

ANALYSIS AND STRENGTHEN PROCESS FOR SAFETY OF HAZARDOUS CHEMICALS USED IN HOSPITAL

Dissertation Submitted to



The IIHMR University, Jaipur

for the partial fulfilment for the award of the
degree of Master of Business Administration

(MBA)

in

Hospital and Health Management

by

Mohd Aamir Khan

Under the Supervision and Guidance of

Dr Sandesh Kumar Sharma

Associate Professor, IIHMR University, Jaipur

2021

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DECLARATION BY STUDENT

I hereby declare that this dissertation titled “**Gap Analysis and Strengthen Process for Safety of Hazardous Chemicals used in Hospital**” is the bonafide record of my original research work. I declare that it has not been submitted to any other university or institution for the award of any degree or diploma. Information derived from the published or unpublished work of others has been duly acknowledged in the text.

(Signature)

Mohd Aamir

Khan

Date

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Date: 03.07.2021

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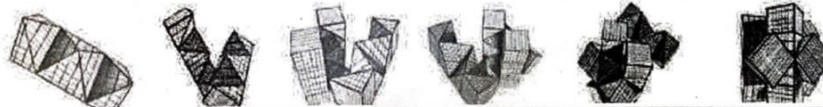
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CERTIFICATE

This is to certify that dissertation titled “**Analysis and Strengthen Process for Safety of Hazardous Chemicals used in Hospital**” is a record of the research work undertaken by Mohd Aamir Khan in partial fulfillment of the requirements for the award of the degree of MBA-Hospital and Health Management from the IIHMR University, Jaipur under my guidance and supervision and approach to the research study has been sincere, scientific, and analytical.

Faculty Guide
IIHMR University, Jaipur

Date

School Dean
IIHMR University, Jaipur

Date

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MOHD AAMIR KHAN

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LIST OF ABBREVIATION

Abbreviation	Name
HAZMAT	Hazardous Material
TJC	The Joint Commission
JCI	Joint Commission International
USA	United States of America
IPSG	International Patient Safety Goals
ACC	Access to care and Continuity of Care
PCC	Patient Centered Care
AOP	Assessment of Patients
COP	Care of Patients
ASC	Anaesthesia and Surgical Care
MMU	Medication Management and Use
QPS	Quality Improvement and Patient Safety
PCI	Prevention and Control of Infection
GLD	Governance, Leadership and Direction
FMS	Facility Management and Safety
SQE	Staff Qualifications and Education
MOI	Management of Information
EHCC	Eternal Heart and Cardiac Care
IPD	In-patient Department
MSDS	Material Safety Data Sheet
NFPA	National Fire Protection Association
PEL	Permissible Exposure Limit
SAR	Supplied Air Respirator
SCBA	Self-Contained Breathing Apparatus

LIST OF FIGURES, TABLES AND CHARTS

Chart	Gap Analysis
Table	Material Safety Data Sheet
Table	Material Safety Data Sheet Customized
Figure	Sticker on Product
Figure	Chemical Safety Sticker
Figure	Hazmat Label Poster
Figure	Hazardous Sticker
Table	Levels of Personal Protective Equipment

0. Abstract

The objective of this project is to find out the safety requirements to be done for the hazardous chemical handling in hospital. There are around 140+ active chemicals used widely inside the Eternal Hospital for various process. While some chemicals are safe in nature, others having properties like highly flammable and toxic in nature. Chemical handling should be taken care of in various stages like loading and unloading when it comes in hospital, storing, usage and disposal having its own significant risks. Through this project, comparison is made between the current methods and practices with the standards. In this project, Gap Analysis method was used as a tool to identify the safety improvements in chemical handling process. The current methods and practices were noted down, and suitable standards and best practices was recognized for all individual chemical handling activity. By using the GAP analysis excel workbook, the comparison was done, and the suggestions given at all levels for elimination of chemical, substitution of chemical, engineering control and administrative control. This project will help involved staff in hazardous chemical process to get it done with proper safety and precautions by working on handling, storing, transporting within the hospital, usage and disposal along with training to the involved staff.

1. Introduction/Background

The present time around the world is giving healthcare sector so much of problems and complications, confronting those became the major challenge for the healthcare sector of India, especially hospitals. To fight these consequences, hospitals are moving towards following standard norms and regulation, which will increase quality of the hospital services, also increase patient care. These factors somehow work towards patient trust build-up.

1.1 Accreditation- To get up-to the standards, hospitals look for accreditation. It has been observed that accreditation can fulfil purposes like quality control, quality improvement, regulation, information giving and marketing. After completing successfully, the arduous process, it is like a sign to patients that a hospital has gone through performance valuation and agrees for a vigorous event of qualifications in patient safety and quality care.

Accreditation has two types- National level and international level. Going for international level of accreditation is a big decision. Obtain accreditation can include hospital with the prestige and knowledge required to implement the proven practices, also includes hiring, and retaining the most qualified type of medical professionals, and reduces cost.

1.2 JCI- The Joint Commission or TJC is a United States based non-profit organization that accredits the healthcare organizations. Majority of hospitals and other healthcare organizations are accredited with JCI in USA while in India, around 35 organizations are accredited with JCI. Presently, 7th edition of JCI is being followed which was came-in effect from January 1st, 2021.

There are two types of sections in standards of JCI accreditation process and each section consist of chapters-

I. The Patient Centered Standards
1. International Patient Safety Goals (IPSG)
2. Access to Care and Continuity of Care (ACC)
3. Patient and Family Rights (PFR)
4. Assessment of Patients (AOP)
5. Care of Patients (COP)
6. Anaesthesia and Surgical Care (ASC)
7. Medication Management and Use (MMU)
8. Patient and Family Education (PFE)

II. The Organization Management Standards
9. Quality Improvement and Patient Safety (QPS)
10. Prevention and Control of Infections (PCI)
11. Governance, Leadership, and Direction (GLD)
12. Facility Management and Safety (FMS)
13. Staff Qualifications and Education (SQE)
14. Management of Information (MOI)

Also, there was addition of two chapters for involved hospitals that fulfils the requirement criteria for accreditation of academic medical centre. These standards fulfil additional needs for medical education and research in human subject. Each standard consists of an intent and measurable element. It elaborates the rationale for the standard and gives examples. The elements that can be measure are specific type of requirements of the standard. Also, as per the standards, an introduction, the eligibility requirements, the Accreditation Participation Requirements (APR), a summary of key accreditation policies, a glossary, and an index are included.

1.3 JCI and Eternal Hospital- Eternal Hospital, which is a unit of Eternal Heart Care Centre (EHCC) is going through the JCI Re-accreditation process. Hospital is working on all aspects to continuously meet the criteria of JCI. Although, all the elements are having equal weightage in some perspective, but facility management is kind of certain importance. It includes safety program, security program, hazardous material management program, fire and smoke safety program, utilities management program and medical technologies

management programs. When we talk about Management of Hazardous Material, hospital specifically works on it by using all the resources, combining all the information received, analysing it, converting it into a plan and implement it along with continuous monitoring.

1.4 Benefits of JCI Accreditation- Accreditation is a long-term procedure that requires commitment. There is good deal of introductory work leading up to a survey and then further performance and work improvement is done to get sure that the accreditation standards are maintained. Organizations which maintains JCI accreditation after achieving it, provide their patients the best available possible patient care.

The standards and evaluation method of JCI are unique tools that are designed to deliver positive change. These methods are-

- Designed to accelerate and support persistent quality improvement.
- Created in a way that reduces risk.
- Focused on setting a tradition of patient safety.
- It is developed by experts of health care from around the globe and tested in every region of world.
- Developed by healthcare personnel for the healthcare sector.
- It is related to individual health care organizations and national level of health care systems.
- Protects patient rights.
- Regular evaluation of patient satisfaction.
- Leads to good working environment.
- Gives hospital an opportunity to benchmark with the best.
- Proper risk management and risk reduction.

1.5 Gap Analysis- Gap analysis is the primary step in the review of existing services. It is a competent tool to implement an updated management system. It can be measured against standards which are already set. It reveals the extents of improvement in the present services. Working on the scope of improvement will make the level up to which service needs to be upgraded.

We can say that Gap analysis is a technique which reveals any shortfall in some process or characteristics. It is done against the template or model. Technique is usually used to know what the areas are to invest efforts for improvement. The management of hospital can then analyse, which are as when improved, would be most beneficial to hospital.

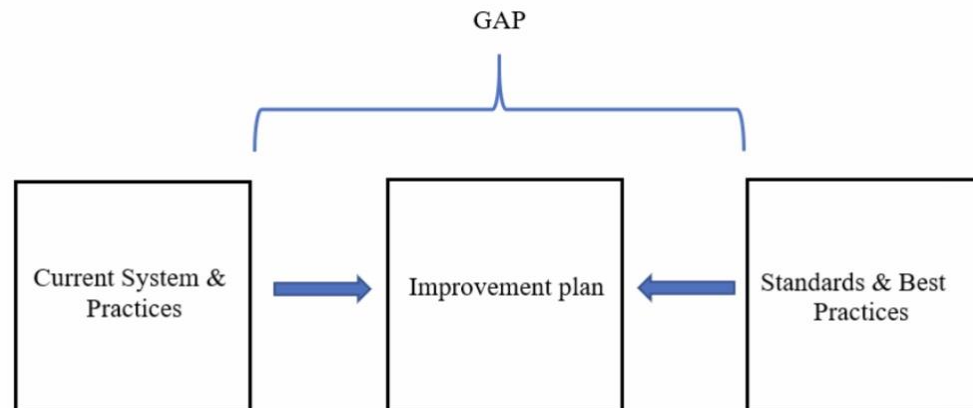


Figure: Gap Analysis

2. Review of Literature-

- Shua Z Alshammari and Uma M Irfan in their study of '*Hazardous Chemicals' Safety Measures and Awareness in Public and Private Hospital Laboratories in Buraydah, Al-Qassim*' says that- the public hospital had more bed capacity and number of In-Patients with a smaller number of laboratory tests performed per year than the private hospital. There was lack of storage sections in the public hospital laboratory for hazardous chemicals whereas the private hospital laboratories had proper storage cabinets. Based on the study results it seems imperative that Public Hospital Laboratory needs to improve the storage and handling of hazardous chemicals; make regular assessments of chemical toxicity and improve the employee's knowledge about these chemicals and its effect on their health and well-being. The Private Hospital Laboratory needs to address issues related to employee compliance to wearing personal protective equipment and to monitor and improve the flammable chemical storage system since they use more flammable chemicals.

- Kip Prichard, in *'Rules for Safe Handling of Hazardous Materials'* says that- for the safe handling of hazardous materials, certain rules and norms should be followed which includes-
 1. All established procedures need to be followed and job duties should be performed as the person is trained.
 2. PPE should be used.
 3. Labelling of containers should be there along with materials in correct container. Use of chemical without container labelling should be avoided.
 4. Labels and the Material Safety Data Sheets (MSDSs) should be read before using any material.
 5. Eating and drinking should be avoided during handling hazmat.
 6. Employees who are handling hazardous chemicals should read the labels on chemicals they use and have Material Safety Data Sheets available to refer to that explains how to deal with handling, storing, and cleaning up spills, and that explains relevant first-aid procedures.
 7. All hazardous materials should be stored properly.
 8. Hands should be washed properly after handling hazardous material.
 9. Emergency procedures, emergency reporting procedures, fire or spill handling should be known to person that helps in evacuation process. Dos and don'ts of emergency handling should be known.
 10. Eyewash in emergency and shower stations should always be clean.
- Balan Sundarakani, in his study of *'Safety Aspects in Handling Hazardous Material Transportation in Middle-East'* says that- Hazmat transport is a dangerous activity while the need of observation is domineering. Because of this environment and staff's both lives will be at stake. As for the material safety and the transport, these factors like flow, structure and volume of the material need to be examined regularly. The assessment of the risk factors is essential for the safety of hazmat and its transportations.
- FG Walter, JTS Chan, B Winegard, FM Shirazi, PB Chase, YY Chow, M de Boer, K Denninghoff; in the study of *'Hazmat Emergency Preparedness in Hong Kong'* says that- it was found that, Preparedness of hazmat emergency and training should emphasize supportive care and focus on the most common categories of dangerous

goods in Kowloon, i.e., substances giving off inflammable vapours, compressed gases, and corrosive and poisonous substances. Disaster planning and training should emphasize antidotes needed to treat the most common dangerous goods with recognised antidotes in Kowloon, i.e., oxygen for carbon monoxide and methylene chloride; calcium gluconate or calcium chloride for fluorine, fluorides, and fluoroboric acid; hydroxocobalamin for cyanides and nitriles; ethanol for methanol; and methylene blue for methaemoglobinaemia produced by nitrobenzene, nitrites, and nitrates.

3. Objective of Study-

- To assess the hospital's existing setup and procedures of management of hazardous materials as per JCI norms.
- To understand the major non-compliance.
- To establish action plan to overcome the gaps based on analysis.

4. Methodology-

The study is observational, evidence based in nature. The study is based on observations made. It is done broadly in two parts-

- Analysis of present condition in the departments.
 - Comparison and compliance with the JCI standards.
- Data collection was done by-
- Discussion with Head of the Departments, managers, and other responsible staff.
 - Listing and segregation of all the chemicals available in hospital.
 - Observation of the information gathered.
 - Using other available information, as per requirement.
 - JCI toolkit.

6. Duration of the Study-

The initial analysis was made over a period of one month from 5th April, 2021 to 4th May, 2021. As the study is about taking the level of the hospital to the standards of JCI in terms of management of hazardous material, so the process includes analysis of present situation; and finding gaps between present situation and targeted situation.

7. Analysis of the Study-

This study involves identification of gaps in the management of hazardous material in Eternal Hospital. Encountered situation in the hospital was compared against the set standards. Analysis was made for considering every aspect for compliance, partial compliance, and non-compliance. Improvement measures were taken in case of partial compliance and non-compliance.

For the above-mentioned project, first listing of all the available chemicals in the hospital was made. Then all these chemicals were segregated based on their storage in various areas of hospital, which includes Central Lab, IPD Pharmacy, Central Store, Engineering Department and Blood Bank.

7.1 Listing and Segregation-

- a) List was made including all the chemicals which are being used in the hospital.
- b) All the materials involved were then set apart based on the area in which they were being used.
- c) These areas include Laboratory, IPD Pharmacy, Stores, Engineering Department, Blood Bank, Housekeeping and Nursing.
- d) Timely updation of chemicals or hazardous materials was made at every step to avoid any divergencies.
- e) Because of the Gap Analysis, it was noted that which all chemicals were there in the list, which all chemicals need to be eliminated and which all chemicals needs to be added.

7.2 MSDS Management-

- An MSDS or Material Safety Data Sheet is a type of document that consist of information about chemicals being used along with the outer label gives good information for chemical safety.
- MSDS Sheet supplied by the manufacturer contains data of every aspect. This data was then converted into the format which is being used in the hospital.
- With the help of Gap Analysis, it was noted that of which chemicals, Material Safety Datasheet is available in the hospital. Hospital was not having Material Safety Datasheet of many chemicals which was obtained after getting in touch with the manufacturer and supplier.

Table: Chemicals used in Eternal Hospital

SR No	Availability From Manufacturer	Already Available in Hospital	
FROM THE LAB			
1	M	A	A1CD
2		A	Absolute Alcohol
3			Absolute Ethanol
4		A	ACETIC Acid Glacial 99-100%
5		A	Acetone Extra Pure
6		A	Albumin Test
7		A	Alkaline Phosphatase Test
8		A	Ammonium Sulphate
9		A	ASLO
10		A	Avagard CHG (Chlorhexidine and Alcohol) Handrub
11		A	Bacillol 25 Spray
12		A	Benedicts Reagent
13		A	Bilirubin Direct
14		A	Bilirubin Total
15		A	Calset Folate
16		A	Carbol Fuschin
17	M	A	Cell Wash Solution (NaOH)
18		A	Cell Wash Solution (Acid Wash)
19		A	Cell Clean
20			Cell Clean M
21		A	Cell Pack
22		A	CFAS Lipid Calibrator
23		A	CFAS PAC

24		A	Clinical Spirit
25		A	Control Varia
26	M		CPK
27		A	Creatinine
28		A	Diethyl Ether
29		A	DPX Mountant
30		A	ECOD
31		A	Ehrlich's Aldehyde Reagent
32	M		ELUENT 80A
33	M		ELUENT 80B
34	M		ELUENT 80C
35		A	Eosin Stain
36	M		ERBA Actime
37		A	Erba Clean 1
38	M		ERBA Control- N
39	M		ERBA Control- P
40	M		ERBA Protime LS
41	M		Fluorocell WDF
42		A	Folate
43		A	Formaldehyde Solution
44		A	Formalin Solution
45		A	Giemsa Stain Solution
46		A	Gram's Iodine Stain
47		A	HBA1C CFAS
48		A	HBA1C Hemolysing
49	M		Hematoxylin Solution
50	M		Hemolysing Washing Solution 80H
51		A	HIV Test
52		A	Hydrochloric Acid
53		A	Iron
54		A	ISE Standard
55		A	ISE SYS
56		A	LDL Cholestrol
57		A	Leishman Eosin Methylene Blue
58		A	Leishman's Stain
59	M		Lysercell WDF
60		A	Magnesium
61		A	Methanol
62		A	Methylene Blue
63		A	Microshield 636 (Chlorhexidine+Alcohol)
64		A	Nitric Acid
65		A	PC Cardiac
66		A	Phosphorus
67		A	Potassium Ferrocyanide

68		A	Precontrol HIV
69		A	Probe Wash
70		A	Procell
71		A	Resorcinol Reagent
72		A	Sample Cleaner 1
73		A	SMS
74		A	Sodium Hypochlorite Solution
75		A	Sodium Nitroprusside
76	M		Sulfolyzer
77		A	Sulphur Powder
78		A	Sulphuric Acid
79		A	Surgistain
80		A	Total Cholestrol
81		A	Total Protein
82		A	Total Protein Urine
83		A	Troponinn Control
84		A	UIBC
85		A	Urea 40% Solution
86	M		Urea Chemical
87		A	Uric Acid
88		A	Vitamin B12
89		A	Vitamin D Hydroxy
90		A	Xylene
FROM THE PHARMACY			
91		A	AVAGARD HANDRUB (3M)
92		A	AVAGARD SCRUB CHG 4 (CHLORHEXIDINE 4%) 500ML (3M)
93		A	BACILLOL-25 SPRAY 250ML (R&W)
94		A	BENZOIN TINCTURE
95		A	D-256 DISINFECTANT 1LTR
96		A	ETO CARTRIDGE (STERIGAS) 3M
97		A	GIGASEPT OPA SOLUTION 5LTR.- SCHUELKE
98		A	HOSPAL OPA SOLUTION 5LTR.- PCS
99		A	HYDROGEN PEROXIDE SOLUTION
100	M		KLOR KLEEN SOLUTION 5LTR.
101	M		MICROKLEEN- SPRAY 250ML (MICROGEN)
102		A	MICROSHIELD 4 747 (CHLORHEXIDINE 4%) 500ML (J&J)
103		A	MICROSHIELD 636 (CHLORHEXIDINE+ALCOHOL) HANDRUB 500ML (J&J)
104		A	MICROSHIELD PVP 727 (POVIDONE IODINE 7.5%) 500ML (J&J)
105		A	MICROSHIELD PVP-S 555 (POVIDONE IODINE 10%) 500ML (J&J)
106		A	MICROSHIELD TINCTURE (CHLORHEXIDINE+ETHANOL) 500ML (J&J)
107		A	MIKROZID HP 10 ONE LITRE (SCHULKE)

108		A	MULTIENZYME CLEAN MANUAL PLUS 5 LTR. (GETINGE)
109	M		NANZIRUB HANDRUB (NANZ)
110	M		SURGICAL SKIN PREP CHG 2 (CHLORHEXIDINE 2%) 500ML (3M)
FROM THE STORES			
120	M		Suma DET D1
121		A	Suma Inox D7
122		A	Taski R2
123	M		Taski R3
124	M		Taski R5
125		A	Taski R6
126	M		Taski TR 101
127	M		Taski TR 103
128		A	Terranova
FROM THE ENGINEERING			
129		A	UC-4
130	M		UC-5
131		A	UC-6
132		A	UC-9
133		A	UC-50
134		A	UC-60
135	M		UC-70
136	M		UC-400
137		A	UC-500
138		A	UC-1000
139		A	UC-1001
140	M		UC-1004
141	M		Citric Acid
FROM THE BLOOD BANK			
142		A	Sodium Hypochlorite Solution Bottle 10%
FROM THE HOUSEKEEPING			
143	M		UC-400
144		A	D-256 Disinfectant
145		A	Handwash
146		A	Suma D-7.1
147	M		Suma DET D1
148		A	Taski R2
149	M		Taski R3
150	M		Taski R5
151		A	Taski R6
152	M		Taski TR 101
153	M		Taski TR 103
154		A	Terranova

- d) In the above-mentioned table, first column denotes serial number; second column which is having indication with 'M' next to chemical name, denotes that the MSDS of this chemical was not available in hospital and availability was done from manufacturer or supplier; third column denotes that MSDS of the chemical was available but of older version but does not require updation when contacted with manufacturer or supplier; fourth column denotes chemical name. Each set of chemicals has mention of area in which they come in use, like, lab, pharmacy, stores, engineering, blood bank, housekeeping etc.
- e) It consists of 5 sections and covers all the information which is required. These sections are:
- i. Chemical Product and Company Identification
 - ii. Physical and Fire Hazard Data
 - iii. First Aid Measure
 - iv. Accidental Release Measure and Personal Protection
 - v. Handling and Storage

 ETERNAL HOSPITAL	MATERIAL SAFETY DATA SHEET
Effective Date: 01 Apr 2018	Prepared By: Dr. Kalpana Bindal

CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Chemical Name:	Hazard Category	
Trade Name:	A- Red ☐	
Chemical's Ingredient name:	B-Yellow ☐	
Manufacturer's Name	C-Blue ☐	
Supplier's Name:	D-White ☐	

PHYSICAL AND FIRE HAZARD DATA

Appearance	Flammable
Odor	Flash Point
Solubility in Water	Auto ignition Temp
Vapor Pressure	Extinguishing Media
Chemical Nature	Explosion Hazards

FIRST AID MEASURE

Skin Contact
Eye Contact
Inhalation
Ingestion

ACCIDENTAL RELEASE MEASURE AND PERSONAL PROTECTION

Spill Management Procedure	
Personal Protective Equipment	☒ Gloves ☐ Respirator ☒ Eye ☐ Footwear ☒ Clothing ☐ Other

HANDLING AND STORAGE

Handling Precautions	
Storage Requirements	☒ Fire Proof Container ☐ Exhaust Fan ☐ Air-conditioning
Regulatory Requirement	

Figure- Customized Format of HazMat in Eternal Hospital

7.3 Stickers Management and Labelling-

- a) There are different stickers for different chemicals.
- b) These stickers need to be pasted after successful procedure of Material Safety Data Sheet Customization.

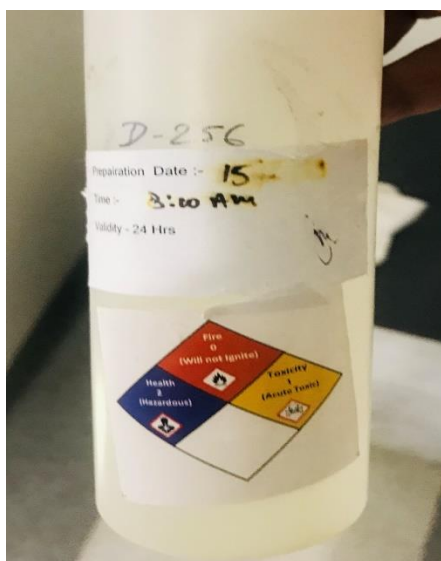


Figure: Hazard Sticker

c) These stickers are usually called NFPA stickers. These stickers are four colored diamond shaped, which contains-

- Red indicates Flammability level
- Yellow indicates Toxicity level
- Blue indicates Health Hazard
- White indicates Special Hazard

Special Hazards includes category of oxidizing material, material which are dangerous for environment, explosives, flammable, corrosive and gas under pressure.

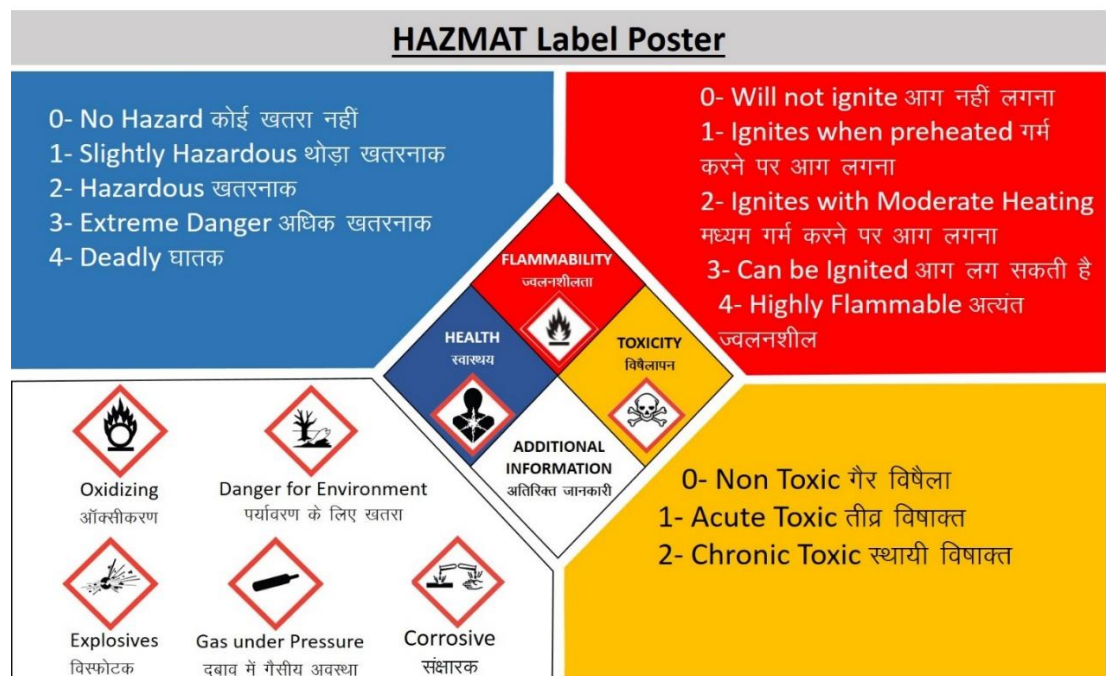




Figure: Hazardous Stickers

7.4 Training of the Personnel-

- a) Stickers or labels pasted on the chemical container or packaging should be there after procurement to the use at last point.
- b) This can be done by successful training of the in-charge of every involved department in this procedure.
- c) All the equipment around the globe will not give immense result if there are no trained staff. Trained staff will cost less, if not then training will result in higher costing.
- d) These trained in-charge will then train the staff of their respective departments.

- e) Sometimes lack of training may lead to any issues like losing stickers even when it was not reached at its last point of use. Such issues can be avoided if involved staff is well-trained.
- f) A training program should be conducted involving right person within the hospital and with proper training along with task description.

7.5 Evaluation or Assessment-

Even after training, there could be chances of any mistakes till the use of the product at the bedside level.

- Ward Level
- Bedside Level

8. What if Hazardous Materials not managed properly?

In healthcare organization, hazards generally come from spills of chemicals used in the hospital. Hazmat found in the hospital may include variety of chemicals as well as powders. Spillage of these materials is of two categories - emergencies and incidental releases.

Responses to incidental releases of hazmat where the chemical can be neutralized, absorbed, or controlled at the very time of release by the staff in the very immediate release area, or by the maintenance people, all are considered under Incidental spills.

Moreover, responses to releases of hazmat where there is no health hazard or immediate safety are not considered to fall under emergency responses. We can say that these are minor spillage and can be handled easily without declaring it emergency.

In emergency, persons or environment gets exposed, and results in larger level of response. Major factor involved in response system development, in terms of PEL, is the necessity for respiratory system protection.

9. Safety from Hazardous Chemicals-

There are two types of equipment-

9.1 Personal Protective Equipment (PPE)–

PPE usually refers to collective of chemical protective clothing like suits, latex gloves, eye protection & boots) along with the respiratory system protection. The United States Environmental Protection Agency and some other Federal Agencies have identified total 4 levels of PPE, which are in table below-

Level	Skin	Respiratory	Comments
A	Vapor Protective (also known as gas tight or fully encapsulating)	Atmosphere Supplying Respirator (Self contained breathing apparatus [SCBA] or Supplied Air Respirator)	Highest level of skin and respiratory protection. Bulky, heavy, and greater potential of heat stress injuries.
B	Liquid Splash Protection	Atmosphere Supplying Respirator (Self contained breathing apparatus [SCBA] or Supplied Air Respirator)	Lower level of skin protection with highest level of respiratory protection.
C	Liquid Splash Protection	Air Purifying Respirator	Lower level of skin and respiratory protection
D	No chemical protection	No respiratory protection	Examples include: work uniforms, street clothes, scrubs, and Standard/Universal Precautions (provides minor chemical protection)

a. Chemical Protective Clothing

While understanding the clothing variety which is apt in hazmat, is that the facility should assess the chemicals which are used in hospital, to avoid the events that may face from the external events. It is not possible that one type of cloth will protect a person against all chemical hazards. So, it is best to select a cloth that can handle most hospital chemical spills. Suits are many a time made of a nonwoven substrate material and one or more coatings. There may be different varieties of suits on the basis of hood availability, shoe cover availability and gloves availability and type of cuff.

There may be gloves of different material type, different cuff length and different thickness that will provide proper protection.

Footwear may be composed of polyvinyl chloride, nitrile, rubber.

Eyewear can be there which includes safety goggles or glasses, or many a times incorporated into the suits.

Head protection, tape, cooling devices and hard hats can be there. Although, wireless communications may also be incorporated into the cooperative effort.

b. Respiratory Protection -

Respiratory protection can be characterized into following two categories:

Air-purifying respirator is a respirator which contains a filter and cartridge that clears the air coming into it.

Atmosphere-supplying respirator Atmosphere-supplying respirators provide pure breathing air from a source independent of the work area. Respirators will protect users from many varieties of airborne contaminants and in oxygen-deficient atmospheres. Three types of ASR- supplied-air respirators (SARs), self-contained breathing apparatus (SCBAs), and combination SARs/SCBAs.

9.2 Decontamination Equipment -

Removal of hazmat from staff and equipment to the standard level to prevent the happening of predictable or foreseeable adverse health results is termed as decontamination equipment. Requirement in hospital would be to sanitize patients who enters the hospital and even others.

9.3 Monitoring Equipment-

The level of dangerousness can be assessed with monitoring equipment, in event of an emergency, a person who is not able to wait to obtain the output from a lab, in this scenario, equipment should be easy to use.

9.4 Response/ Clean-up Equipment-

Response and clean-up equipment are the ones which are used to stop the leakage and chemical spill of product. It can be done through kits which are available in market. Kits may contain PPE.

In many cases kits are pre-placed just into the area where a spill is likely to occur. Involved staff in working with the hazmat area on a regular basis should be trained and skilled enough to put on.

There are variety of kits available for hospital setting for a specific waste stream, namely:

- Solvents
- Aldehydes
- Mercury
- Chlorin
- Fluids required in X-Ray procedure
- Petrol Fuels
- Drugs which are hazardous in nature
- Caustics
- Anaesthetic Agents

Please note that without preparing for spillage handling, the ability to monitor, and availability of appropriate PPE, life of worker can be endangered. In case of doubt, follow isolation and stop the entry in that area.

10. Results-

We can say that there are many choices that need to be prepared by the hospital. Equipment response management, ongoing training, and implementing a respiratory system protection program are the main problems that has to be avoided. The facility capability to get involved in an acute response to a hazmat incident is mainly resolute by actions taken just before the event.

11. Conclusion-

Hazmat Management is a complex process involving cooperation and coordination of all involved departments and staffs. Thus, improving the drawbacks and lacks will not only improve the safety but also improves the handling and availability of these materials.

From the analysis made in the study period, it has been observed that there were few chemicals which were not in used but still available in the hospital's hazmat records, while some newly added materials were not present in hazmat records. This problem was resolved along with the problem of availability of Material Safety Datasheet which must be there in every department but MSDS of few chemicals was not there. Same problem was encountered with labelling of the chemicals too. For this, labelling was ensured from scratch level to the last point of use.

12. Suggestions-

- I. Materials should be checked immediately once it gets into the hospital.
- II. Training of incharge should be done on urgent basis to update the staff with the handling and usage of hazardous materials.
- III. Concerned staff should be trained and be informed further for the same by incharge.
- IV. Proper coordination from ground level to top level should be present.
- V. There should not be any delay in handling the materials.

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