant to penetration and leakage designed so that items can be dropped in using one hand and no item can be removed. The containers shall be colored yellow and marked "DANGER! CONTAMINATED SHARPS". The sharp container shall be closed when three quarters full. If the sharp container is to be incinerated, it shall be placed in the yellow waste bag with the other risk waste.

Holy Family Hospital

Cut or broken syringes and needles are collected in yellow container placed in every ward. These containers should be labeled as required under rule 16(4) but some are labeled with "Toxic waste" and mostly are found unlabeled. Needles are collected separately and mixed with cement then filled in small containers and buried in ground by the waste collectors. Syringes and drips shredded by shredder and according to the CEHA guidelines that shredded material can be recycled but still HFH doesn't start this process and incinerate the drips and syringes.

(5) Large quantities of pharmaceutical waste shall be returned to the suppliers. Small quantities shall be placed in yellow waste bag preferably after being crushed, where this can be done safely.

Holy Family Hospital

Expire medicines, injections and syrups are brought back by the supplier that's why the pharmaceutical wastes are in fewer amounts including medicine foils, injection glass and glass bottles of syrups. Glass materials are crushed by sanitary workers as required under rule 16(5) and then mixed with cement then are buried.

(6) Large quantities of chemical waste, and waste with a high content of mercury or cadmium shall not be incinerated, but shall be placed in chemical resistant containers and sent to specialized treatment facilities.

Holy Family Hospital

HFH doesn't have the waste containing mercury and cadmium.

(7) Radioactive waste, which has to be stored to allow decay to background level, shall be placed in a waste bag, in a large yellow container or drum. The container or drum shall be labeled, showing the radio nuclide's activity on a given date, and the period of storage required, and marked "RADIOACTIVE WASTE", with the

radiation symbol. Non-infectious radioactive waste, which has decayed to background level, shall be placed in yellow waste bags. High level and relatively long half life radio nuclides shall be packaged and stored ion accordance with instructions of the original suppliers under supervision of the radiology Officer and sent back to the suppliers for disposal.

Holy Family Hospital

HFH doesn't have radiology department that's why they don't generate radioactive waste.

(8) Non-risk waste shall be placed in a suitable container lined with a white waste bag. Adequate numbers of non-risk waste containers shall be placed in all areas of

the hospital and notices affixed to encourage visitors to use them.

Holy Family Hospital

There are bins placed under the patient's beds in each ward for non-toxic waste but other bins for usage of visitors aren't observed during any visit in any ward, which are required under rule 16(8). However, CDA container is placed in the premises of hospital to dump non-toxic wastes.

6.1.15 Waste collection under rule 17

(2) Sanitary staff sweepers shall, when handling waste, wear protective clothing at all times including facemask, industrial aprons, leg protectors, industrial boots and disposable or heavy-duty gloves, as required.

Holy Family Hospital

Although all workers should wear protective gears as required under rule17 (2) but waste collectors don't wear protective gears. They wear only the plastic sleepers and plastic gloves instead of long boots and heavy duty gloves. Only operator of incinerator was observed with complete protective gears while operating the incinerator.

(3) Sanitary staff and sweepers shall ensure that,

(a) Waste is collected at least once daily;

Holy Family Hospital

The waste collectors collect waste twice a day as required under rule17(3)(a)

(b) All waste bags are labeled before removal, including the point of production, ward, hospital and contents;

Holy Family Hospital

No labeling is found on most of the colored containers and bags lined up in the containers were also of white color instead of yellow color. Collectors

don't mention any date, point of production, ward, hospital and contents on the bags which are required under rule 17(3) (b).

(c) The removed waste bags and containers are immediately replaced with new ones of the same type; and

Holy Family Hospital

Waste bags are collected and loaded in trolley by the waste collectors then lined the emptied container with new bags of the same type as required under rule 17(3) (c).

(d) Where a waste bag is removed from a container, the container is properly cleaned before a new bag is fitted therein.

Holy Family Hospital

Waste collectors fit the new bags of same type in the containers with out properly cleaning the containers as required in Rules 14(a) (iii) and 17(3) (d).

6.1.16 Waste transportation under rule 18

(1) For on-site transportation, a waste collection trolley shall be free of sharp edges, easy to load, unload and to clean, and preferably a stable three or four-wheeled design with high sides. The trolley shall be cleaned regularly.

Holy Family Hospital

As the central storage room is in the premises of Holy Family Hospital so they designed the transportation trolley, which is free of sharp edges, ten to fifteen bags can be loaded in it, easy to handle, four wheeled and waste workers clean that trolley thrice in a week as required under rule18(1).

(2) The sealed waste bags shall be carefully loaded by hand onto the trolley to minimize the risks of punctures or tears.

Holy Family Hospital

The waste bags are carefully loaded by hands on to the trolley by waste collectors but there's the risk of puncture as they don't wear the tough duty gloves as required under rule17(2).

(3) Yellow-bagged risk waste and white bagged non–risk waste shall be collected on separate trolleys, which shall be painted or marked in the corresponding colors.

Holy Family Hospital

Yellow containers are placed in almost all wards of the hospital but the bags lined in the container are of white color by which they violate the rule18 (3) and risk waste is segregated in yellow containers and non- risk waste is collected from the bins that are placed under the beds of patients. The waste collectors collect risk-waste in four-wheeled yellow colored trolley and the sweeper collects the non-toxic waste in one wheeled trolley.

(4) The collection route shall be the most direct one from the final collection point to the central storage facility designated in the waste management plan. The collected waste shall not be left even temporarily anywhere other than at the designated central storage facility.

Holy Family Hospital

The collection route is short and direct from collection points to the central storage facility but the waste collectors left the trolley temporarily in front of the wards from where they have to collect the waste. After collection from that ward they move towards the next ward for the collection of risk-waste which causes the violation of rule 18 (4).

(5) Transportation off site shall, unless otherwise agreed, be the responsibility of the local council, which shall ensure that;

Holy Family Hospital

In the waste management team of Holy Family Hospital there's no member of local council so Head of Administration and Medical Director monitor every thing.

6.1.17 Waste storage under rule 19

(1) A separate central storage facility shall be provided for yellow-bagged waste with sign prominently displaying the biohazards symbol and clearly mentioning the facility stores risk waste.

Holy Family Hospital

In the premises of Holy Family Hospital, they have designed the central storage room that's air-conditioned and that have the enough capacity to store fifty to sixty waste bags. The bags are of white color instead of yellow and don't have any biohazard symbol on them which is required under rule 19 (1).

(2) The designated central storage facility

- Shall be located with in the hospital premises close to the incinerator, if installed, but away from food storage or food preparation areas.

Holy Family Hospital

The central storage room is in the premises of Holy Family Hospital and adjacent with the room of incinerator but away from food storage and food preparation areas as required under rule 19(2).

- Be large enough to contain all risk waste produced by the hospital with spare capacity to cater for collection or incinerators breakdowns;

Holy Family Hospital

Central storage room of Holy Family Hospital is large enough to contain all risk waste produced by the hospital and two spare trolleys are always placed there for emergency purpose as required under rule 19(2).

- Be easy to clean and disinfect with an impermeable hard standing base, plentiful waste supply and good drainage, lighting and ventilation;

Holy Family Hospital

In central storage room of Holy Family Hospital, after loading all wastes in incinerator they wash the room with bleach as required under rule 19(2).

- Be easily accessible to collection vehicles and authorized staff, but totally enclosed and secure from unauthorized access including inaccessible to animals, insects and birds.

Holy Family Hospital

The central storage room is locked every time and inaccessible by scavengers and rodents as required under rule 19(2).

(3) No materials other than yellow-bagged waste shall be stored in the central storage facility.

Holy Family Hospital

Only toxic waste that has to be incinerated is stored in Central storage room as required under rule 19(3).

(4) No waste shall be stored at the central storage facility for more than twenty four hours:

Holy Family Hospital

Holy Family Hospital stores its waste not more than 24 hours in central storage room.

(5) Provided that in case of emergency where infectious waste is required to be stored for more than twenty-four hours, it shall be refrigerated at a temperature of 3 °C to 8 °C.

Holy Family Hospital

Central storage room is air conditioned for 24 hours in summers and 48 hours in winter at Holy Family Hospital as required under rule 19(5).

6.1.18 Waste Disposal under rule 20

Depending upon the type and nature of the waste material and the organisms in the waste, risk waste shall be inactivated or rendered safe before final disposal by a suitable thermal, chemical, irradiation incineration, filtration or other treatment method, or by a combination of such methods involving proper validation and monitoring procedures. Effluent from the waste treatment methods shall also be periodically tested to verify that it conforms to the National Environmental Quality Standards before it is discharged in to the sewerage system under rule 20(1)

Holy Family Hospital

There's no pretreatment system before final disposal of waste in Holy Family Hospital. They only sterilize the operation equipments, apparels of doctors and nurses and bed sheets for the reuse purposes. But before disposal of toxic wastes they don't follow any pretreatment method as they drain out the expired syrups and chemicals in sewerage system, in this way they violate the rule 20(1) which has mentioned in HWM rules 2005.

(2). Yellow-bagged waste shall be disposed off by burning in an incinerator, by burial in a landfill or by any other method of disposal approved by the federal Agency or a Provincial Agency concerned.

Holy Family Hospital

Risk Waste is disposed off by the method of incineration in Holy Family Hospital as required under rule 20(2) and Govt. of Punjab has been approved this method of disposal in the form of PC-I.

(3). Sharps containers, which have not been placed in yellow waste bags for incinerator, shall be disposed off by encapsulation or other method of disposal approved by the

Federal Agency or a Provincial Agency concerned.

Holy Family Hospital

Holy Family Hospital disposes off sharps and needles by mixing them in cement, filled them in small containers and then buried them in ground.

(4). The method of disposal, whether by burning in an incinerator or by burial in a landfill or otherwise, shall be operated by a hospital only after approval of its Environmental Impact Assessment in accordance with the provisions of section12:

Provided that hospitals, local councils or other persons already using an incinerator or landfill on the date of commencement of these rules shall submit an Initial Environmental Examination in respect thereof to the Federal Agency concerned with in two months from the said date, and may continue to use the incinerator or landfill pending decision on the EIA.

Holy Family Hospital

Holy Family Hospital has prepared their PC-1 for installation of incinerator and submitted to Govt. of Punjab. After getting approval from the Punjab Govt. they received financial assistance from Govt. of Punjab and WHO for installation of incinerator and other expenses. According to the member of Waste Management Team of Holy Family Hospital the EIA is not their headache that's the duty of INCINCO to approve their incinerator from EPA. After getting approval by the EPA the company named INCINCO installed the incinerator in the HFH, as required under rule 20(4). EPA requirement has not been fulfilled by the hospital for installation of incinerator.

(5). Ash and residues from incineration and other methods shall be placed in robust, non-combustible containers and sent to the local council's designated risk waste landfill site.

Holy Family Hospital

Ash and residues are collected from incinerator and are then dumped in the ground that's adjacent to the wall of incinerator's building and that's harmful for the students of the nursing school, which is behind the incinerator's building. There's no landfill site designed by Local council which is required as under rule 20(5).

(6). Landfills shall be located at sites with minimal risk of pollution of groundwater and river. Access to the site shall be restricted to authorized personnel only. Risk waste shall be buried in a separate area of the landfill under a layer of earth or non-risk waste at least

one meter depth, which shall then be compacted. The landfill shall be regularly monitored by the local council to check groundwater contamination and air pollution. The local council shall ensure that the landfill operators are properly trained, especially in safe disposal procedures, use of protective equipment and hygiene and emergency response procedures.

Holy Family Hospital

The waste management team is trying to arrange landfill for ash disposal but at present they dump the ash in the premises of the hospital that can be access by any unauthorized personnel. There's high risk of ground water contamination as it already polluting the air. By open dumping of ash in the premises of hospital they violate rule 20(6).

(7). Daily collection of risk waste from hospitals shall be taken by the vehicles of the local council immediately to the designated landfill site or incinerator by the most direct

route in accordance with prior scheduling of collection times and journey times.

Holy Family Hospital

The waste management team doesn't arrange any landfill site for ash disposal as required under rule 20(6) and 20(7).

(8) All liquid infectious waste shall be discharged in to the sewerage system only after being properly treated and disinfected.

Holy Family Hospital

All liquid infectious wastes are disposed off in the sewerage system without any treatment. In this way they violate rule 20(9) because still there's not any waste water management system in hospital.

(9) In the case of gaseous radioactive waste, portable filter assembles shall be used to extract iodine and xenon. The used filters shall be treated as solid radioactive waste.

Holy Family Hospital

They don't have radiology department so there's no any arrangement of treatment of radioactive waste in the Holy Family Hospital.

6.1.19 Accidents and Spillages under rule 21

1. All hospital staff members shall be trained and prepared for the emergency response including procedures for treatment of injuries under rule 21(1)(a), evacuated the contaminated area under rule 21(1)(b), clear up the contaminated area under rule 21(1)(c) exposure of staff members shall be limited to the contaminated area and immunization may be carried out under rule 21(1)(d) and emergency equipment shall be replaced in the same location under rule 21(1)(e).

2. All hospital staff members shall be trained and prepared for the emergency response including procedures for treatment of injuries, clean-up of the contaminated area and prompt reporting of all incidents of accidents, spillages and near-misses.

Holy Family Hospital

All staff members are trained against any incident and accident. But as such they havn't face any accident.

3. A Waste Management Officer shall immediately investigate, record and review

   all such incidents to establish causes and shall submit his report to a Waste Management Team.

Holy Family Hospital

In case of any accident the workers of Holy Family Hospital are obliged to inform infection control nurse, which is responsible to report incident or accident to the infection control officer and medical director as required under rule 21(3).

4. The Waste Management Team shall review the report, and necessary shall amend the Waste Management Plan to prevent recurrence of such incidents, and take such further action as may be required under rule 21(4).

Holy Family Hospital

According to one member of waste management team of Holy Family Hospital the form has been prepared by the administration to record and review any report of accident. But there's no information of any incident or accident reported yet that's why they have no record of accidents and incidents. For any needle stick injury the

administration has already immune the workers against Hepatitis B which is accordance to the rule 21(1)(d).

6.1.20 Inspection under rule 22

1. An health officer may inspect any hospital, incinerator or landfill located within the area of his jurisdiction to check that the provisions of these rules are being compiled with.
2. If an Health Officer discovers any contravention of any provision of these rules, he shall report the same to the concerned Hospital Complaint Scrutiny Committee.

Holy Family Hospital

There's no any inspection held ever before by any health officer at Holy Family Hospital.

6.1.21 Hospital Waste Management Advisory Committee under Rule 23

Holy Family Hospital

Local and provincial councils don't designate any advisory committee at Holy Family Hospital so the WHO and CEHA give them waste management guidelines and the Waste management team is supervised by Medical Superintendent, Head of Administration and Medical Director.

6.1.22 Applicability of Section 14 under rule 24

Each hospital generating risk waste shall apply to the Federal Agency for issuance of license for handling hazardous substances and the provision of section 14 shall apply for the purpose of granting such license.

Holy Family Hospital

The Government of Punjab has approved PC-1 and gave financial assistance to the hospital. After the approval of PC_I the Holy Family Hospital became able to install Incinerator and manage hazardous waste in the vicinity of Hospital.

6.2. Comparison with WHO guidelines

For critical analysis of Waste management Plan of Holy Family Hospital Rawalpindi, it's necessary to compare it with the guidelines of WHO. So some of the WHO 's guidelines are compared with Waste Management practices of Holy Family Hospital.

6.2.1 Legal Provision under guideline 4.2

National Legislation is the basis for improving health-care waste practices in any country. It establishes legal controls and permits the national agency responsible for the disposal of health-care waste, usually the ministry of health, to apply pressure for their implementation. The ministry of environment or national environmental protection agency may also be involved; there should be a clear designation of responsibilities before the law is enacted.

Holy Family Hospital

There is no designation of responsibilities to any person from national EPA and ministry of environment in Holy Family Hospital.

Under guideline 4.2.1

The law should be complemented by a policy document, and by technical guidelines developed for implementation of the law. This legal "package" should specify regulations on treatment for different waste categories, segregation, collection, storage, handling, disposal, and transport of waste, responsibilities, and training requirements; it should take into account the resources and facilities available in the country concerned and any cultural aspects of waste-handling.

Holy Family Hospital

Holy Family Hospital is following its own SOPs as rules for Hospital waste management. Their SOPs specify rules on waste collection, segregation, transportation and disposal. The training requirements are offered to Holy Family Hospital by the WHO and CEHA.

Under guideline 4.2.2

The law should include the following:

- A clear definition of hazardous health-care waste and of its various categories;
- A precise indication of the legal obligations of the health-care waste producer regarding safe handling and disposal;
- Specifications for record-keeping and reporting;

- Specifications for an inspection system to ensure enforcement of the law, and for penalties to be imposed for contravention;
- Designation of courts responsible for handling disputes arising from enforcement of or noncompliance with the law.

Holy Family Hospital

The SOPs of HFH includes

- A clear definition of hazardous health-care waste and of its various categories.
- A precise indication of the SOPs regarding safe handling and disposal of Hospital Waste.
- Specifications for record keeping but still no reporting of any incident.
- There's Infection control Nurse for the enforcement of rules in each ward but usually the penalties are not imposed on any contravention.
- There's no designation of any court for handling disputes.

6.2.2 Waste segregation and Packaging under guideline 7.1

Under guideline 7.1.2

Sharps should all be collected together, regardless of whether or not they are contaminated. Containers should be puncture-proof (usually made of metal or high density plastic) and fitted with covers. They should be rigid and impermeable so that they safely retain not only the sharps but also any residual liquids from syringes. To discourage abuse, containers should be tamper-proof (difficult to open or break) and needles and syringes should be rendered unusable. Where plastic or containers are unavailable or too costly, containers made of dense cardboard are recommended (WHO, 1997); these fold for ease of transport and may be supplied with a plastic lining.

Holy Family Hospital

Sharps are collected in red colored containers and other infectious wastes are collected in yellow colored containers. Containers are puncture proof and in some wards these containers are of plastic and in others may be of metal, lined with polythene bags.

Under guideline 7.1.3

Bags and containers for infectious waste should be marked with the international infectious substance symbol.

The international infectious substance symbol is mentioned in fig 6.1 below

Figure 6.1: International infectious substance symbol

Holy Family Hospital

Containers and bags are not marked with any International infectious substance symbol but labeled with words "Hazardous Wastes ". Containers used at Holy Family Hospital are mentioned in plate 6.2

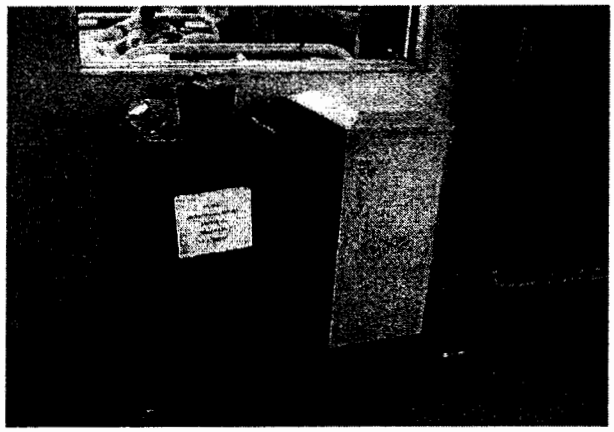

Plate 6.2: Waste collection bins in HFH

Under guideline 7.1.4

Highly infectious waste should, whenever possible, be sterilized immediately by autoclaving. It therefore needs to be packaged in bags that are compatible with the proposed treatment process: red bags, suitable for autoclaving, are recommended

Holy Family Hospital

The autoclaving process is not followed in Holy Family Hospital but to sterilize the apparels of doctors and nurses, operating equipments and bed sheets, the sterilization process is followed. Bleaching of drips and syringes after shredding is also

recommended by the CEHA to promote the recycling process in Holy Family Hospital.

Under guideline 7.1.7

Large quantities of obsolete or expired pharmaceuticals stored in hospital wards or departments should be returned to the pharmacy for disposal. Other pharmaceutical waste generated at this level, such as spilled or contaminated drugs or packagings containing drug residues should not be returned because of the risk of contaminating the pharmacy; it should be deposited in the correct container at the point of production.

Holy Family Hospital

Pharmaceutical suppliers are bound to replace the expired medicines with new ones. The contaminated drugs or packages are disposed off by disposal methods like burning or burial methods.

Under guideline 7.1.13

Appropriate containers or bag holders should be placed in all locations where particular categories of waste may be generated. Instructions on waste separations and identification should be posted at each waste collection point to remind staff of the procedures. Containers should be removed when they are three quarters full.

Holy Family Hospital

They placed waste collecting containers in almost all wards, some of them are properly labeled and instructional notices are also pasted on the walls of the wards to avoid the mismanagement and to aware all staff members and visitors about importance of health care waste management.

6.2.3 Waste Collection under guideline 7.2.1

Certain recommendations should be followed by the anciliary workers in charge of the waste collection:

- Wastes should be collected daily (or as frequently as required) and transported to the designated central storage site.
- No bags should be removed unless they are labeled with their point of production (hospital and ward or department) and contents.
- The bags or containers should be replaced immediately with new ones of the same type.

Holy Family Hospital

- Waste is collected twice a day in Holy Family Hospital and transported to the central storage room.
- The lined up bags in the colored containers are removed without any labeling with their point of production and contents.
- The bags are replaced with new ones of the same type when filled.

6.2.4 Waste Storage under guideline 7.2.2

Unless a refrigerated storage room is available, storage times for health-care waste (i-e. the delay between production and treatment) should not exceed the following:

Temperate climate:	72 hours in winter
	48 hours in summer
Warm climate:	48 hours during the cool season
	24 hours during the hot season

Holy Family Hospital

The central storage room is in the premises of Holy Family Hospital and properly air-conditioned. In summers the waste is stored for 24 hours and in winter the waste is stored in Central storage room for 48 hours. Storage room is mentioned in plate 6.3

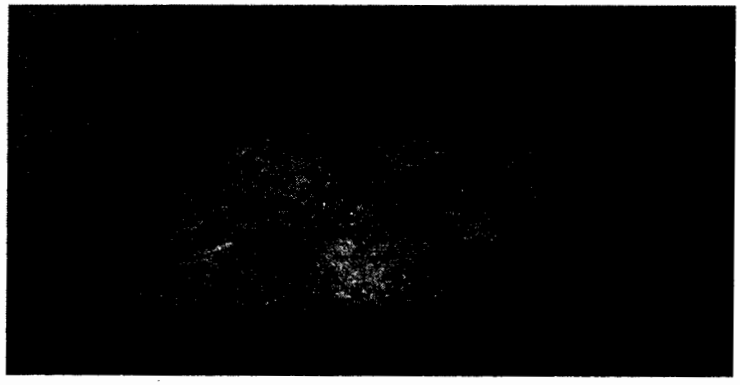

Plate 6.3: Central Waste stortage room in Holy Family Hospital

6.2.5 Recommendations for storage facilities for health-care waste under guideline 7.2.2.1

- The storage area should have an impermeable, hard-standing floor with good drainage; it should be easy to clean and disinfect.
- There should be a water supply for cleaning purposes.

- The storage area should afford easy access for staff in charge of handling the waste.
- It should be possible to lock the store to prevent access by unauthorized persons.
- Easy access for waste collection vehicles is essential.
- There should be protection from the sun.
- The storage area should be inaccessible for the animals, insects and birds.
- There should be good lighting and at least passive ventilation.
- The storage area should not be situated in the proximity of fresh food stores or food preparation areas.
- A supply of cleaning equipment, protective clothing, and waste bags or containers should be located conveniently close to the storage area.

Holy Family Hospital

- Storage room is with good hard standing floor and good drainage system. It's easy to clean and disinfect.
- Sufficient water supply is in the storage room.
- Storage room is accessible only for the authorized staff members.
- Storage room is locked properly to avoid the access of scavengers and rodents.
- The storage room is with good lightning and ventilation.
- Storage room is situated away from food storage areas.
- All containers, protective clothing's, waste bags are stored in storage room for easy access.

6.2.6 On-Site transportation under guideline 7.2.3

Health-care waste should be transported with in the hospital or other facility by means of wheeled trolleys, containers, or carts that are not used for any other purpose and meet the following specifications:

- Easy to load and unload
- No sharp edges that could damage waste bags or containers during loading and unloading
- Easy to clean

The transport trolley recommended by WHO is mentioned in fig 6.4 below

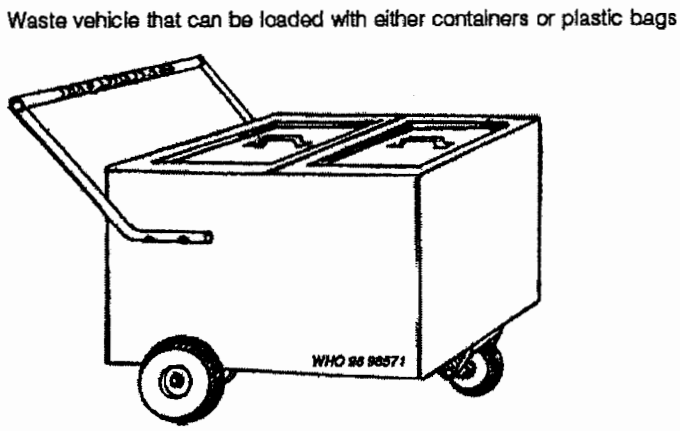

Fig 6.4: Recommended Waste trolley by the WHO

Holy Family Hospital

The trolleys used in Holy Family Hospital are four in number and are four wheeled, yellow-colored trolleys. Health care wastes are transported with in the hospital by the help of these trolleys. These trolleys aren't use for any other purpose. After the collection, the collectors wash the trolley with bleach. The waste transportation trolley is mentioned in Plate 6.5 below

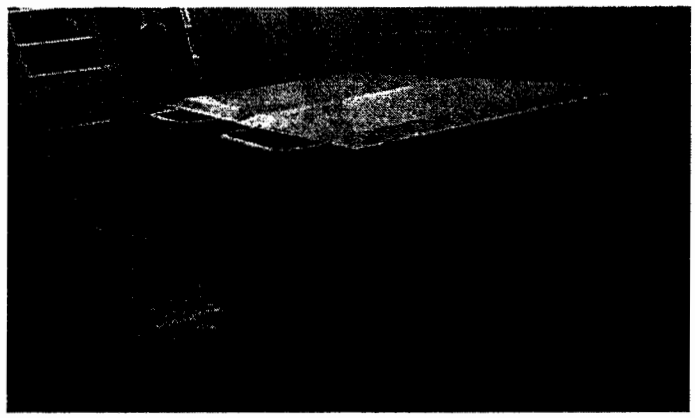

Plate 6.5: Waste transportation trolley used in HFH

6.2.7 Consignment Note under guideline 7.3.1.1

A consignment note should accompany the waste from its place of production to the site of final disposal. On completion of the journey, the transporter should complete the part of the consignment note especially reserved for him and return it to the waste producer.

Holy Family Hospital

There's no any arrangement of consignment note at Holy Family Hospital. It's the duty of collectors to collect the waste from each ward without any check and balance they do their work as their daily routine work. On completion of their journey the transporters stored the collected waste bags in the storage room.

Under guideline 7.3.1.3

Handling and disposal facilities should hold a permit, issued by a waste generation authority, allowing the facilities to handle and dispose of health care waste.

Holy Family Hospital

The Punjab Government issued permit to Holy Family Hospital, allowed the facilities to handle and dispose of health care waste by incineration method, which was approved by Govt. of Punjab in the form of PC-1.

6.2.8 Health Care Facilities to the workers under guideline 12.1

Essential occupational health and safety measures include the following:

- Proper training of workers;
- Provision of equipment and clothing for personal protection;
- Establishment of an effective occupational health programme that includes immunization, post-exposure prophylactic treatment, and medical surveillance.

Holy Family Hospital

WHO and CEHA give guidelines to the Hospital waste management team members for proper waste management as well as for their personal protection. WHO arranged workshops to give proper training to the workers about handling the hazardous waste and importance of personal protection equipment but provision of the personal protective equipment is improper as only incinerator operator is found with all required personal protective equipment. The collectors were found during handling the waste without complete protective gears even they had wore the plastic gloves instead of heavy duty gloves, sleepers instead of long shoes.

6.2.9 Protective clothing under guideline 12.2.1

- Helmets, with or without visors---depending on the operation.

- Face masks--- depending on operation.
- Eye protectors (safety goggles) ---depending on operation.
- Overalls (coveralls) ---obligatory.
- Industrial aprons---obligatory.
- Leg protectors and/or industrial boots---obligatory.
- Disposable gloves (medical staff) or heavy-duty gloves (waste workers) --- obligatory.

The waste handlers should wear protective geared under guideline 7.7 mentioned in fig. 6.6 below

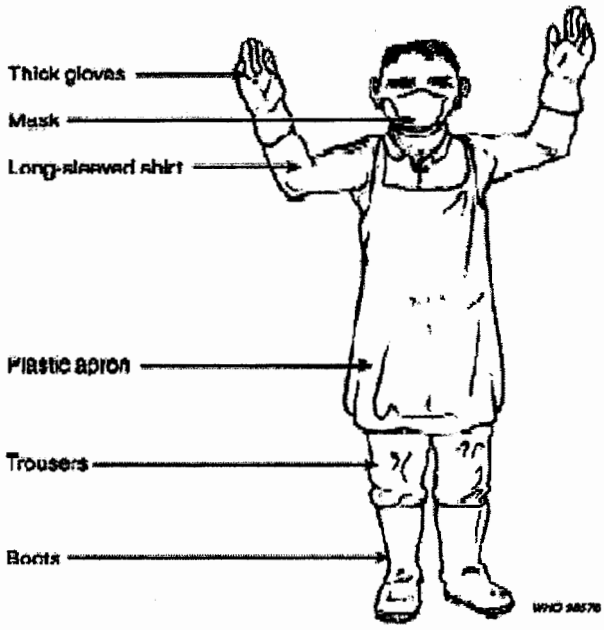

Fig 6.6: Waste handler's protective gears recommended by WHO

Holy Family Hospital

All required protective clothing is provided to the workers but only operators of incinerator were found with complete protective clothing shown in plate 6.7. The collectors, who perform their duties as transporters as well, were found without protective gears even they had put on disposable gloves instead of heavy duty gloves as shown in plate 6.8 below.

Plate 6.7: Incinerator's operator with complete protective gears

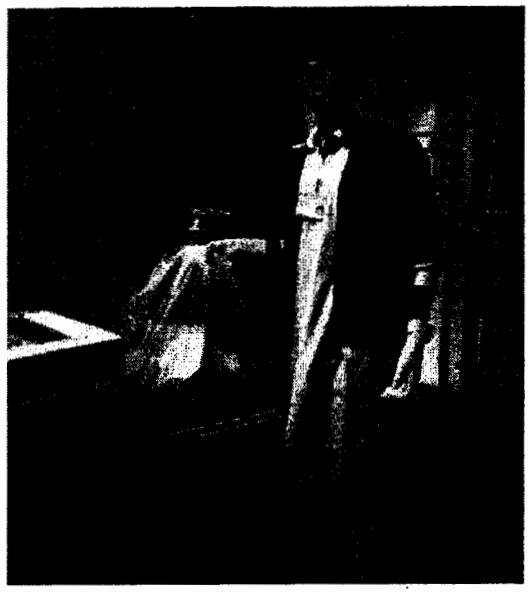

Plate 6.8: Waste Collector with incomplete protective gears

6.2.10 Immunization under guideline 12.2.3

Viral hepatitis B infections have been reported among health-care personnel and waste handlers, and immunization against the disease is therefore recommended. Tetanus immunization is also recommended for all personnel handling waste.

Holy Family Hospital

Immunization against Hepatitis B has been given to 80 % workers of Holy Family Hospital and the remaining 20% workers are those who were new employed there.

6.2.11 Training of landfill operators under guideline 15.3.3

In many middle- and lower-income countries, "safe burying" will continue to be used for the disposal of health-care waste until there is sufficient capacity for incineration or other disinfection. The training of landfill operators is important for limiting the risks associated with buried health-care waste, in relation to both scavenging and the quality of groundwater.

Holy Family Hospital

Incineration method is used for hazardous waste disposal in Holy Family Hospital and ash is disposed off in the ground adjacent to the incinerator's building by open dumping. For final disposal of ash they couldn't finalize any specific method and place.

CONCLUSIONS

7.1 Health Care Waste Sources

After study of Hospital Waste Management in Holy Family Hospital, a wide range of sources of waste generation have been identified, including patient's wards, operation theaters and other departments.

7.2 Health Care Waste Management

Holy Family Hospital is doing better for the management of health care waste as they try to follow the HWM rules 2005 and guidelines of WHO as discussed before. Existing system is satisfactory but still requires filling of the vacant posts in waste management team of Holy Family Hospital Rawalpindi. Awareness level of the environmental and health risks by waste management practices is unsatisfactory in the majority levels of management, although the concerned personals appear to be the exceptions to this situation. A lack of awareness concerning for the handling and effects of infectious and hazardous health care wastes on the part of doctors, nurses, ayah, cleaners and visitors gives rise to the serious problems. (Gupta et. al., 2009)

In Holy Family Hospital, the authorities are trying to improve health care waste management but have not yet fully achieved their goals according to WHO guidelines. In Holy Family Hospital, improper hospital waste management creating undesirable environmental conditions like soil, air and ground water contamination.

7.3 Legislation

Hospital Waste Management rules 2005 appear to serve the purpose of legislation but some of them have not yet been implemented by the Hospital, The compliance of these rules has been discussed in the chapter of discussion.

According to the comparative study of HWM Rules 2005 and HFH waste management system. It has cleared that the Holy Family Hospital, Rawalpindi is trying to follow all HWM rules 2005 and guidelines of WHO for the handling of hazardous substances. Holy Family Hospital, Rawalpindi do not have any procedures dealing with recycling the waste from solid waste. The authorities are trying to aware doctors, nurses etc by workshops as required in our Rules 2005 (Ensure that all doctors, nurses, clinical staff in their respective departments, are aware of, and where required properly trained, in waste management procedures). Duties are identified to

some specific persons like collection, segregation and transportation. WHO and Government of Punjab allocate sufficient financial resources to ensure efficient compliance with waste management rules 2005 and WHO guidelines. An infection control officer, Hospital engineer and Hospital waste management advisory committee etc are not designated as required in HWM rules 2005 that's the reason rules are not followed. Colored bags are not used for segregation and collection of hazardous waste as required by the Rules 2005 and WHO's guidelines. All Hazardous waste delivered to the incinerator is burned within twenty-four hours but in storage room chemicals seep out from the bags which are effecting operators and workers health and polluting by evaporation of those chemicals. Ash and residues from incineration are dumped in adjacent ground and there's no any specific hospital's designated Hazardous waste landfill site. Dumping site is located at the ground adjacent to the Hospital incinerator. This is creating high risk of pollution of groundwater and air pollution. Access to the site should be restricted to authorized personnel as mentioned in Rules 2005 but dumping site in Holy Family Hospital is accessed by everyone. All yellow-bagged waste is daily collected at least once. All staff members handling waste bags do not wear protective clothing. It is observed that during waste segregation workers ignored to use proper gloves. Yellow-bin's waste is transported separately from all other wastes and transportation carts are only used for carrying of yellow-bins waste and are free of sharp edges, easy to clean and disinfect, easy to load and unload by hand, fully enclosed, lids are locked, to prevent any spillage in the hospital premises or on the highway during transportation as required by the Rules 2005.All concerned staff members are properly trained in the handling, loading. Unloading, transportation, and disposal of yellow bins waste as mentioned in Rules 2005 but they are not fully aware of emergency procedures, dealing with accidents or spills and harmful effects on health.

The transportation of waste is properly documented. Workers wash the transportation trolleys after use and disinfect them by bleach.

7.4 Segregation and primary storage

The waste containers used to collect and store waste in Holy Family Hospital are specially designed for the purpose and for better segregation of infectious and non infectious wastes. Different colored containers are provided for storage and segregation of different types of wastes at source, the plastic bags used in the

containers should be of specific colors to identify about type of waste. Storage containers should be labeled with logo of Hazardous and non-hazardous material.

Satisfactory segregation of waste components was observed in Holy Family Hospital but unfortunately still there is improper hospital waste management as they violate some of the guidelines of WHO and HWM rules 2005 that's why hazardous and infectious materials like drips, blood bags, syringes etc are typically mixed with general wastes was found in municipal drum and this leads to high risk of infection of scavengers.

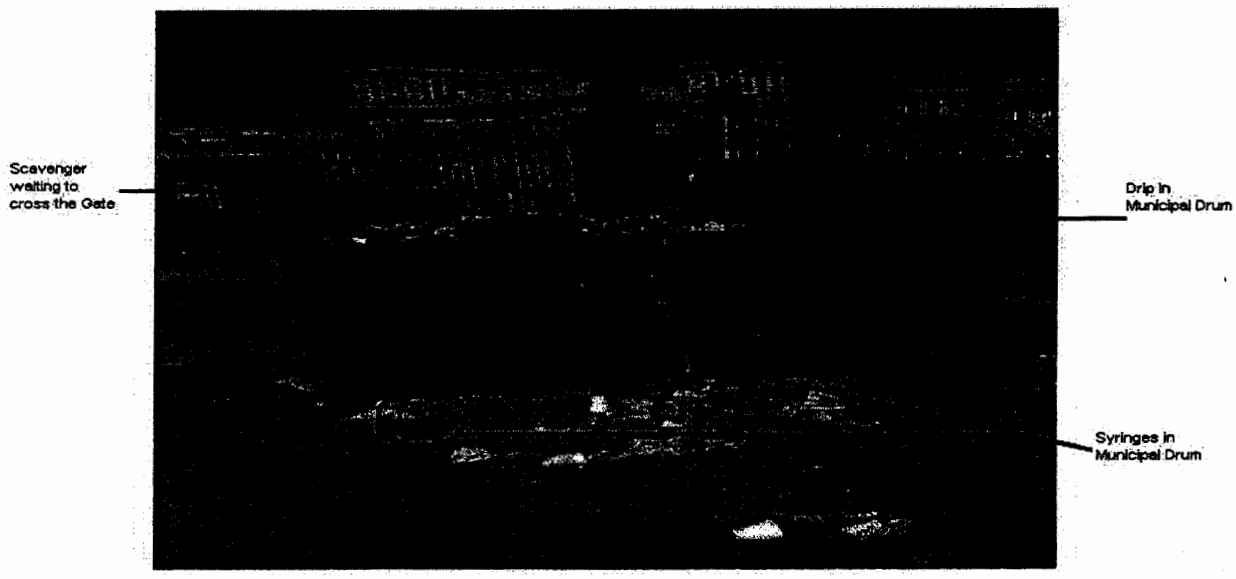

Fig 7.1: Municipality container at Holy Family Hospital Rawalpindi

7.5 Primary collection and storage

In Holy Family Hospital, segregated wastes are collected by the employed workers of the Holy Family Hospital. These waste handlers are usually the cleaners. They are unaware of the hazards associated with handling health care wastes and only do their jobs as duty. They are supplied with protective clothing but they are careless to use. They were not properly trained for importance of protective equipment, so they are unaware about hazardous effects on their health.

The workers only know about their duties and safety measures for collection and segregation of hazardous wastes, and have not been trained about causes of these precautionary measures, which they have to consider. That's why they behave hastily to use preventive measures during hazardous waste collection and segregation.

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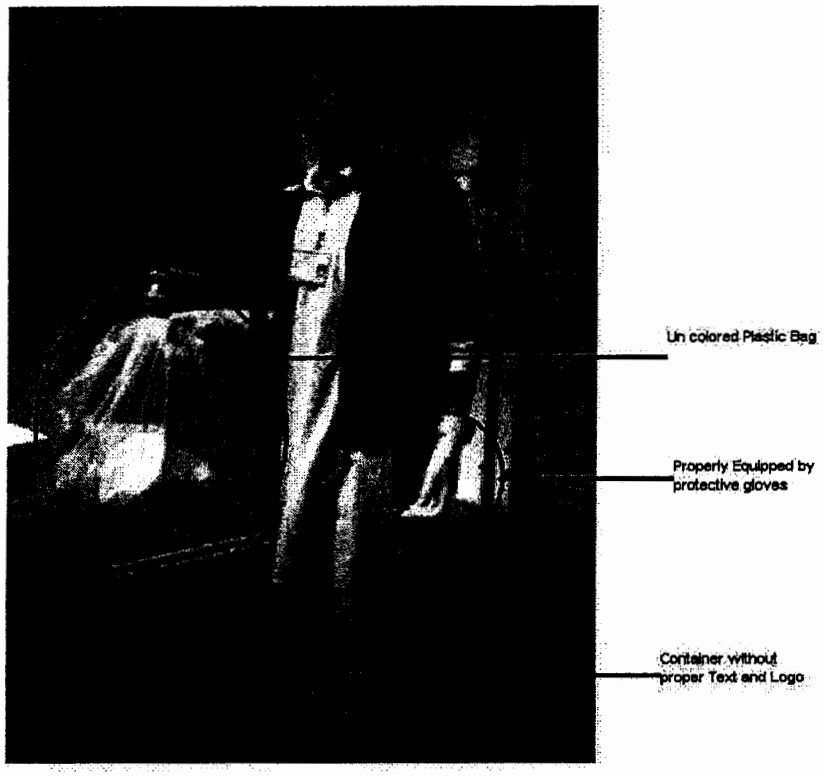

Fig 7.2: Sanitary worker collecting segregated waste from the yellow bin

Waste collected from the departments and wards in Holy Family Hospital is stored temporarily in the storage room that's located adjacent to incinerator's room. This storage room has been designed for the hazardous waste storage, that's properly covered, and secured. After transport of waste to storage room by the trolleys, waste has to be there till incinerator is ready to be used or enough waste is collected to incinerate. Plastic bags containing Hazardous wastes frequently split and spill toxic liquid and this is noticed at central storage room, which is harmful to the workers health.

to the hospital specially nursing students and visitors of Holy Family Hospital. The building of incinerator is mentioned in plate 7.3 below:

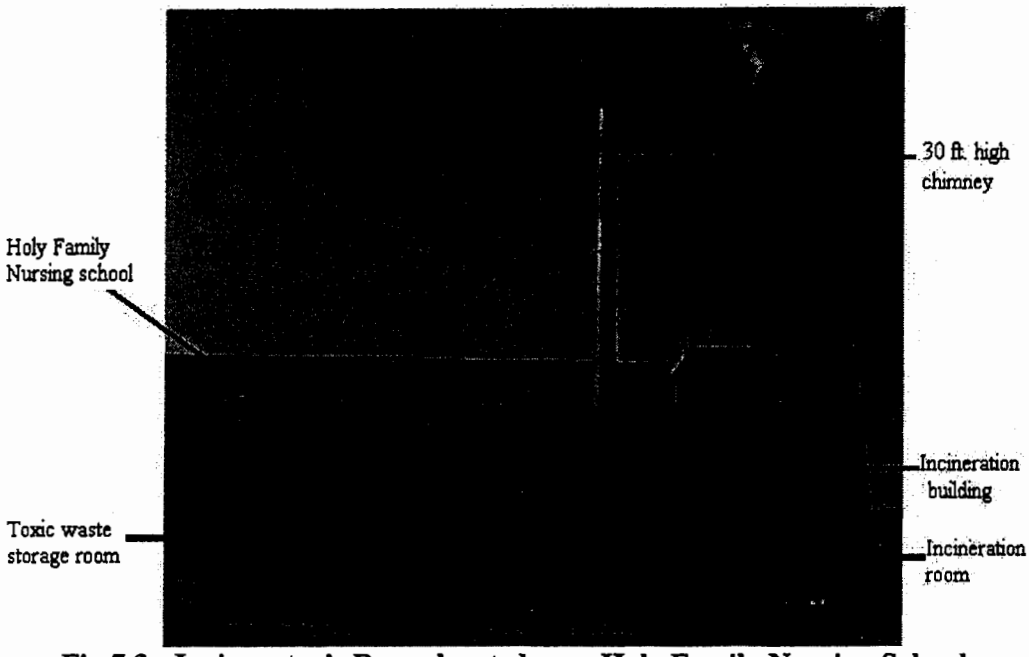

Fig 7.3: Incinerator's Room located near Holy Family Nursing School emitting residues through the chimney

During my ten to twelve visits to the Holy Family Hospital from the month of September to July 2009, two to three scavengers were found in different visits near the municipality container, collecting the recyclables and there was no watchman to stop them.

7.7 Strengths and weaknesses

The Holy Family Hospital lacks need of awareness for efficient health care waste handling and disposal at all levels of management. Doctors, health care workers and nurses need adequate training so that they can understand the involved risks in proper management of wastes and consequences of poor practices. Hospital staff must be made aware of the possibilities for the importance of the waste segregation at source. In addition they should be influenced to pay respect to the waste handlers to provide necessary protective equipment and make them understand serious effects on health while doing those works. The hospital has a better level of technological capacity and arranged workshops to train their workers for handling of Hazardous wastes.

The non-infectious waste handling is unsatisfactory as flies sit on the uncovered garbage. This promotes mechanical transmission of fatal diseases. Although

7.7 Strengths and weaknesses

The Holy Family Hospital lacks need of awareness for efficient health care waste handling and disposal at all levels of management. Doctors, health care workers and nurses need adequate training so that they can understand the involved risks in proper management of wastes and consequences of poor practices. Hospital staff must be made aware of the possibilities for the importance of the waste segregation at source. In addition they should be influenced to pay respect to the waste handlers to provide necessary protective equipment and make them understand serious effects on health while doing those works. The hospital has a better level of technological capacity and arranged workshops to train their workers for handling of Hazardous wastes.

The non-infectious waste handling is unsatisfactory as flies sit on the uncovered garbage. This promotes mechanical transmission of fatal diseases. Although arrangements like workshops, meetings with WHO and CEHA have been made in Holy Family Hospital for the effective management of hospital waste, but the ultimate goal of controlling the infectious and non infectious waste is needed to be improved.

RECOMMENDATIONS

RECOMMENDATIONS

8.1 Plan

The report draws the findings of research in Holy Family Hospital, Rawalpindi. The techniques and systems applied for segregation, storage, collection and disposal of waste generated in the hospital focused on the role of waste management. It is clear that the management is not satisfactorily managing the health care wastes according to the HWM rules 2005. The Holy Family Hospital has to follow all the HWM rules 2005 and guidelines of the WHO strictly to remain in compliance.

8.2 Awareness

The general awareness of the environmental and health risks resulting from poor hospital waste management practices is limited at all level of management. A lack of knowledge about and concern for the handling, effects of infections and hazardous health care waste by the administrators, doctors, nurses, cleaners and waste handlers gives rise to serious health problems among the staff of the hospital and around the neighbor hood community.

8.3 Training

The staff and workers of Holy Family Hospital should be given proper training and training should include the use of personal protective equipment and motivate them towards the advantages of using personal protective equipment and to ensure them that these are for their own safety.

Holy Family Hospital should designate one full time infection control officer and a waste management team for proper hospital waste compliance. Hazardous waste logo should also be mentioned on the waste collecting containers and transport trolleys. Specific colored plastic bags with logo should be lined up in the bins for the prevention of any mistake.

8.4 Waste Management System Improvements

Holy Family Hospital needs some improvements for best Hospital waste management practice.

1) They should designate personnel on the vacant posts of waste management team as required by the HWM rules 2005 and WHO guidelines, which will

helpful for regular monitoring of sanitation workers and upgrading of waste management Plan. It will help to review the rules and regulations mentioned in HWM rules 2005 for improving the waste management conditions in the hospital and fulfill the regulatory compliance.

2) There should be the proper waste management team for efficient hospital waste management. The Waste management team will be responsible for waste management due to awareness of pollution prevention needs rather than only concentrate on completion of their duties like sweeping and cleaning.
3) There should be the allocation of sufficient financial and manpower resources to ensure the efficient and effective implementation of the waste management plan.
4) The containers should be properly labeled in each ward because labeled containers were found only in some wards.
5) Ensure adequate training and refresher courses for all staff and make them aware about the consequences of improper hazardous waste management, as even doctors, nurses, Maid and sweepers are unfamiliar about its hazardous nature and its associated risks.
6) Emphasis should be put on the reduction of waste.
7) Workers safety should be ensured through education, training for proper waste management and effects of not using proper personal protective equipment to their health.
8) Promote the recycling but by efficient planning and by specific employees for segregation and collection of recyclable material.
9) Waste management and its needs related educational posters should be available to all wards as well as theaters and on main locations of housekeeping.
10) There should be careful registration of the accidents to prevent future possibilities of accidents and proper records should be kept.
11) There should be the separate infection control department in the Holy Family Hospital to develop comprehensive programs for identifying problem areas and to take preventive measures for improper waste handling.

12) The gap between different departments of doctors, waste management teams, administration and pharmaceutical departments should be removed for creating awareness among all levels of Hospital.
13) The ash produced during incineration should be properly disposed off immediately, through appropriate choice of land filling and avoid dumping of ash in vicinity of Holy Family Hospital as it can cause soil and ground water contamination, leaching, air pollution and respiratory and skin diseases to the neighborhood community and hospital staff.
14) The ash should be properly disposed of outside the city by proper covered transport facility in the proper lined Landfill. Sanitary landfill must be designed to prevent contamination of soil, air and ground water.
15) Avoid splitting and spill from bags during storage of wastes by covering waste in double bags or in steel containers.
16) Provide prior treatment to the waste like autoclaving and chemical disinfection before disposal.
17) Adopt the Composting Technique as disposal method for non-hazardous material, it will also be useful to maximize the economy by selling the compost.
18) Wastewater should also be properly disposed of and small quantities of liquid wastes must be treated by sterilization before disposal.
19) Through sale of non-hazardous wastes like used tins, non-contaminated plastics, waste food etc. A recurring income can also be generated.
20) The boiled water released from incinerator can also be utilized for energy production. The produced energy can be utilized by Holy Family Hospital and help for room heating and in reduction of the expenses used for paying electricity bills.
21) Facilitate the sanitation workers by allowances and respect to prevent them from illegal practices such as selling used syringes or other items.
22) There should be the emergency departments for treatment of workers in any accident like explosions and burn and puncture injuries etc.
23) Holy Family Hospital should make a policy with commitment to prevent health and safety issues in the hospital.
24) Incinerator emission gas should be regularly tested for regulatory compliance.

25) There should be the proper institutional decision making framework in Holy Family Hospital, Rawalpindi.

REFERENCES

Abu-Gad, A.H and Al-Turki and A.K. (2001). Some epidemiological aspects of needle stick injuries among the hospital health care workers: Eastern Province, Saudia Arabia. *European Journal of Epidemiology*.**17**:401-407.

Alagoz, A.Z. (2008). Determination of the best appropriate management methods for the health care wastes in Istanbul.*Waste Management.*

Byun, H.Y, Lee, K.J, Lee, S.H, Lee YH, Kang, U.G, Lee, B.M, Hwang, H.J, Park, R.W and Park, P ( ). Advanced points of care system for reducing Adverse Drug Events using 13.56/900 MHz RFID,WI-FI,Text-To-Speech Technology in Ajou University Hospital.*IFMBE Proceedings.***1**:335-338

Coker A, Sangodoyan A, Sridhar M, Booth C, Hammond F and Olomolaiye P (2009). Medical Waste Management in Ibadan, Nigeria: Obstacles and Prospects.*Waste Management.***29**:804-811.

Das, N.K, Prasad, S. and Jayaram, K.(1998). A TQM approach to implementation of handling and management of hospital waste in TATA main hospital"

Gupta,S., Boojh, R., Mishra, A. and Chandra, H. (2009). Rules and management of biomedical waste at Vivekananda Polyclinic: A case study. *Waste Management.* **29**:812-819.

http://www.wwfpak.org/factsheets_hwf.php

Kermode, M., Holmes, W., Langkham, B., Thomson, M. and Giffard, S. (2005). Safer injections, fewer infections: injection safety in rural north. Tropical medicine and International Health.**10**:423-432.

Li, J., Bai, Q. and Nie, Y.(2002). Future Solutions for the treatment and disposal of hazardous wastes in China. *Environmental Management.***29**:501-507

GoP, Notification S.R.O.1013 (2005), (Ministry of Environment)

Pescod, M.B. and Dr.Saw, C.B.(1998).Hospital waste management –A Synthesis Report. *Waste.*

Qdais, H.A, Rabi, A and Abdulla, F. (2006).Characteristics of the medical waste generated at the Jordanian Hospitals.*Springer.*

Svetlana, R.(2000).The state of technological sophistication and the need for the new specialized tertiary degrees in food services. *International journal of Hospitality Managament.***28**:71-77

Sysr, J.M.(2008).Technical Efficiency and Productivity of hospitals.*SpringerLink*.**32**:509-519

Toux, M. and Pavlas, M.(2008). Efficient waste to energy system as a contribution to clean technologies. *Clean Tech Environ Policy*.**11**:19-29