

**DEVELOPMENT OF HAZARDOUS MATERIAL
INFORMATION SYSTEM**

IN

**SCHLUMBERGER ASIA SERVICES PRIVATE
LIMITED, MUMBAI**

Final year project report

Submitted by

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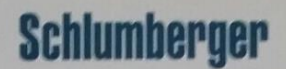
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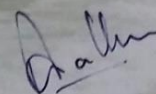
This is to acknowledge that

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ABSTRACT

Hazardous Material Information System (HMIS) is one of the simplest inclusive hazard communication systems by which worker gets informed about the workplace hazards proactively, thereby receives appropriate training to work safely. The system therefore creates a safer workplace by making workers aware of hazards as a means of quick and emergency access relatively. The system is to reduce the likelihood of exposure of workers from workplace injuries, illness and accidents by proactive information through cautionary labels and symbols (with the perspective of layman) of hazards, adequate (PPE) personnel protective equipment, appropriate fire extinguishing media. This can be achieved by management commitment via communicating and displaying HMIS at the notice boards & giving training to the workers for ensuring better and safer workplace. This system is one of the attempts for the safe management of hazardous chemicals in the workplace by providing a user-friendly interface to vendors, clients and employees.

THE NATION BUILDERS UNIVERSITY

Keywords: *Hazard Communication, Training, Workplace Hazards, Cautionary labels & Symbols, Quick & Emergency Access, etc.*

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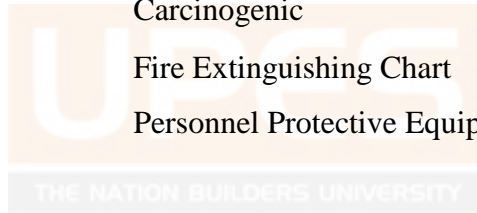
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LIST OF ABBREVIATIONS

HMIS	: Hazardous Material Information System
HAZCOM	: Hazard Communication
HSE	: Health, Safety & Environment
QHSE	: Quality Health Safety & Environment
MSDS	: Material Safety Data Sheet
WHMIS	: Workplace Hazardous Material Information System
ATSDR	: Agency for Toxic Substances and Disease Registry
HMEIS	: Hazardous Material Exposure Information System
UN	: United Nations
IBC	: International Buildings Code
CAS	: Chemical Abstract Service
OSHA	: Occupational Safety & Health Administration
NFPA	: National Fire Protection Association
UV	: Ultra Violet
CO ₂	: Carbon Dioxide
PPE	: Personnel Protective Equipment

CHAPTER 1

1. INTRODUCTION

This report presents the Hazardous Material Identification System (HMIS) for the given **well services** (one of the segments of schlumberger) chemicals. It is a comprehensive hazard communication system for safe management of hazardous chemicals. The purpose of the hazardous material identification system is to clearly inform about the hazards in the workplace by means of rating and receives appropriate training to enable workers to work safely.

1.1 AIM

The aim of HMIS is

- To develop Hazardous Material Information System at Schlumberger.
- To define & classify the hazards of chemicals used in the workplace by means of rating scale.
- To transmit & provide information to vendors, manufacturers, workers throughout the whole nation with key vital information about hazardous materials used or present at the workplace which may be hazardous to the safety& health of workers.

1.2 SCOPE

The Hazardous Material Identification System (HMIS) is meant to reduce the likelihood of disease or injury in the workplace due to exposure to hazardous materials by considering adequate and appropriate protective & preventive measures.

1.3 ABOUT THE COMPANY

Schlumberger is the world's leading supplier of technology, integrated project management and information solutions to customers working in the oil and gas industry worldwide. Employing approximately 120,000 people representing over 140 nationalities and working in more than 85 countries, Schlumberger provides the industry's widest range of products and services from exploration through production.

1.3.1 Schlumberger HSE Management System

The Schlumberger HSE Management System defines the principles by which we conduct our operations worldwide with regards to health, safety, and the environment.

Management communicates the HSE philosophy to all employees, customers, contractors, and third parties associated with our business, and each Schlumberger organization must provide positive evidence of conformance to the system.

The HSE Management System model comprises eight interrelated components:

- commitment and leadership and accountability
- policies and objectives
- organization and resources
- contractor and supplier management
- risk management
- business processes
- performance monitoring and improvement
- audits and reviews.

These are continuously improved by conformance checks

- on day-to-day standards and procedures (controls)
- on the management system (correction)
- through modifications to the management system (improvement)

1.3.2 HSE Policy Statement

The long-term business success of Schlumberger depends on our ability to continually improve the quality of our services and products while protecting people and the environment. Emphasis must be placed on ensuring human health, operational safety, environmental protection, quality enhancement, and community goodwill. This commitment is in the best interests of our customers, our employees and contractors, our stockholders, and the communities in which we live and work.

Schlumberger requires the active commitment to, and accountability for, QHSE from all employees and contractors. Line management has a leadership role in the communication and implementation of, and ensuring compliance with, QHSE policies and standards. We are committed to

- Protect, and strive for improvement of, the health, safety and security of our people at all times;
- Eliminate Quality non-conformances and HSE accidents;
- Meet specified customer requirements and ensure continuous customer satisfaction;
- Set Quality & HSE performance objectives, measure results, assess and continually improve processes, services and product quality, through the use of an effective management system;
- Plan for, respond to and recover from any emergency, crisis and business disruption;

- Minimize our impact on the environment through pollution prevention, reduction of natural resource consumption and emissions, and the reduction and recycling of waste;
- Apply our technical skills to all HSE aspects in the design and engineering of our services and products;
- Communicate openly with stakeholders and ensure an understanding of our QHSE policies, standards, programs and performance. Reward outstanding QHSE performance;
- Improve our performance on issues relevant to our stakeholders that are of global concern and on which we can have an impact, and share with them our knowledge of successful QHSE programs and initiatives.

This Policy shall be regularly reviewed to ensure ongoing suitability. The commitments listed are in addition to our basic obligation to comply with Schlumberger standards, as well as all applicable laws and regulations where we operate. This is critical to our business success because it allows us to systematically minimize all losses and adds value for all our stakeholders.



1.4 BACKGROUND

Exposure to hazardous materials can cause various health effects such as skin irritation, burns, sensitization and organ damage. Few are responsible for fire and explosion and other hazardous scenarios if stored and moved improperly. Tobacco, wood and other dangerous materials in transit, hazardous wastes are exempted from HMIS. This system classifies the hazardous material based on the type of the hazard that they present. (J. Takala *etal* 1991), to reduce the number of unlikely incidents such as accidental/emergency releases there are usually a number of methods. The key elements in safe usage of chemicals are appropriate and adequate information on the inherent hazards and their usage; effective means of communicating the information to the workers who are responsible for safety and health. The information can be obtained from many sources such as MSDS but problem with descriptive language which poses a great sort of inconvenience to the semi - skilled workers and layman. Addressing this problem, a system has to be developed with minimum basic hazardous information in semi- descriptive language with cautionary labels and symbols (e.g. irritant, carcinogenic, flammable symbols) thereby provides an easy understanding of physical and health hazards, first-aid treatment, PPE, extinguishing media (with tick and wrong marks), HMIS rating to the workers.



CHAPTER 2

2. LITERATURE SURVEY

The following literature survey on Hazardous Material Information System includes the current knowledge on substantial findings, as well as theoretical and methodological contributions to HMIS. This tells about the objective & study aspect, experimental steps, key findings, conclusion on every paper related to HMIS.

S. No	Objective & Study Aspect	Experimental Steps	Key Findings	Conclusion	References
1	This paper worked on WHMIS which is responsible to reduce the incidence of illness & injuries those from the usage of hazardous materials in the workplace.	1. Preliminary factors in the evaluation of Health Hazards for WHMIS such as a) Applicable routes of exposure b) Hazard its risk level c) Studies on untested and tested mixtures 2. Evaluation of toxicological Hazards for WHMIS classification & MSDS Disclosure	Inadequate information associated with the MSDS	This paper suggested that sources of exposure, air-borne concentrations, degree and extent of toxicity and lethal information of the particular substance (applicable to the mixtures even) must be disclosed in MSDS for the flexible development of advanced WHMIS.	Rosanne Co ^{te} <i>etal</i> 1998

2	<p>This paper worked on the provision of HMEIS as a quick information access to the medical professionals who treat victims exposed to hazardous materials</p>	<p>a) Development of HMEIS was done with the support of Agency for Toxic Substances and Disease Registry (ATSDR)</p> <p>b) Collection of On-Sight information.</p>	<p>Effective monitoring by dedicated phone line to receive on-sight calls, proper instructions while victim's treatment and follow-up is crystal clear from this paper.</p> <p>Also, a study on victim's condition before and after transport which shown the former mode as more desirable.</p>	<p>The outcome of HMEIS shows that drop in transport rate values of victims of course represent a significant savings in medical cost.</p> <p>The system was considered to be best in collecting the data very effectively and provides useful treatment controls to the victims.</p>	<p>Jefferey L Burgess <i>etal 1996</i></p>
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3	<p>This paper worked on the provision of the knowledge to the firefighter proactively about what is present at the fire site before arrival through an appropriate data retrieval system which possess hazardous information</p>	<ol style="list-style-type: none"> 1. Figuring out the constraints to overcome during the development of data base structure with supporting programs 2. Design the system with certain requisites. <ol style="list-style-type: none"> a)File Initialization b)Update File <ol style="list-style-type: none"> 1. Add 2. Change 3. Delete c)Information Retrieval 	<p>Semi-skilled workers found inconvenient to prefer to this system.</p>	<p>This system system presents an easy, quick, simple information access on hazardous materials in a user - friendly way.</p>	<p>BRUCE E. HERRING <i>etal</i> 1985</p>
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4.	This paper worked on development of Prototype Hazardous Material Movement Information system	<p>1) Development of this system starts with the gathering information of material that is to be moved such as</p> <p>a) Identification Number b) Product and its Quantity c) Origin & Destination points to & from which product is carried.</p> <p>2) Hazardous Material Movement Information Survey</p>	<p>The result of this system is flexible enough and summarized saying about three reports in which the</p> <p>First report is on type of hazardous materials observed.</p> <p>Second on sources of hazardous materials.</p> <p>Third on breach of hazardous material regulations that found during survey.</p>	<p>If hazardous materials are transported through bridges, population centres, highways, tunnels & other facilities, wherever the quantity and nature of material pose an unacceptable risk, regulations are in place to mitigate the damage caused by accidents.</p>	Salvatore Belardo <i>etal</i> 1985
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5	This paper worked on the development of machine aided human translation system of all the hazardous material data, also to convert this material for further translation into local languages.	<p>Searching and finding out the difficulties to overcome.</p> <p>Development of system by</p> <ul style="list-style-type: none"> a) Morphological Analysis b) Checking the general dictionary c) Phase translation d) General grammatical rule base translation e) Working environment and tasks of the translator f) Creating the final English Chemical data sheet 	Transformation of sheets in bulk mode was not up to the mark with some quality & grammatical problems.	System owns all the necessary hazardous material information with cautionary labels and symbols, sometimes the number of synonyms of chemical names would be serious issue although CAS numbering system doesn't have any logical backdrop.	J. Takala <i>etal</i> 1991
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Table 2.1 Literature Survey

CHAPTER 3

3. METHODOLOGY

1. Collected of all the chemicals using and present at the workplace.
2. Gathered all the (MSDS) Material Safety Data Sheets of chemicals.
3. Developed HMIS for the given chemicals with the following information taken from MSDS & from the templates.

- 3.1 Product Code & Name
- 3.2 HMIS Index (rating) of a chemical
- 3.3 First Aid Treatment
- 3.4 Main Health & Physical Hazards
- 3.5 Fire Extinguishing Media
- 3.6 Personnel Protective Equipment

3.0 MATERIAL SAFETY DATA SHEET

MSDS is a document that contains information on potential hazards (health, fire, reactivity and environment) and how to work safely with the chemical product. It is an essential starting point for the development of a complete health and safety program. It also contains information on the use, storage, handling and emergency procedures all related to the hazards of the material.

The MSDS contains much more information about the material than the label. MSDSs are prepared by the supplier or manufacturer of the material. It is intended to tell what the hazards of the product are, how to use the product safely, what to expect if the recommendations are not followed, what to do if accidents occur, how to recognize symptoms of overexposure, and what to do if such incidents occur.

There are 16 sections in MSDS. They are listed in brief below.

SECTION 1: Identification of the substance/mixture and of the company/undertaking

- 1.1. Product identifier
- 1.2. Relevant identified uses of the substance or mixture and uses advised against
- 1.3. Details of the supplier of the safety data sheet
- 1.4. Emergency telephone number

SECTION 2: Hazards Identification

- 2.1. Classification of the substance or mixture
- 2.2. Label elements
- 2.3. Other hazards

SECTION 3: Composition/Information on ingredients

- 3.1. Substances
- 3.2. Mixtures

SECTION 4: First - Aid Measures

- 4.1. Description of first aid measures
- 4.2. Most important symptoms and effects, both acute and delayed
- 4.3. Indication of any immediate medical attention and special treatment needed

SECTION 5: Firefighting Measures

- 5.1. Extinguishing media
- 5.2. Special hazards arising from the substance or mixture
- 5.3. Advice for firefighters

SECTION 6: Accidental Release Measures

- 6.1. Personal precautions, protective equipment and emergency procedures
- 6.2. Environmental precautions
- 6.3. Methods and material for containment and cleaning up
- 6.4. Reference to other sections

SECTION 7: Handling and Storage

- 7.1. Precautions for safe handling
- 7.2. Conditions for safe storage, including any incompatibilities
- 7.3. Specific end use(s)

SECTION 8: Exposure Controls/Personal Protection

- 8.1. Control parameters
- 8.2. Exposure controls

SECTION 9: Physical and Chemical Properties

- 9.1. Information on basic physical and chemical properties
- 9.2. Other information

SECTION 10: Stability and Reactivity

- 10.1. Reactivity
- 10.2. Chemical stability
- 10.3. Possibility of hazardous reactions
- 10.4. Conditions to avoid
- 10.5. Incompatible materials
- 10.6. Hazardous decomposition products

SECTION 11: Toxicological Information

- 11.1. Information on toxicological effects

SECTION 12: Ecological Information

- 12.1. Toxicity
- 12.2. Persistence and degradability
- 12.3. Bio accumulative potential
- 12.4. Mobility in soil
- 12.5. Other adverse effects

SECTION 13: Disposal Considerations

- 13.1. Waste treatment methods

SECTION 14: Transport Information

- 14.1. UN number
- 14.2. UN proper shipping name
- 14.3. Transport hazard class(es)
- 14.4. Packing group
- 14.5. Environmental hazards
- 14.6. Special precautions for user
- 14.7. Transport in bulk according to IBC Code

SECTION 15: Regulatory Information

- 15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture
- 15.2. Chemical safety assessment

SECTION 16: Other information

Among the above information, the following data is chosen for the development of HMIS considering as minimum and basic information that is mandate for the Health & Safety of employees, means of achievement of HAZCOM and for other factors.

3.1 PRODUCT CODE & NAME

The product code and product name are used to identify the chemical/product. Historically, chemicals have been identified by a wide variety of synonyms. Frequently, these are constructed according to the regional naming conventions relating to chemical structure & its origin. Also a chemical is assigned a unique numerical identifier by Chemical Abstract Service (CAS) to make easy and convenient database search. To find a correct MSDS, product identifier (product name) is essential & appropriate. Generally product name appears on MSDS and WHMIS label. Both may also display other identification, such as product code or catalogue number.

3.2 HMIS RATING OF A CHEMICAL

HMIS is a numerical hazard rating that includes usage of labels with colour developed by the American Coatings Association as a compliance aid for OSHA Hazard Communication standard. The labels provide user and responder with a quick summary of the chemical hazards by means of rating. The label doesn't include all pertinent information. (HMIS works on the basic assumption that fire is present). Some chemicals are classified with a rating and some are unclassified by HMIS.

The labels have colour code bars that relate to the following hazards.

Blue	- Health
Red	- Flammability
Yellow	- Reactivity
White	- PPE

Reactivity, Health and Flammability hazards are rated on a scale from 0 to 4, 0 being the least hazardous and 4 being the extreme hazardous.

3.2.1 HEALTH

0. MINIMAL HAZARD

This material poses no significant risk to health. These are listed on the MSDS with the minimum hazard caution. May be harmful by skin absorption, inhalation & ingestion. May cause skin & eye irritation.

1. SLIGHT HAZARD

This material poses irritation/minor reversible injury on contact with skin, eyes, mucous membrane/upper respiratory tract. This category includes materials which are listed on the MSDS as harmful only if swallowed.

2. MODERATE HAZARD

This material causes temporary/minor/reversible injury. This category includes materials which are listed on the MSDS as harmful only if swallowed, absorbed, inhaled.

3. SERIOUS HAZARD

This material causes vital/major injury on contact unless prompt remedial measure/action is taken and person gets medically treated. This category includes materials which are listed on MSDS as responsible for severe irritation/extensive tissue damage.

4. SEVERE HAZARD

This substance/material causes permanent/major tissue damage or may be life threatening with a single/repeated exposure. This category includes materials which are listed on MSDS as being extremely devastating to at least one type of tissue/ which may be fatal if swallowed/inhaled/absorbed.

3.2.2 FLAMMABILITY

0. MINIMAL HAZARD

This material/substance is stable and won't burn unless heated.

1. SLIGHT HAZARD

This material must be preheated to get ignited. Liquids of this category will have the flash points at or above 200 ° F (NFPA Class IIIB).

2. MODERATE HAZARD

This material must be moderately heated before ignition occurs. Liquids of this category have flash points between 100° and 200° F (NFPA Class II & Class IIIA).

3. SERIOUS HAZARD

This material is adept of ignition below all normal temperatures and liquids have flash points below 100° and boiling point above 100° F (NFPA Class IB & Class IC).

4. SEVERE HAZARD

Flammable gases and volatile liquids with flash points below 73° and boiling points below 100° F (NFPA Class IA) comes under this category.

3.2.3 REACTIVITY

0. MIMINAL HAZARD

This material is stable, even subjected to fire and won't react with water.

1. SLIGHT HAZARD

This material is stable, but can become unstable at high temperatures and pressures. This material may reacts with water but will not release energy violently. These are very much sensible to moisture.

2. MODERATE HAZARD

This material is usually unstable and will readily undergo violent and drastic chemical change, but will not detonate; may react violently with water/ may have a tendency to form potentially explosive mixtures with water.

3. SERIOUS HAZARD

This material is capable of explosive reaction/detonation but needs a strong initiating source/must be heated under confinement before ignited; react explosively with water.

4. SEVERE HAZARD

This material is readily capable of explosive decomposition or detonation at normal temperatures and pressures.

General Rating Summary		
Health	Flammability	Reactivity
4 May be fatal on short exposure. Specialized protective equipment is required	4 Flammable gas or extremely flammable liquid	4 Explosive material at room temperature
3 Corrosive or toxic. Avoid skin contact or inhalation	3 Flammable liquid flash point below 100 degrees F	3 May be explosive if shocked, heated under confinement or mixed with water
2 May be harmful if inhaled or absorbed	2 Combustible liquid flash point of 100 to 200 degrees F	2 Unstable or may react violently if mixed with water
1 May be irritating	1 Combustible if heated	1 May react if heated or mixed with water but not violently
0 No unusual hazard	0 Not combustible	0 Not reactive when mixed with water

Figure 3.2.a General HMIS Rating Summary

3.3 FIRST - AID TREATMENT

First - aid describes the actions/measures that are to be taken immediately in case a person is accidentally exposed to the hazardous material. The main intend of first-aid is to decrease/minimize the injury and followed by disability. In particular and emergency cases, first aid may be required to keep victim alive.

Before entering into the worksite, first aid information/measures needs to be known because in case of emergency, there won't be any time left to go through MSDS. The first aid procedures must be frequently reviewed especially the employees trained to give first aid. All the workers/employees should be aware of first aid equipment and facilities. E.g. first - aid kit, emergency eye - wash stations, safety showers etc.

First - aid procedures are specific, different and well - described for each route of exposure & should be followed same as accordingly i.e. Eye contact, Absorption, Inhalation, Ingestion. When treatment is necessary, MSDS must be readily available at the emergency facility. In emergency case, for medical assistance dial 911.

3.4 MAIN HEALTH & PHYSICAL HAZARDS

A Hazard is a source or situation that poses a level of threat to life, health, environment and property. Most of the hazards are potential with only theoretical risk of harm, however once hazard becomes active it creates an emergency.

There are different types of hazards & listed below

1. Physical Hazard
2. Chemical Hazard

3. Ergonomic Hazard
4. Biological Hazard
5. Psychological Hazard

3.4.1 PHYSICAL HAZARDS

These hazards can harm the body without necessarily touching it. They can be both natural and human made elements.

It includes

- Radiation: Ionizing and Non - ionizing
- High exposure to sunlight/UV rays
- Temperature extremes - hot and cold
- Constant loud noise

3.4.2 CHEMICAL HAZARDS

These are the hazards present when a worker is exposed to any chemical in a workplace in any form solid, liquid, gas, dust, mist, fog, smog, particulate matter. Workers who are more sensitive to usual solutions and chemicals causes illness, irritation to skin, breathing problems.

Additional care has to be taken for the below chemicals

- Liquids like cleaning agents/products, paints, solvents, acids - especially if chemicals are placed in an unlabeled container.
- Vapors and fumes that comes from welding activity
- Gases like acetylene, propane, carbon monoxide, helium
- Flammable materials like gasoline, LPG
- Explosive chemicals
- Pesticides

3.4.3 ERGONOMIC HAZARDS

A worker get exposed to ergonomic hazard when kind of job/work, body position and working environment put strain on human body. Short - term exposure results in sore - muscles the immediate day or the following days. Long - term exposure can result in serious and long - term illness.

These include

- Improperly adjustment of chairs and workstations
- Frequent lifting
- Poor posture
- Awkward movements, especially if they are repetitive

3.4.4 BIOLOGICAL HAZARDS

These are associated with animals, people or infectious plant materials, schools, facilities, laboratories, nursing homes, outdoor occupations etc.

These include (exposed to)

- Blood and other body fluids
- Fungi/mold
- Bacteria, Virus & Parasites
- Plants & Insecticides
- Animal & bird droppings

3.4.5 PSYCHOLOGICAL HAZARDS

These are created in a stressful environment/during work related stress. A person is affected psychological disturbance through stress, work shift patterns.

If the above all hazards or any type of hazard affects health, it becomes a Health Hazard.

Some of the Hazards with cautionary symbols are mentioned below



Figure 3.4.a Irritant



Figure 3.4.b Environmental Hazard



Figure 3.4.c Toxic



Figure 3.4.d Corrosive to skin & metals



Figure 3.4.e Oxidizer



Figure 3.4.f Flammable



Figure 3.4.g Harmful



Figure 3.4.h Biological Hazard



Figure 3.4.i Carcinogenic



3.5 FIRE EXTINGUISHING MEDIA

There are different types of fire extinguishing media available to extinguish different classes of fire. Fire extinguishing media must be suitable & appropriate to extinguish the fire.

3.5.1 CLASSIFICATION OF FIRES

Fires are classified on the basis of type of fuel they burn.

CLASS A

Class A fires consist of ordinary combustibles such as paper, trash, wood or anything left with residue such as ash. Water extinguishing media works best to extinguish Class A fire.

CLASS B

Fires involving flammable liquids (such as petrol, paints, oils) and liquefiable solids (such as fats, waxes, greases but excluding cooking oils/fats. Foam works best to extinguish Class B fires.

CLASS C

Fires involving gases such as propane, butane. Dry chemical Powder works best to extinguish this type of fire.

CLASS D

Fires involving certain metals such as sodium, magnesium, aluminium. Special dry powder is used to extinguish this type of fire.

CLASS E

Fires involving electrical appliances. Carbon dioxide is suitable to extinguish this type of fire

CLASS F

Fires involving commercial deep fat/oil fryers.

Fire Extinguisher Chart





Extinguisher		Type of Fire				
Colour	Type	Solids (wood, paper, cloth, etc)	Flammable Liquids	Flammable Gasses	Electrical Equipment	Cooking Oils & Fats
	Water	✓ Yes	✗ No	✗ No	✗ No	✗ No
	Foam	✓ Yes	✓ Yes	✗ No	✗ No	✓ Yes
	Dry Powder	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✗ No
	Carbon Dioxide (CO₂)	✗ No	✓ Yes	✗ No	✓ Yes	✓ Yes

Figure 3.5.a Fire Extinguishing Chart

3.5.2 TYPES OF EXTINGUISHING MEDIA

WATER

Water media principally works with the phenomena of cooling. Even though water is effective against cellulosic (also called ‘Class A’) fires, they can be ineffective and dangerous if tried on hydrocarbon fires (causing it to float and spread). Water mist is an exception.

Water - Mist is of fine mist of water droplets and has found use as an alternative to gaseous inerting systems. Research has shown that very fine water mists less than 400 microns diameter are effective on both cellulosic type fires (Class A) and flammable liquid fires (Class B).

FOAM

1-3 % of foam concentrate is injected to fire - water (system) from a separate storage vessel using a metering pump. Foam - based systems are generally very effective for hydrocarbon pool fires, but not effective for hydrocarbon jet fires. Foam is responsible for smothering the fire by creating a layer of foam on the fuel surface in order to exclude air. Also foam stops the liquid beneath from forming vapours. Wide variety of foam is available such as alcohol resistant foam, low/medium/high expansion foam etc.

DRY CHEMICAL POWDER/ABC TYPE

Dry chemical is expelled onto the fire using a pressurized carrier gas. It can be used on wide variety of fires, including hydrocarbon jet fires but the problem associated with this media is danger of re - ignition. It works principally by smothering and also interrupts chain reaction. This is used on Class A,B,C fires.

Ordinary dry chemical is for Class B & C fires only. It is important to use the correct extinguisher for the type of fuel! Using the incorrect agent can allow the fire to re-ignite after apparently being extinguished successfully.

Wet Chemical is a new agent that extinguishes the fire by removing the heat of the fire triangle and prevents re-ignition by creating a barrier between the **oxygen** and **fuel** elements.

Wet chemical of Class K extinguishers were developed for modern, high efficiency deep fat fryers in commercial cooking operations. Some may also be used on Class A fires in commercial kitchens.

CARBON DIOXIDE

Carbon Dioxide extinguishers are filled with non-flammable carbon dioxide gas under extreme pressure. You can recognize a CO₂ extinguisher by its hard horn and lack of pressure gauge. The pressure in the cylinder is so great that when you use one of these extinguishers, bits of dry ice may shoot out the horn.

Carbon dioxide extinguishes work by displacing oxygen, or taking away the oxygen element of the fire triangle. The carbon dioxide is also very cold as it comes out of the extinguisher, so it cools the fuel as well. CO₂s may be ineffective at extinguishing Class A fires because they may not be able to displace enough oxygen to successfully put the fire out. Class A materials may also smolder and re-ignite.

CO₂s will frequently be found in laboratories, mechanical rooms, kitchens, and flammable liquid storage areas. Since CO₂ takes away the oxygen, it is necessary to ensure that no personnel are present. Fire fighters should wear suitable respirators due to hazardous characteristic of CO₂, as asphyxiate.

CLEAN AGENT

Halogenated or Clean Agent extinguishers include the halon agents as well as the newer and less ozone depleting halocarbon agents. They extinguish the fire by interrupting the chemical reaction of the fire triangle.

Clean agent extinguishers are primarily for Class B & C fires. Some larger clean agent extinguishers can be used on Class A, B, and C fires.

3.6 PERSONNEL PROTECTIVE EQUIPMENT

Personnel Protective Equipment refers to helmets, goggles, respirator, footwear, protective clothing, impervious suit, other equipment/clothing designed and designated to protect the individual body from injury, accident or infection. PPE protects the person from physical, heat, electrical, chemical, biological, air - borne particulate matter.

The nature of the activity/task and the risk associated will determine the selection, suitability and appropriateness of the PPE to be worn. PPE is the last line of defence in the hierarchy of controls.

EYE PROTECTION

Depending on the job doing and the type of material handling, various levels of eye protection (e.g. safety glasses, chemical safety goggles, a face shield or some combination of these) is needed and mandatory to wear.

SKIN PROTECTION

Skin protection includes items such as gloves, aprons, full body suits, and boots. The type of rubbers or other materials that provide the best protection against the product using is mentioned in MSDS. No one material acts as a barrier to all chemicals. It is also important to consider the temperature conditions and the need for materials not easily cut or torn. Sometimes, the MSDS may simply advise to use impervious (resistant) materials. In this case, finding out with which specific materials it is best is required and necessary. This information is obtained from the product supplier or manufacturer or from a protective clothing supplier or manufacturer. It is also important to maintain protective clothing or gloves properly and replace them when necessary.

RESPIRATORY PROTECTION

There are many different types of respirators. One type may be effective against some chemicals but may provide little or no protection against others. Selecting the best respirator for is quite complicated and needs a minimum technical knowledge. Usually a qualified person must carry out a detailed assessment of the workplace, including all chemicals used and their airborne concentrations and forms. Consequently, complete respiratory protection guidelines generally cannot be given on the MSDS. If respirators are required at your work site, a complete respiratory protection program including respirator selection fit testing, training and maintenance is necessary.


















Figure 3.6.a Personnel Protective Equipment Chart


















































CHAPTER 4

4. RESULT AND DISCUSSION

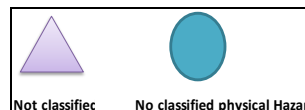
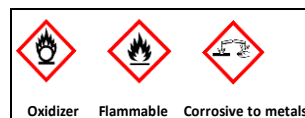
- HMIS is developed effectively by gathering mandate and minimum basic information from MSDS such as product code & name, HMIS rating, first - aid treatment, hazards, extinguishing media, PPE without any ambivalence.
- Hazards are mentioned in terms of cautionary symbols & classified by means of HMIS rating scale accordingly. (Table below). Chemicals that are not classified under HMIS are termed as NC i.e. NOT Classified.
- Suitable extinguishing media in case of fire, appropriate PPE while handling the chemical is clearly (tick) marked in the HMIS. Additional measures to be taken are mentioned in the Remarks. First - Aid Treatment for each chemical is mentioned clearly and specifically for Eyes, Skin, Inhalation, Ingestion.
- HMIS is displayed at all the workplaces where workers (semi - skilled/layman/skilled) informed and communicated proactively with the key vital information about hazardous materials in a simple & cautionary language i.e. which clearly shown that HAZCOM is achieved successfully.
- By noticing the signs and symbols, worker alertness level relatively increased which helps in defending his/her health and safety thereby reducing the likelihood of disease or injury in the workplace due to exposure to hazardous materials.

Sr. No	Product Code	Product Name	HMIS Index	First Aid Treatment	Main Health Hazards	Main Physical Hazards	PPE					Remarks	Fire Extinguishing Media						
													CO2	Dry Chemical	Alcohol Foam	Water	Remarks		
1	A123	XYZ	3	Eyes	Flush eyes with water for 30 min holding eyelids open.			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Face shield, chemical resistant suit, chemical resistant boots are must	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	-
			2	Skin	Take off contaminated clothing/shoes, wash with soap&water														
			NC	Ingestion	DO NOT induce vomiting. If occurs, properly position the person.														
				Inhalation	If breathing stops;artificial respiration/CPR,as required														
2	A243	ABC	3	Eyes	Flush eyes with water for 30 min holding eyelids open.			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Face shield, chemical resistant apron are must	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	-
			3	Skin	Take off contaminated clothing/shoes, wash with soap&water														
			0	Ingestion	DO NOT induce vomiting. If occurs, properly position the person.														
				Inhalation	Move to fresh air.If not breathing, give artificial respiration.														
3	A251	AFG	3	Eyes	Flush eyes with water for 30 min holding eyelids open.			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Face shield, chemical resistant suit, chemical resistant boots are must	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	-
			3	Skin	Take off contaminated clothing/shoes, wash with soap&water														
			NC	Ingestion	DO NOT induce vomiting. If occurs, properly position the person.														
				Inhalation	Move to fresh air.If not breathing, give artificial respiration.														
4	A368	HJU	2	Eyes	Flush eyes with water for 15 min holding eyelids open.			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Solvent -Resistant Apron is must	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	-
			1	Skin	wash with plenty of soap & water for at least 15 minutes.														
			NC	Ingestion	Do not induce vomiting.No mouth-to-mouth transfer if unconscious.														
				Inhalation	Move to fresh air;breathing difficult, give artificial respiration.														
5	A455	KIUG	2	Eyes	Flush eyes with water for 15 min holding eyelids open.			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	-	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	-
			1	Skin	Wash with soap & water.Medical attention if irritation occurs														
			NC	Ingestion	Do not induce vomiting.No mouth-to-mouth transfer if unconscious														
				Inhalation	Move to fresh air. Obtain medical attention.														

Sr. No	Product Code	Product Name	HMIS Index	First Aid Treatment	Main Health Hazard	Main Physical Hazard	PPE					Remarks	Fire Extinguishing Media					
													CO2	Dry Chemical	Alcohol Foam	Water	Remarks	
6	D003	GHT	NC	Eyes	Rinse with water. Seek medical attention if irritation occurs								-	✓	✓	✓	✓	-
			NC	Skin	Wash off with soap and water.													
			NC	Ingestion	Rinse mouth. No mouth-to-mouth to an unconscious person													
				Inhalation	Move to fresh air.													
7	D054	TYI	NC	Eyes	flush eyes with water for 15 min holding eyelids open.								Chemical Resistant Apron is must	✓	✓	✓	✓	foam can also be used
			NC	Skin	Rinse with plenty of water for at least 15 minutes.													
			NC	Ingestion	Do not vomit; Rinse; No mouth-to-mouth if unconscious													
				Inhalation	Move to Fresh air													
8	D099	POI	NC	Eyes	wash with water lifting eye lids for at least 15 min.								-	✓	✓	✓	✓	-
			NC	Skin	Wash off with soap & water removing all contaminated ones.													
			NC	Ingestion	Rinse. Do not vomit w/o medical. No mouth-to-mouth if unconscious.													
				Inhalation	Move to fresh air. Medical if respiratory irritation/difficult breathing.													
9	D127	JUYT	1	Eyes	wash with water lifting eye lids; remove lenses continue for 15 min								-	✓	✓	✓	✓	-
			0	Skin	Wash off with soap & water removing all contaminated ones.													
			0	Ingestion	Rinse. Do not vomit w/o medical. No mouth-to-mouth if unconscious.													
				Inhalation	Move to fresh air. Medical if respiratory irritation/difficult breathing.													
10	D677	NHRE	NC	Eyes	wash with water lifting eye lids for at least 15 min.								Chemical Resistant Apron is must	*	*	*	*	ABC Type
			NC	Skin	Wash off with soap & water removing all contaminated ones.													
			NC	Ingestion	Rinse. Do not vomit w/o medical. No mouth-to-mouth if unconscious.													
				Inhalation	Move to fresh air. Medical if respiratory irritation/difficult breathing.													
11	D789	ZWE	1	Eyes	Seek medical attention at once								-	*	*	*	*	None Needed
			1	Skin	Wash off with soap & water. Seek Medical attention if irritation.													
			NC	Ingestion	Obtain Medical attention. No mouth-to-mouth if unconscious.													
				Inhalation	Move to fresh air. Obtain medical attention													

12	D888	FTT	1	Eyes	Rinse with water also under the eyelids. Seek Medical if irritation.			✓	✓	✓	*	✓	—	✓	✓	✓	✓	—
			1	Skin	Wash off with soap and water.													
			NC	Ingestion	Obtain Medical attention. No mouth-to-mouth if unconscious.													
				Inhalation	Move to fresh air. Obtain Medical attention													
13	D899	ERR	3	Eyes	flush eyes with water for 30 min with eyelids open.Medical attention.			✓	✓	✓	✓	✓	Boots of chemical resistant,Face Shield,chemical resistant suit are must	✓	✓	✓	✓	—
			1	Skin	Take off contaminated,wash with soap&water for at least 15 min													
			NC	Ingestion	Do not vomit;medical delay,(activ.charcoal+H2O)/2 glasses milk/H2O.													
				Inhalation	Move to fresh air;breathing stops,artificial respiration/CPR.													
14	D901	QUT	0	Eyes	Seek medical attention if irritation occurs. Rinse with water			✓	✓	✓	*	✓	—	*	*	*	*	None Needed
			0	Skin	Wash off with soap and water.													
			NC	Ingestion	Rinse mouth. Never give anything by mouth to an unconscious person													
				Inhalation	Move to fresh air.If breathing is difficult, give artificial respiration.													

General Rating Summary		
Health	Flammability	Reactivity
4 May be fatal on short exposure. Specialized protective equipment is required	4 Flammable gas or extremely flammable liquid	4 Explosive material at room temperature
3 Corrosive or toxic. Avoid skin contact or inhalation	3 Flammable liquid flash point below 100 degrees F	3 May be explosive if shocked, heated under confinement or mixed with water
2 May be harmful if inhaled or absorbed	2 Combustible liquid flash point of 100 to 200 degrees F	2 Unstable or may react violently if mixed with water
1 May be irritating	1 Combustible if heated	1 May react if heated or mixed with water but not violently
0 No unusual hazard	0 Not combustible	0 Not reactive when mixed with water



Special Precautions for firefighters

During firefighting, wear protective **firefighting clothing** and avoid breathing vapors by using **suitable respirator/** mask whichever is **appropriate**.

Also,use **Self Contained Breathing Apparatus(SCBA)** in closed areas



NC - NOT CLASSIFIED

Table 4.1.a HMIS

CHAPTER 5

5.1 SUMMARY

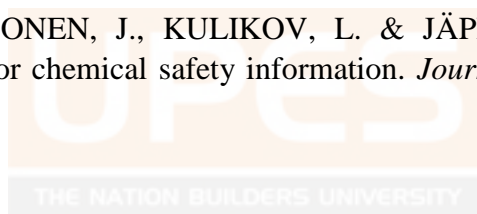
HMIS is an effective hazard communication tool to manufacturers, employees, clients, medical professionals, employers and vendors as a means of quick and emergency access. This system is accountable for generating a healthier and safer workplace by making workers aware of hazards and accordingly safeguards to be taken. Majority of MSDS is in illustrative format which creates a sort of discomfort to the semi - skilled and layman. Considering this as a key prospect, a system with caution signs and labels usage has to be developed which provides a comfortable platform for vigilance in the individuals by noticing the warning sign. A worker distinctly intimated about the workplace hazards proactively by means of HMIS rating and its severity thereby undergo proper training before any work start. HMIS assists in the preparation of Personnel Protective Equipment plan directly without going through entire MSDS which ultimately saves time. Accomplishment of HMIS to workers is attained when it gets communicated in a healthy way by displaying at notice boards.

5.2 CONCLUSION

- Development of HMIS is one of the most important parameters to transmit and provide vital workplace hazardous information to workers, manufacturers throughout the whole nation which may be hazardous to Health & Safety. Workplace hazards are defined and classified in terms of HMIS rating, symbols and labels.
- The developed HMIS is communicated to employees with due commitment from management effectively and the information can be shared with clients, vendors nation - wide with the perspective of HSE.
- For basic information, choosing MSDS pose a difficulty to medical professionals, firefighters, workers and if it is emergency such as fire, liquid splashing, leads to direct and indirect losses.
- It's not the end if individual gets communicated with HMIS, a gap between worker and HMIS still exists which needs to be and can be bridged by giving adequate training.
- However most of the data is from MSDS, which doesn't mean that it is a way of ignoring it; for complete information and for better health and safety, MSDS is a best way.

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APPENDIX I

OBSERVATION

Name of the worker : Mr. Rahul Thakur

Day, Date & Time : Tuesday, 4th March, 2015; 10:30 AM

Description : Mr. Rahul is continuing his job by handling a chemical XXXX which is a part of his routine work. Before starting his work, he remembered that Personnel Protective Equipment is must. He opened MSDS of chemical XXXX and found some difficulties in the data sheet. Then, he immediately walked towards the notice board and checked HMIS (which was displayed day before). He seemed to be clear enough with the PPE required and went to the work site.

At 11:25 AM, he came back from the worksite and refreshed. I Ms. A. Arun Shourie went to the Mr. Rahul to take his opinion on HMIS. Rahul said “I found few difficulties while going through MSDS of XXXX,, I was pretty much confused to choose the PPE that is adequate and appropriate. Of course, detailed and descriptive data is present in it but as of now, the information I need is PPE only and suddenly I remembered about the HMIS and went to the notice board, checked whatever information required. I was very much clear with what I want by seeing tick and wrong marks, in fact by seeing the cautionary symbols I made myself alert and remembered while handling the chemical. Also I noticed fire extinguishing media appropriate for this chemical in case if it catches fire. Yes, this HMIS is effective and informative.”

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