

# **ENVIRONMENTAL AUDITING AS A MANAGEMENT TOOL FOR EVALUATION OF CATEGORY WISE BIOMEDICAL WASTE [BMW RULES, 1998] AND ITS PRACTICES IN HOSPITALS IN INDIA**

## **ENVIRONMENTAL AUDITING AS A TOOL TO EVALUATE BIO-MEDICAL WASTE**

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**ABSTRACT** The Biomedical waste (BMW) means any waste, which is generated during the diagnosis, treatment or immunization of human beings or animals or in research activities pertaining thereto in the production or testing of biological and including categories mentioned in schedule I of the Rules<sup>1</sup>. Biomedical waste being generated is potentially hazardous and toxic in nature transmitting various diseases to the residents where it is thrown and dumped. Environmental auditing is a periodic, documented and systematic approach in the management of waste. The data collected for ten categories of waste and study of various waste disposal mechanisms, collection and treatment helps us to have an approach for waste minimization and reduction. Ministry of Environment and Forests (MOEF) has formulated biomedical waste rules, 1998 for management of medical waste. The general approach for environmental audit activities covers three main phases namely collection of information, evaluation of information collected and formulation of conclusions. These three phases are carried out as three steps of Environmental Audit study which plays a great role in the management of biomedical waste. It is a management tool for waste minimization and the reduction of the same.

**KEYWORDS** Biomedical waste, Biomedical waste Rules, immunization, potentially hazardous, diagnosis, Environmental auditing and waste minimization.

**INTRODUCTION** Environmental health and safety auditing dates back to the early 1970s when some companies developed audit programs for reviewing and evaluating environmental problems associated with their operations. This concept got projected under different approaches and names such as environmental reviews, survey assessments, quality controls, environmental diagnostic studies depending on the audit programs of the company concerned. The definition of environmental auditing adopted by International Chamber of Commerce in its publication Environmental Auditing (1989) <sup>2</sup>is as follows: A management tool comprising a systematic, documented, periodic and objective evaluation of how well environmental organization, management systems and equipment are performing with the aim of facilitating management control of environmental practices and compliance with the company policies including meeting regulatory requirements.

## **PRESENT STATUS OF BIOMEDICAL WASTE**

Issue of biomedical waste need to be addressed and dealt wisely. The problem of medical waste has acquired huge proportions and complex dimensions. Everyday country's numerous hospitals churn out tons of waste. The disposable syringe one uses with a sense of security may actually be false as these might be repacked in medical waste trafficking. Unmutilated and untreated syringes in the municipal dump may come back in the hospitals and may be used again. Medical waste mismanagement is not only linked with the spread of infectious

agents like HIV but also with indirect problems like endocrine disruption, cancers, reproductive disorders and nervous disorders. Equipments and chemicals used in hospitals like mercury containing instruments, radioactive, cytotoxic drugs etc pose a big threat if not disposed of properly. The most dangerous of all is the needle and sharp waste capable of transmitting infections. Occupational health hazards to health care workers can be reduced to a greater extent by management of health care waste. Rag pickers and others associated with medical waste collection benefit from a proper waste disposal mechanism. Due to infected medical waste in municipal dumps these rag pickers have been exposed to infections. This reflects on the alarming rate with which infectious diseases can be transmitted in the society due to mixing of medical waste with the municipal component. Rules for the management of this waste exist what is needed now is training of all the healthcare staff and setting up of a waste management system in the hospitals.

Health care workers are prone to a lot of problems with medical waste management. Their work may expose them to infectious disease transmission through needle sticks, radiation exposure, diagnostic and therapeutic radio-isotopes, chemotherapy drugs, chemical disinfectants etc.

If the hospitals fail to manage biomedical waste large chunk of this waste reaches municipal dumps where it increases the danger of spread of infection to the community.

## **RELEVANCE OF ENVIRONMENTAL AUDIT OF BIOMEDICAL WASTE**

Environmental auditing plays a great role in the management of biomedical waste as it has become evident from the studies and research carried out in this field that the periodic, documented and systematic approach in the management of waste helps us to have an approach for the waste minimization and the reduction of the same. The data collected for the ten categories of waste<sup>3</sup> and in depth study of the various waste disposal mechanisms, collection and treatment and the technology available helps us to take desired steps. The Ministry Of Environment and Forests has taken the steps in this direction for formulating the BMW rules, 1998<sup>4</sup> that help the hospitals to manage their wastes properly and reduce the pressure on the environment by posing lesser risk to the environment.

## **PURPOSE OF ENVIRONMENTAL AUDIT**

1. Compilation of the complete information on the operational facilities
2. Evaluation of the conditions surrounding the facility to estimate the possible impacts
3. Preparation of the action plan for better control of the environment.

This includes all the work that has been carried out in the project either qualitatively or quantitatively and analysis of whole data is done using statistical formulae wherever required. This waste is being collected, segregated and disposed of by the rules of biomedical waste which segregates this waste category wise on a scale of 1-10.

## **ENVIRONMENTAL AUDIT METHODOLOGY**

The general approach for environmental audit activities covers three main phases namely collection of information, evaluation of information collected and formulation of conclusions. These three phases are carried out as three steps of Environmental Audit study which plays a great role in the management of biomedical waste. It is a management tool for waste minimization and the reduction of the same. These three steps are as follows-

**a) Pre-Audit Methodology** involves the preparation of questionnaire based on the factors covering the following aspects:-

- Quantum of waste being generated
- Waste disposal facilities
- Segregation of waste category wise or quality wise
- Biomedical waste rules
- Auditing probes.

**b) On-site methodology** involves

- Summary of each hospital one by one giving each the time of 4-7 days.
- Inventory of each ward and the quantity being generated as per records available
- Differentiation of waste quality wise/category wise as per 1998 BMW Rules
- Evaluation of waste disposal facilities quantity wise
- Evaluation of wastes with respect to potential dangers to human health
- Analysis of existing waste management practices.

**c) Post Audit Methodology** involves

- Preparation of Audit report
- Recommendations regarding management system and waste disposal facilities

## **STUDY OF BIOMEDICAL WASTE MANAGEMENT IN HOSPITALS/NURSING HOMES**

### **SITE SELECTION**

Private hospitals and nursing homes small or big are coming up speedily with all the modern facilities. These towns provide adequate sites and proper samples for the study. Bhopal district is almost 80% urbanized with most people living in the city of Bhopal. As the principal city of the region, it serves all towns and districts around, then nearest large city of Indore being about 180 km. to west<sup>5</sup>. There are no proper waste management practices being followed in the hospitals of M.P. even after the implementation of Bio-medical Waste (Management & Handling) Rules, 1998 by the government. This was confirmed by the surveys done in these hospitals but the conditions were worst in the government managed hospitals as compared to privately managed hospitals. So a comparative analysis study is taken up for the government run and private hospitals/nursing homes of two major towns of Madhya Pradesh.

### **STUDY AREA**

Bhopal, the administrative capital of M.P. and Indore the industrial capital of the state has been selected for the study area. The present study has been carried out in six hospitals of Bhopal and Indore cities, three hospitals of each study area were chosen. Out of these three one is government hospital and other two are private hospitals of each city. In total four hospitals of study area are private and two are government hospitals.

The hospitals are chosen mainly in which the average number of the beds are in the range of 300-950 for four hospitals and less than 300 for two hospitals. The respondents were a group of people in each of the hospitals that included doctors, nurses, ward boys and management personnel. Each of them was given a set of questionnaire to be filled up by them, giving the

details of hospital management in general and biomedical waste management in particular. The set of questionnaire was prepared only after consulting State Pollution Control Board (SPCB) and Central Pollution Control Board (CPCB) officials, making visits to the hospitals, contacting them for inventory and finalizing questionnaire set with them for data collection.

1. HAMIDIA HOSPITAL **GOVERNMENT** (885 Beds) **BHOPAL**
2. M.Y.HOSPITAL **GOVERNMENT** (917Beds) **INDORE**
3. KASTURBA HOSPITAL (BHEL), **PRIVATE** (350 Beds) **BHOPAL**
4. PEOPLES' GENERAL HOSPITAL **PRIVATE** (100 Beds) **BHOPAL**
5. CHOITRAM HOSPITAL **PRIVATE** (250 Beds) **INDORE**
6. GOKULDAS HOSPITAL LTD. **PRIVATE** (130 Beds) **INDORE**

## **ENVIRONMENTAL AUDIT METHODOLOGY FOR BMW DATA COLLECTION**

### **1.Data collection for Pre-Audit part**

The data was collected from Central Pollution Control Board and State Pollution Control Board offices of Bhopal and Indore cities. This mainly included the inventories having schedules, questionnaires, Central Pollution Control Board reports etc. Hospital records were collected which included the quantity wise waste being generated from the hospitals.

### **2.Data collection for On Site-Audit part**

The data collected through questionnaires prepared by contacting management authorities, doctors, nurses and ward boys. Questionnaires were both close ended (giving options/y or n) and open ended (questions prepared specifically for data collection).

### **3.Data collection for Post -Audit part**

The Quantitative data (Inventory of waste) of all the hospitals can be utilized to calculate it statistically taking up various variables converting it into a usable form for interpretation and analytical purposes reaching at the conclusion. The three important profile scores were developed using statistical equations which are given in the result and discussion section.

1. Risk Potential Score for all the hospitals.
2. Percentage profile of each Category waste in six hospitals
3. Performance profile of each hospital on Total Waste generation in each hospital

The Qualitative data (Certifications) of all the hospitals is analyzed by studying their management systems and various certifications which they adhere to or made mandatory by the government.

1. Study of present waste disposal mechanisms
2. Study of Management systems being followed in the hospitals

## OBSERVATIONS FROM THE SURVEYS

The total waste being generated is quantified by the different category waste. The segregation, collection, treatment and disposal of each waste category were studied and all the data collected is given in the table form for each of the hospital of the two towns.

### I. INVENTORY OF WASTE FOR KASTURBA HOSPITAL (BHEL), BHOPAL, PVT (350 bedded)

CATEGORY WASTE	SEGREGATION	WASTE/DAY(KG)	COLLECTION / TREATMENT	DISPOSAL
Category 1	Human Anatomical Waste	3-4	Yellow bags Collected by Bhopal Incinerators Ltd. -	Ash by deep burial or goes to municipal waste
Category 2	Animal Waste	0	-	-
Category 3	Microbiology & Biotechnology Waste	5-10	Yellow bags Collected by Bhopal Incinerators Ltd.	Organic manure formation
Category 4	Waste Sharps Needles, bottles broken glassware	30-40	In puncture proof blue containers Needles, sharps mutilated and disinfected by hypochlorite	Broken glass recycled
Category 5	Discarded Medicines and Cytotoxic drugs	0.5-1	Black bags No special treatment	Disposed in secured landfill
Category 6	Soiled Waste (items contaminated with blood, cotton linens)	25-30	Red bags Collected by Bhopal Incinerators Ltd.	Ash by deep burial or goes to municipal waste
Category 7	Solid Waste (Waste generated from disposal items)	180	Buckets with hypochlorite solution Decontamination with the hypochlorite	Plastic bottles and tubing sent for recycling after disinfecting and mutilation
Category 8	Liquid Waste	4	Goes to sewerage with ETP at Barkhera	Discharge into drains
Category 9	Incineration Ash	0	-	-

Category 10	Chemical Waste	10lit.	- - -	For disinfection purpose discharge into drain to ETP
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## WASTE DISPOSAL FACILITIES AND MANAGEMENT SYSTEM IN HOSPITAL

HOSPITAL	WASTE DISPOSAL FACILITIES	MANAGEMENT SYSTEM
<u>KASTURBA HOSPITAL(BHEL),BHOPAL,PVT</u>	Entered into contract with Bhopal Incinerators Ltd	Got ISO 14001 and OHSAS 18001. Entered into contract with Eureka Forbes Ltd. For cleaning services.

## II.INVENTORY OF WASTE FOR PEOPLES' GENERAL HOSPITAL, BHOPAL, PVT. (100)

CATEGORY WASTE	SEGREGATION	WASTE/DAY(K G)	COLLECTION /	TREATMENT	DISPOSAL
Category 1	Human Anatomical Waste	3	Yellow bags	Incinerator working in the old hospital	Ash by deep burial or goes to municipal waste
Category 2	Animal Waste	0			
Category 3	Microbiology & Biotechnology Waste	1	Yellow bags	Treatment in their hospital	
Category 4	Waste Sharps Needles,bottles, broken glassware	0.5	In puncture proof blue containers	Needles,sharps mutilated and disinfected by hypochlorite	Broken glass recycled
Category 5	Discarded Medicines and Cytotoxic drugs	0.5	Black bags	No special treatment	Disposed in secured landfill
Category 6	Soiled Waste (items contaminated with blood, cotton linens	3	Red bags	Taken to their own incinerator	Ash by deep burial or goes to municipal waste
Category 7	Solid Waste (Waste generated from disposal items	0.5	Buckets with hypochlorite solution	Decontamination with the hypochlorite	Plastic bottles and tubing sent for recycling after disinfecting and mutilation
Category 8	Liquid Waste	2	Goes to sewerage		Discharge into drains
Category 9	Incineration Ash	0	-	-	-
Category 10	Chemical Waste	1.5lit			Discharge into drain

**WASTE DISPOSAL FACILITIES AND MANAGEMENT SYSTEM IN HOSPITAL**

HOSPITAL	WASTE DISPOSAL FACILITIES	MANAGEMENT SYSTEM
<u>PEOPLES' GENERAL HOSPITAL, BHOPAL, PVT.</u>	1.Incinerator(1) 2.Autoclave 3.Needle cutters	In the process for applying ISO 9000 SERIES, Total Quality Management System

**III.INVENTORY OF WASTE FOR HAMIDIA HOSPITAL,BHOPAL,GOVT.(885)**

CATEGORY WASTE	SEGREGATION	WASTE/DAY(K G)	COLLECTION /	TREATMENT	DISPOSAL
Category 1	Human Anatomical Waste	300		Incineration	
Category 2	Animal Waste	0			
Category 3	Microbiology & Biotechnology Waste	100	No collection facility	No treatment facility	No disposal system
Category 4	Waste Sharps Needles,bottles, broken glassware	300	No collection facility	No treatment facility	No disposal system
Category 5	Discarded Medicines and Cytotoxic drugs	250	No collection facility	No treatment facility	No disposal system
Category 6	Soiled Waste (items contaminated with blood, cotton linens	2000		Incineration	
Category 7	Solid Waste (Waste generated from disposal items	1500	No collection facility	No treatment facility	No disposal system
Category 8	Liquid Waste	150	No collection facility	No treatment facility	Discharge into drains
Category 9	Incineration Ash	20	No collection facility	No treatment facility	No disposal system
Category 10	Chemical Waste	100			Discharge into drains

**WASTE DISPOSAL FACILITIES AND MANAGEMENT SYSTEM IN HOSPITAL**

HOSPITAL	WASTE DISPOSAL FACILITIES	MANAGEMENT SYSTEM
<u>HAMIDIA HOSPITAL,BHOPAL,GOVT</u>	Incinerator(1)	No Existing Management System

**IV. INVENTORY OF WASTE FOR CHOITRAM HOSPITAL, INDORE, PVT. (250)**

CATEGORY WASTE	SEGREGATION	WASTE/DAY(K G)	COLLECTION /	TREATMENT	DISPOSAL
Category 1	Human Anatomical Waste	4-5	Yellow bags	Incineration	Ash by deep burial or goes to municipal waste
Category 2	Animal Waste	0			
Category 3	Microbiology & Biotechnology Waste	20	Yellow bags	Autoclaving	Organic manure formation
Category 4	Waste Sharps	200	In puncture proof blue containers	Needles, sharps mutilated and disinfected by hypochlorite	Broken glass recycled
Category 5	Discarded Medicines and Cytotoxic drugs	0.5-1	Black bags	No special treatment	Disposed in secured landfill
Category 6	Soiled Waste (items contaminated with blood, cotton linens)	25-30	Red bags	Taken to their own incinerator	Ash by deep burial or goes to municipal waste
Category 7	Solid Waste (Waste generated from disposal items)	180	Buckets with hypochlorite solution	Decontamination with the hypochlorite	Plastic bottles and tubing sent for recycling after disinfecting and mutilation
Category 8	Liquid Waste	-	Goes to sewerage with ETP connected		Discharge into drains
Category 9	Incineration Ash	8-10	No collection facility	No treatment facility	Ash by deep burial or goes to municipal waste
Category 10	Chemical Waste	20-24lit			For disinfection purpose discharge into drain to ETP

**WASTE DISPOSAL FACILITIES AND MANAGEMENT SYSTEM IN HOSPITAL**

HOSPITAL	WASTE DISPOSAL FACILITIES	MANAGEMENT SYSTEM
<u>CHOITRAM HOSPITAL, INDORE, PVT</u>	Incinerator(1), Autoclave, Needle cutters, Microwave, ETP	Got ISO 14001 EMS



**V.INVENTORY OF WASTE FOR GOKULDAS HOSPITAL LTD.,INDORE,PVT(130)**

CATEGORY WASTE	SEGREGATION	WASTE/DAY(K G)	COLLECTION /	TREATMENT	DISPOSAL
Category 1	Human Anatomical Waste	1	Yellow bags	HOSWIN Incinerator Pvt.Ltd	-
Category 2	Animal Waste	0	-	-	-
Category 3	Microbiology & Biotechnology Waste	1	Yellow bags	Autoclaving	
Category 4	Waste Sharps	6	In puncture proof blue containers	Needles,sharps mutilated and disinfected by hypochlorite	Broken glass recycled
Category 5	Discarded Medicines and Cytotoxic drugs	0			
Category 6	Soiled Waste (items contaminated with blood, cotton linens)	60	Red bags	Taken HOSWIN Incinerator Pvt.Ltd	Ash by deep burial or goes to municipal waste
Category 7	Solid Waste (Waste generated from disposal items)	10	Buckets with hypochlorite solution	Decontamination with the hypochlorite	Plastic bottles and tubing sent for recycling after disinfecting and mutilation
Category 8	Liquid Waste	3kl/day	Goes to sewerage with ETP connected		Discharge into drains
Category 9	Incineration Ash	-	No collection facility	No treatment facility	
Category 10	Chemical Waste	20-25lit			For disinfection purpose discharge into drain to ETP

**WASTE DISPOSAL FACILITIES AND MANAGEMENT SYSTEM IN HOSPITAL**

HOSPITAL	WASTE DISPOSAL FACILITIES	MANAGEMENT SYSTEM
<b>GOKULDAS HOSPITAL LTD.,INDORE,PVT</b>	<b>1. Contract with HOSWIN Incinerator Pvt.Ltd.for the safe disposal of waste.</b>  <b>2.Needle cutters in all the units</b>	<b>In the process of applying ISO 14001</b>

**VI. INVENTORY OF WASTE FOR M.Y. HOSPITAL, INDORE, GOVT (917)**

CATEGORY WASTE	SEGREGATION	WASTE/DAY(K G)	COLLECTION /	TREATMENT	DISPOSAL
Category 1	Human Anatomical Waste	200	No collection facility	No Incineration	No disposal system
Category 2	Animal Waste	0	-	-	-
Category 3	Microbiology & Biotechnology Waste	100	No collection facility	No treatment facility	No disposal system
Category 4	Waste Sharps	300	No collection facility	No treatment facility	No disposal system
Category 5	Discarded Medicines and Cytotoxic drugs	200	No collection facility	No treatment facility	No disposal system
Category 6	Soiled Waste (items contaminated with blood, cotton linens)	2000-2500	No collection facility	No treatment facility	No disposal system
Category 7	Solid Waste (Waste generated from disposal items)	1200	No collection facility	No treatment facility	No disposal system
Category 8	Liquid Waste	90	No collection facility	No treatment facility	Discharge into drains
Category 9	Incineration Ash	0	No collection facility	No treatment facility	No disposal system
Category 10	Chemical Waste	50	-	-	Discharge into drains

**WASTE DISPOSAL FACILITIES AND MANAGEMENT SYSTEM IN HOSPITAL**

HOSPITAL	WASTE DISPOSAL FACILITIES	MANAGEMENT SYSTEM
<u>M.Y.HOSPITAL, INDORE, GOVT</u>	Incinerator(1)	No Existing Management System

## RESULTS AND DISCUSSIONS

### RESULT I-

#### CALCULATION OF RISK POTENTIAL SCORE

This score depend on the total waste being generated from each of the hospitals being taken into consideration and the score given to each of the hospital on the ranking of State Pollution Control Board

Evaluation of this risk potential score was done by giving the category waste rank and score. The scale was developed on which all the six hospitals were evaluated following the criteria of-

- A. Quantity of each category of waste being generated in all the six hospitals.
- B.Importance given to each category of waste w.r.t. environmental pollution.

The following is the nine point scale developed foe pair wise comparisons for capturing the importance of various category of waste w.r.t. environmental pollution.

The table is developed for the category of waste by categorizing them on the basis of their intensity of importance from equal importance to extreme importance of the waste by its potential hazard and then converting this intensity of importance ranking to score designated on that scale from 1-9

**The intensity of importance is given to the category waste in ranking based on their potential hazard to the environmental pollution. The score is developed from 1-9 scale giving score 9 to waste category of extreme hazard and giving score 1 to waste category of least or equal importance**

Table formulated for developing score on the basis of intensity of importance of waste

Intensity of importance	Definition	Score (R)
I	Extreme importance	9
II	Very to extremely strong importance	8
III	Very strong importance	7
IV	Strong to Very strong importance	6
V	Strong importance	5
VI	Moderate to strong importance	4
VII	Moderate importance	3
VIII	Equal to Moderate importance	2
IX	Equal importance	1

**Table formed on the basis of ranks and score given by State Pollution Control Board (SPCB) to each category of waste**

Catg waste	Ranking SPCB	Score developed	Peoples Total waste Kg/day	Choitram Total waste Kg/day	Gokuldas Total waste Kg/day	Hamidia Total waste Kg/day	M.Y. Total waste Kg/day	BHEL Total waste Kg/day
1	VI	4	3	5	0.83	300	200	4
2	VI	4	0	0	0	0	0	0
3	I	9	1	20	0.03	100	100	10
4	I	9	0.5	15	0.2	300	300	40
5	IX	1	0.5	1	0	250	200	1
6	II	8	3	30	2	2000	2500	30
7	VIII	2	0.5	15	0.3	1500	1200	180
8	IV	6	2	8.4	3	150	90	4
9	IX	1	0	10	0	20	0	0
10	VII	3	1.5	24	0.5	100	50	10
		$W_i$	$X_1$	$X_2$	$X_3$	$X_4$	$X_5$	$X_6$

The evaluation equation becomes

$$RP = \frac{\sum W_i X_i}{\sum W_i}$$

*RP = Risk potential of a waste category*

*$W_i$  = Score assigned to a category of waste*

*$X_i = X_1 X_2 X_3 X_4 X_5 X_6$  is the quantity of waste generated in each category*

1.  $RP_4$  = Risk potential of Hamidia hospital = 100.42

2.  $RP_5$  = Risk potential of MY hospital = 98.72

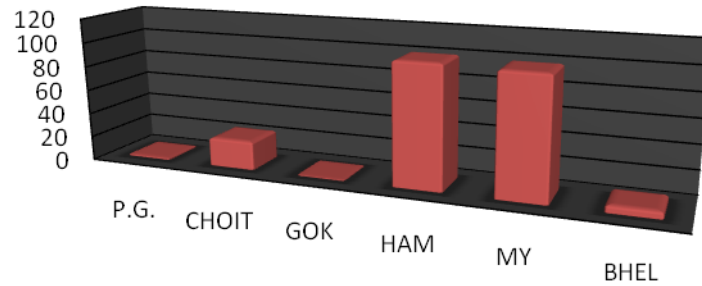
3.  $RP_6$  = Risk potential of Kasturba, BHEL hospital = 5.936

4.  $RP_1$  = Risk potential of Peoples general hospital = 1.436

5.  $RP_2$  = Risk potential of Choitram hospital = 23.87

6.  $RP_3$  = Risk potential of Gokuldas hospital = 0.88

## RISK POTENTIAL PROFILE



	P.G.	CHOIT	GOK	HAM	MY	BHEL
RISK POTENTIAL PROFILE	1.436	23.87	0.88	100.4	98.72	5.936

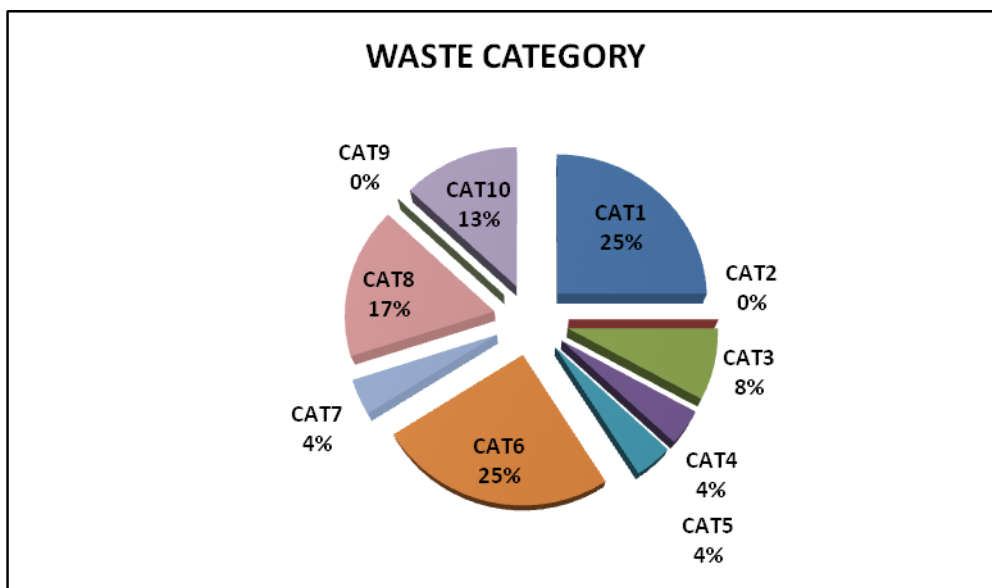
### DISCUSSION-

The chart shows the comparative risk analysis of all the hospitals depending on the total waste being generated from them by comparisons of their risk potential scores.

1. HAMIDIA HOSPITAL BHOPAL, GOVT =100
2. M.Y.HOSPITAL,INDORE,GOVT(917)=98.72
3. CHOITRAM HOSPITAL, INDORE, PVT.(250)=23.87
4. KASTURBA HOSPITAL(BHEL),BHOPAL,PVT(350 bedded)=5.936
5. PEOPLES' GENERAL HOSPITAL, BHOPAL,PVT(100)=1.436
6. GOKULDAS HOSPITAL LTD.,INDORE,PVT=0.88

**RESULT II-****PERCENTAGE PROFILE OF CATEGORY WASTE IN THE SIX HOSPITALS**

CATEGORY WASTE	SEGREGATION	Percentage of waste in the six hospitals
Category 1	Human Anatomical Waste	25%
Category 2	Animal Waste	nil
Category 3	Microbiology & Biotechnology Waste	8%
Category 4	Waste Sharps Needles,bottles, broken glassware	4%
Category 5	Discarded Medicines and Cytotoxic drugs	4%
Category 6	Soiled Waste (items contaminated with blood, cotton linens	25%
Category 7	Solid Waste (Waste generated from disposal items	4%
Category 8	Liquid Waste	17%
Category 9	Incineration Ash	nil
Category 10	Chemical Waste	13%



**DISCUSSION-**

This profile shows the total category waste of each hospital being generated. The category 1 and category 6 wastes are generated maximum from all the six hospitals and their treatment and disposal involves the use of incinerators, autoclaves or microwaves.

**RESULT III-****III.PERFORMANCE PROFILE OF EACH HOSPITAL ON TOTAL WASTE GENERATION IN EACH HOSPITAL**

The following findings show the performance of each hospital taking number of beds as the input and total waste generated in each of the hospital as the output of the hospital. This performance profile takes into consideration the following two factors:

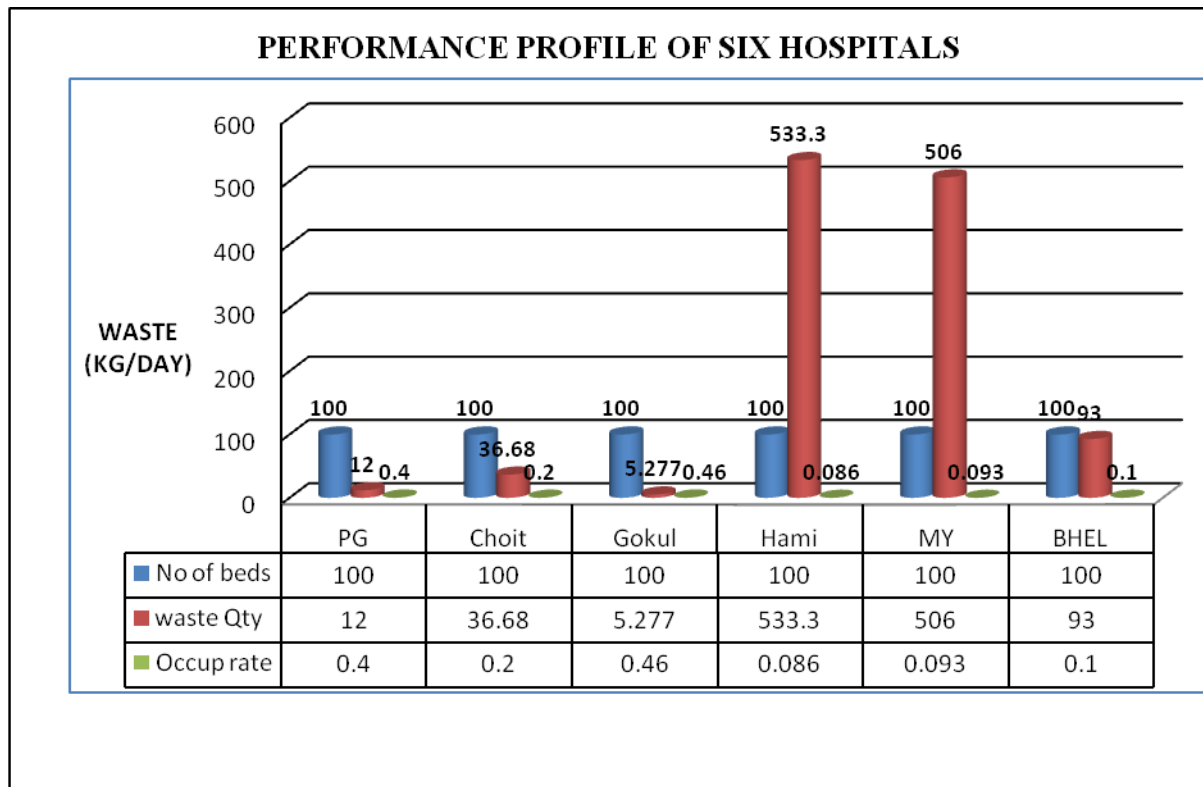
1. Total number of beds
2. Occupancy Rate

**SPCB INVENTORY OF NO. OF BEDS, TOTAL WASTE, OCCUPANCY RATE**

NO.	NAME OF HOSPITAL	NO OF BEDS	TOTAL WASTE GENERATE	OCCUPANCY RATE
1	PEOPLES' GENERAL HOSPITAL, BHOPAL	100	12	0.4
2	CHOITRAM HOSPITAL, INDORE, PVT	350	128.4	0.7
3	GOKULDAS HOSPITAL LTD., INDORE	130	6.86	0.6
4	HAMIDIA HOSPITAL, BHOPAL	885	4720	0.76
5	M.Y. HOSPITAL, INDORE	917	4640	0.85
6	KASTURBA HOSPITAL (BHEL), BHOPAL	300	279	0.3

**SPCB INVENTORY OF SIX HOSPITALS (TAKING NO OF BEDS CONSTANT)**

NO.	NAME OF HOSPITAL	NO OF BEDS	TOTAL WASTE GENERATE	OCCUPANCY RATE
1	PEOPLES' GENERAL HOSPITAL, BHOPAL	100	12	0.4
2	CHOITRAM HOSPITAL, INDORE, PVT	100	36.68	0.2
3	GOKULDAS HOSPITAL LTD., INDORE	100	5.277	0.46
4	HAMIDIA HOSPITAL, BHOPAL	100	533.3	0.086
5	M.Y. HOSPITAL, INDORE	100	505.99	0.093
6	KASTURBA HOSPITAL (BHEL), BHOPAL	100	93	0.1



## DISCUSSION-

Taking the number of beds constant the waste quantity generated by all the six hospitals is measured on a comparative scale by using bar chart column graph

- 1.The maximum amount of waste is generated by Hamidia hospital with the greatest value which is a government hospital and not functioning as per the Biomedical waste rules and its handling.
2. The second rank goes to MY hospital which is also a government run organization.
3. Gokuldas hospital of Indore is generating minimum biomedical waste from its hospital and managing the treatment and disposal of waste properly as per state rules

## CONCLUSIONS

### Conclusions that can be drawn from Result and Discussion

#### 1.RISK POTENTIAL SCORE

The risk potential score is maximum for Hamidia Hospital,Bhopal posing greatest danger to the environmental security and having maximum risk for causing environmental pollution and Gokuldas Hospital is least damaging to the environment having the minimum risk potential score.



## **RANKING OF ALL HOSPITALS ON RISK POTENTIAL SCORE**

<b>Name of the hospital</b>	<b>Rank</b>	<b>Score</b>
HAMIDIA HOSPITAL <b>GOVERNMENT</b> (885 Beds) <b>BHOPAL</b>	<b>I</b>	<b>100.42</b>
M.Y.HOSPITAL <b>GOVERNMENT</b> (917Beds) <b>INDORE</b>	<b>II</b>	<b>98.72</b>
CHOITRAM HOSPITAL <b>PRIVATE</b> (250 Beds) <b>INDORE</b>	<b>III</b>	<b>23.87</b>
KASTURBA HOSPITAL (BHEL), <b>PRIVATE</b> (350 Beds) <b>BHOPAL</b>	<b>IV</b>	<b>5.936</b>
PEOPLES' GENERAL HOSPITAL <b>PRIVATE</b> (100 Beds) <b>BHOPAL</b>	<b>V</b>	<b>1.436</b>
GOKULDAS HOSPITAL LTD. <b>PRIVATE</b> (130 Beds) <b>INDORE</b>	<b>VI</b>	<b>0.88</b>

### 2.CATEGORY WISE WASTE PROFILE

In the category wise waste generation maximum waste is in the Category 1(Human anatomical waste) and Category 6 (Solid waste) with 25% of the waste out of the total amount of waste being generated in all the six hospitals.

### 3.TOTAL WASTE PROFILE

The maximum amount of waste being generated taking the number of beds to be constant in each category waste is that by the Hamidia Hospital,Bhopal.

### 4. WASTE DISPOSAL FACILITIES

In the waste disposal facilities Choitram Hospital is the best having all the upgraded technologies and the maximum disposal facilities and all of them in all the working conditions.

## 5. WASTE MANAGEMENT PRACTICES

In the waste management practices Kasturba hospital ( BHEL) is the best having the ISO 14001 and OHSAS 18001 Certification for the better management of their processes and the hospital management

## REFERENCES

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