

**Guidelines for Five Weeks Course for supervisors to be employed in Hazardous Process Industries under section 41-C(b) of the Factories Act, 1948**

**1. COURSE TITLE: CERTIFICATE COURSE IN SAFETY AND HEALTH FOR SUPERVISORS TO BE EMPLOYED IN HAZAROUS PROCESS INDUSTRIES**

**2. QUALIFICATION AND EXPERIENCE FOR ADMISSION**

- (a) (i) A degree in chemistry or a diploma (three years full time) in any branch of engineering or technology or equivalent with not less than 5 years experience;  
or  
(ii) A master's degree in chemistry or a degree in any branch of engineering or technology or equivalent with not less than 2 years experience.
- (b) The experience stipulated above shall be in process operations and maintenance, in any hazardous process industry.

**3. COURSE DURATION**

The duration of the course shall be as follows:

- (a) Full time (minimum 6 contact hours per day) – 5 weeks (three weeks class room teaching followed by one week project work and on completion of which a further one week classroom teaching – 120 contact hours )

**4. COURSE CONTENT**

The content of the syllabus of the training course for supervisors shall be as per **Annexure-I**. The training manuals to be used during the course will be provided by DGFASLI.

**5. ATTENDANCE**

Minimum 80% of attendance shall be required for appearing for the examination. This minimum requirement is mandatory even if a candidate is declared sick on medical grounds. Those candidates not attaining the minimum percentage of attendance shall not be allowed to appear for the viva, Laboratory work, Project work and written examination and shall be required to repeat the course.

**6. SCHEME OF EXAMINATION**

- |   |             |
|---|-------------|
| (a) Project work  | - 20 marks  |
| (b) Laboratory work (Safety, Hygiene and Industrial Medicine) | - 20 marks  |
| (c) Oral examination based on project / laboratory work       | - 10 marks  |
| (d) Written examination                                       | - 150 marks |

The project work may be carried out in the sponsoring organization or any organization of the participant's choice.

The examinations will be conducted by DGFASLI and the expenses towards TA/DA for the officials of DGFASLI for the conduct of the examination shall be borne by the Institute /organization as per their entitlement.

The written examination shall be of objective type consisting of 150 questions (multiple choice questions) and of two hours duration. Further, for every wrong answer, 25% mark (Negative Marking) shall be deducted. All arrangements for conducting written, project, laboratory and oral examination shall be made by the institute concerned by adhering to the specified norms.

The examination works including setting the question paper and evaluation of answer books, project reports, laboratory work and Oral examination of the candidates shall be done by the empanelled examiners of DGFASLI only.

## **7. STANDARD OF PASSING**

A candidate shall be declared to have passed the course if he/she secures minimum 50% marks in each of the items of the examinations (item 6(a), (b), (c) & (d)) and an aggregate of 60% or more.

## **8. AWARD OF CLASS /GRADE**

The candidates passing in the examination as per the scheme given at item no. 6 & 7 above shall be awarded the Grade as below:

<b>A+</b>	-- 80% and above
<b>A</b>	-- 70% and above but below 80%
<b>B+</b>	-- 65% and above but below 70%
<b>B</b>	-- 60% and above but below 65%

## **9. RE-EXAMINATION**

If a candidate for some genuine reasons could not appear for the examination after securing 80 % of the attendance, he shall be permitted to appear when the next examination is conducted within a reasonable period of time.

## **10. AWARD OF CERTIFICATE**

The certificate to the successful candidates shall be awarded by DGFASLI only. The format of the certificate is appended herewith as **Annexure – II**. The certificate will carry a photograph of the successful candidate, duly attested by DGFASLI and Head of the Institution or any other

authority so declared competent for this purpose with the seal of the institution and DGFASLI affixed on the certificate.

## **11. COURSE FEE**

The course fee to be charged from the participants of this course shall not exceed the following:

- (a) In case of CLI & RLIs : ₹ 6,000/- (₹ 3,000/- institute fees and ₹ 3,000/- other fees)
- (b) For others: Not exceeding ₹ 20,000/- (Twenty Thousand only)

## **12. QUALIFICATION AND EXPERIENCE FOR FACULTY**

The minimum qualifications and experience of the faculty members to be engaged for the course shall be as under :

- (a) Three years diploma in chemical / mechanical / electrical / environmental / instrumentation / civil engineering and one year diploma in industrial safety conducted by DGFASLI or any institution recognised by the State Technical Boards or equivalent with 15 years of relevant work experience including teaching experience in an polytechnic / educational institutions for a minimum of three years.

OR

- (b) Master of Science in Chemistry (any branch) and one year diploma in industrial safety conducted by DGFASLI or any institution recognised by the State Technical Boards or equivalent with 10 years of relevant work experience including teaching experience in an polytechnic / educational institutions for a minimum of two years.

OR

- (c) Bachelors degree in engineering / technology in chemical (including petro-chemical) / mechanical / electrical / environmental / instrumentation / civil engineering and one year diploma in industrial safety conducted by DGFASLI or any institution recognised by the State Technical Boards or equivalent with 10 years of relevant work experience including teaching experience in an polytechnic / educational institutions for a minimum of two years.

Note : The term ‘relevant work experience’ means working in any industry / Major Accident Hazard installation. The term ‘teaching experience’ means experience in a teaching capacity in an educational institution imparting diploma / degree in engineering / technology.

## **13. PROCEDURE FOR APPROVAL OF THE TRAINING PROGRAMME CONDUCTED BY THE INSTITUTE /ORGANISATION**

- (1). The application in duplicate in the prescribed format should be sent to the approving authority, i.e., DGFASLI. (Please see **Annexure – III**).

- (2). Approval issued by DGFASLI shall be valid for a period of 2 years from the date of approval for the first time.
- (3). The training imparted by different institutes and certificates awarded by DGFASLI will be valid all over India.
- (4). For renewals the institute shall reapply with the requisite fee within 3 months before expiry of the previous approval and the approval shall be renewed for a period of 5 years provided that the institute had conducted a minimum of two courses during the period of last approval and based on the performance of the institute or re-inspection as may be decided by DGFASLI. The arrangements for travel, lodging and boarding of DGFASLI officers and other members shall be required to be made by the applicant institute / organization as per their entitlement.
- (5). Approving authority may constitute a committee for visit of the Institution / Organisation for verification.
- (6). So far as the approval by DGFASLI is concerned, an officer not below the rank of the Director shall be the Chairman and another member on the Committee from DGFASLI in the level of Dy. Director / Asst. Director, of DGFASLI shall be the Member-Secretary or as decided by the Director General. Other members shall be one expert member each from the concerned CIF of the state, IIT or Govt. engineering institution and one representative from the industries association from the state to be nominated by the Director General.  
  
Note: The Committee shall consist of not less than three members for the purpose of recommending the training institute /organization for approval.
- (7). A Registered Association of safety and health professionals having minimum 15 members shall also be eligible to apply for approval provided they meet the eligibility criteria in terms of the infrastructure facilities, faculty and expertise for conducting such courses.
- (8). The application form in duplicate along with the necessary documents in support of the infrastructure facilities, faculty and any other claim made therein, accompanied by a Demand Draft of ₹ 10,000/- for fresh application and ₹ 5,000/- for renewal shall be drawn in favour of Pay & Accounts Officer, DGFASLI, Mumbai.

#### **14. Conditions for grant of approval by DGFASLI**

The approval shall be subject to the following terms and conditions:

- (1) All terms and conditions mentioned in the guidelines are to be complied by the institutes.

- (2) The logo of DGFASLI or the Government of India shall not be used by the institution along with its name or in its pamphlets, brochure, training material, website, certificates, etc. or in any other place.
- (3) The approvals granted by DGFASLI will be exclusively for running this course only and not for any other course conducted by the institute.
- (4) The number of participants in each batch shall be restricted to 30 (thirty) or less as may be recommended by the committee constituted by DGFASLI on case to case, for the purpose of grant of approval to the institute and the number of such courses to be conducted in a calendar year shall be restricted to 4 only.
- (5) The training manuals to be used during the course would be prepared by DGFASLI and distributed to CLI/ RLIs and the institutions carrying out the course as per the number of candidates registered by them. The study and evaluation scheme is given in **Annexure-VI**.
- (6) The mode of selection and the list of selected candidates for each course shall be intimated to DGFASLI along with a certificate of eligibility (as prescribed Para-2) within one week from the date of commencement of the course.
- (7) The institute shall comply with any other terms and conditions which the Director General, DGFASLI may like to impose on case to case basis.
- (8) The Director General, DGFASLI reserves the right to cancel the approval granted to any institute for conducting the subject course without assigning any reason.

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## ANNEXURE-I

### TEACHING PLAN OF THE TRAINING COURSE FOR SUPERVISORS

Minimum  
no. of sessions  
(each of 75 min.)

<b>1. Statutory Provisions -</b>	
1.1 The Factories Act, 1948 and Rules	3
1.2 The Environment (Protection) Act, 1986 and Rules with special emphasis on MSIHC Rules & Handling of Hazardous Wastes Rules	2
1.3 The Indian Petroleum Act 1934 and Rules	1
1.4 The Indian Explosives Act, 1984 and Rules	1
1.5 The Static and Mobile Pressure Vessel Rules	1
1.6 Indian Boilers Act and Rules	1
1.7 The Insecticides Act and the Rules	1
1.8 Other applicable Acts and Rules	1
NOTE: Inputs to be imparted to the participants in the above Acts and Rules should be relevant to the factory processes and operations.	
<b>2. Basic Principles of Accident Prevention –</b>	
2.1 Basic philosophy of industrial accidents– causation and prevention, near miss reporting and learning lessons; Accident causation models	1
2.2 Safety and Health Policy	1
2.3 Types of hazards – physical, chemical, electrical, mechanical, biochemical, radiological, etc.	1
2.4 Role of supervisor in promoting safety & health	1
2.5 Accident and root cause analysis	1
2.6 Principal factors for classification	2
2.7 Formulation of accident prevention programme	1
2.8 Electrical Safety	
2.9 Case study	

<b>3. Techniques of Identification of Hazards and Risk Management –</b>	
3.1 Plant Safety Inspection	2
3.2 Accident Investigation	2
3.3 Job Safety Analysis (JSA)	1
3.4 Fault tree Analysis (FTA)	
3.5 Failure Modes and Effect Analysis (FMEA)	
3.6 Hazards and Operability (HAZOP) Study	
3.7 Hazard Identification and Risk Assessment (HIRA)	
3.7 Risk and Risk Management	
<b>4. Prevention and Control Techniques -</b>	
4.1 Hierarchy of Controls	
4.2 Engineering, Administrative and PPE controls	
4.3 Substitution, etc.	
4.4 Dilution	
4.5 Segregation	
4.6 Isolation	
4.7 Enclosure	
4.8 Barricading	
4.9 Guarding	
4.10 Interlocks	
<b>5. Chemical Hazards and Specific Control Measures –</b>	
5.1 Storage, handling and transportation of chemicals (safety in bulk storage, Handling of hazardous chemicals, chemical safety)	2
5.2 Permit to work – procedure and compliance	1
5.3 Safety in shut-down and start-up procedures	2
5.4 Colour coding of pipelines , cylinders & valves	1
5.5 Labelling and Hazard Communication (HAZCOM)	2
5.6 Personal Hygiene	1
5.7 Tankfarm Safety and dyke arrangements	1
5.8 Chemical Safety Data Sheets/ MSDS	1

5.9 House Keeping	1
5.10 Personal Protective Equipment	2
5.11 Standard Operating Procedures (SOP)	1
5.12 Standard Maintenance Procedures (SMP)	
5.13 Safety Instrumented System (SIS)	
5.14 Concept of Reliability and calibration	
<b>6. Fire and Explosion Hazards –</b>	
6.1 Fire and Explosion	1
6.2 Flash point, explosive limits	1
6.3 Fire Prevention and Control; Portable and fixed fire fighting systems;	2
6.4 Hazards area classification and safety aspects including flameproof electrical Equipment	2
6.5 DOW fire & explosion index	2
6.6 Reporting deviations for inspection, refilling, examination, etc, of fire fighting System	1
6.7 Consequence Modelling	
6.8 Electrical Safety, bonding, earthing and Hazardous Area Classification	
6.9 Static Electricity hazards and its prevention and control	
<b>7. Health hazards due to chemical exposure –</b>	
7.1 Factors contributing to hazardous situation	1
7.2 Routes of entry	1
7.3 Concentration and types of exposure	2
7.4 Work environment monitoring – techniques & procedure	2
7.5 Toxic effects of chemicals	1
7.6 Health monitoring	1
7.7 First Aid	1
7.8 PLE, TLV, IDLH, LC <sub>50</sub> and LD <sub>50</sub>	
7.9 Toxicology; Dose Vs. Response Relationship	
<b>8. Chemical Emergency Procedures –</b>	
8.1 The onsite Emergency Plan	
8.1.1 Key persons and their responsibilities	



8.1.2 Alarms	2
8.1.3 Control room	
8.1.4 Evacuation	
8.1.5 Assembly points	
8.1.6 Emergency Control Centre	
8.1.7 Rehearsals	
8.1.8 Rehabilitation of the affected area	1
8.2 Off-site Emergency Plan	
8.3 Disaster Management Planning	
<b>9. Counseling and motivating for safety &amp; health –</b>	
9.1 Techniques	1
9.2 Strategies	1
9.3 At Risk Behaviours	
9.4 Discretionary Performance	
9.5 Motivational Models	
9.6 Human Error – Prediction, Prevention and Control	
<b>10. Others –</b>	
10.1 Safety audit and OSHAS	1
10.2 Environmental Management System (EMS)	1
10.3 Communication skills for safety & health at work	2
10.4 Training cycle, training techniques, tool box talks	1
10.5 Behavioural aspects of safety	
10.6 Physiological aspects of safety	
10.7 Total Safety Culture	
10.8 Resilience Engineering	

(The detail content of the syllabus shall be as given in **Annexure-IV**)

**CERTIFICATE**

This is to certify that Shri/Smt/Kum.....  
attended the “Certificate Course in Safety and Health for Supervisory Personnel Engaged in Hazardous Process Industry ” as required under Section 41-C(b) of The Factories Act, 1948 and the Rules made there under, from ..... to ..... at .....

On successful completion of the course with grade ....., he/she is herewith conferred with this certificate of competency to work as Supervisor in industries involving hazardous processes.

Photograph of the candidate  
duly attested by the Head of the  
Training Institute/ Organization

Seal of the Training  
Institute/ Organisation  
(overflowing the photograph)

(Signature of  
Approving Authority with seal)

Date:

Grading: A+ - 80% and above, A - 70% to 80%, B+ - 65% to 70%, B – 60% to 65%

## ANNEXURE – III

### **APPLICATION FOR APPROVAL OF TRAINING INSTITUTION/ ORGANISATION FOR THE PURPOSE OF TRAINING OF SUPERVISORS UNDER SECTION 41 C(b)**

Note:

1. Applications are to be submitted in duplicate.
2. A committee constituted by approving authority shall inspect the Institute/ Organisation for verification in case of fresh applications.
3. A committee constituted by approving authority may visit the Institute/ Organisation for verification in case of renewals if necessary as may be decided by the Director General.

#### 1.0 GENERAL

##### 1.1 Name and Address

- (a) Name of the Institution/ Organisation :
- (b) Postal address :
- (c) Website :
- (d) Email address :
- (e) Fax and Phone Nos. (with STD code in bracket) :
- (f) Date of establishment of the Institution/ Organisation :  
( The organization shall have a minimum of three years of training experience in the relevant field at the time of application)

##### 1.2 Name and designation of the Head of the Institution/ Organisation with residential & office telephone numbers (with STD Codes in bracket) :

##### 1.3 Type of the Institution (Central Govt./ State Govt./ Autonomous/ Private) :

##### 1.4 Please specify whether your training institution/ organization is located in your own building or hired building (in case of hired building pl. attach a copy of the 'Registered Lease Agreement' which is valid for a minimum period of five years) :

#### 2.0 TRAINING DETAILS

##### 2.1 Training Programmes conducted during the previous years (A Minimum of three years training details shall be provided)

S.No.	Type of training programme, title and Venue	Level of participants	Duration
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3.1 Whether your Institution /organization is recognized by State govt./ DGFASLI or any other Organisation. If yes' please enclose a copy of the approval/ certificate  
 Yes [ ] No [ ]

3.2 List of the Organisations where training Programmes were conducted by you during the previous years : (A Minimum three years Training details shall be provided)

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3.3 Please provide a list of training manuals, publications, etc. brought out by your organization/ institute.( The copies of the supporting documents shall be enclosed)

#### 4.0 DETAILS OF TRAINING FACULTY

##### 4.1 Faculty for training

Type of Faculty	Strength
i) Full-Time*	
ii) Part-time	
iii) Visiting	
(Please give details such as name, qualification, experience & address in respect of each faculty in separate annexure)	

- The faculty shall have the required academic qualification and experience as mentioned at sl. No. (12) of the guidelines.

\* A minimum of three full-time faculties each one specialized in the field of Safety, Hygiene and Industrial Medicine shall be ensured. These full-time faculties shall be on the institution / organisation's pay-roll.

4.2 Any other activities / services :

5.0 FACILITIES AVAILABLE IN THE INSTITUTION/ ORGANISATION

Facility	Nos.
<p>(i) Conference room/ training room with Area in Sq. Mtrs. (minimum 25 Sq. Mtrs.)</p> <p>(ii) Overhead projector/ computer projection system</p> <p>(iii) Films, DVDs/VCDs on safety, health and environment, etc. (Please provide the list)</p> <p>(iv) (a) <b><u>Industrial Hygiene and work environment monitoring laboratory</u></b> (please provide list of equipment available or copy of the signed agreement between the institution and the organisation willing to provide this facility.)</p> <p>(b) <b><u>Safety Engineering Laboratory</u></b> (please provide list of equipment available or copy of the signed agreement between the institution and the organisation willing to provide this facility.)</p> <p>(c) <b><u>Industrial Medicine Laboratory</u></b> (please provide list of equipment available or copy of the signed agreement between the institution and the organisation willing to provide this facility.)</p> <p>Note : equipments as mentioned in <b>Annexure-V</b> are mandatory.</p> <p>(v) Other facilities</p> <p>(Video recording of all above facilities shall be submitted in a CD along with the application)</p>	

6.0 LIBRARY FACILITIES AVAILABLE

(with respect to safety, health and environment)

Category	Total No. of titles acquired till date	Total no. of volumes acquired during past one year
a) Reference books*		
b) Encyclopedia		
c) Others (journals,		

etc.) Please specify.		
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\* Reference books shall consist of books relevant to the syllabus of the course specially on industrial safety, industrial hygiene, occupational health and copies of the relevant Acts and Rules (as per syllabus).

- Books listed must have been published within a period of 5 years from the date of application.

(Video recording of the library shall be submitted in a CD along with the application)

#### 7.0 CONSULTANCY AND MAN-POWER DEVELOPMENT

Give details of the consultancy, projects/ studies, Sponsored Research, professional development Programs undertaken during the last five years

(Please enclose the list and supporting documents)

#### 8.0 ANY OTHER INFORMATION

#### 9.0 CERTIFICATE

Certified that the information furnished above and in the Annexures attached is true to the best of my knowledge and belief.

Signature of the Head of Institution/  
Organization with official seal

Place:

Date:

**Detailed contents of the Syllabus to be covered****1. Statutory Provisions**

**Rationale :** Every Supervisory personnel working in Chemical Industry must know the various laws relating to Industrial Safety as these provide guidelines in decision making in any situation.

S.No.	Units	Coverage time (Each of 75 Min)
1.1	The Factories Act & Rules	3
1.2	The Environment (Protection) Act 1986 with special emphasis on MSIHC Rules & Handling of Hazardous wastes Rules	2
1.3	The Indian Petroleum Act 1934 & Rules	1
1.4	The Indian Explosive Act 1984 & Rules	1
1.5	The Static & Mobile Pressure Vessel Rules	1
1.6	The Indian Boiler Act & Rules	1
1.7	The Insecticides Act & Rules	1
1.8	Gas Cylinder Rules	1
		11

**Detailed Contents :****1.1 The Factories Act & Rules**

- Definition – Adult, adolescent, young person, child, competent person, hazardous process, manufacturing process, worker, factory, occupier.
- General duties of occupier & manufacturers, powers of Inspectors & certifying surgeons.
- Provisions relating to Safety, health and welfare measures and rules made there under.
- Dangerous operations and schedule on chemical works.
- Notice of accidents, dangerous occurrences & certain diseases.
- Obligation & Right of Workers.

**1.2 Environmental Protection Act:**

- Manufacture, Storage & import of hazardous chemical rules 1989
- Hazardous waste (Management & Handling) Rules 1989.

**1.3 Petroleum Act & Rules :**

- Petroleum & its classification, General Provision for Transportation of Petroleum by vehicles & pipe lines, bulk storage, type of licences & their terms & conditions, electric installation in hazardous areas.

#### 1.4 Indian Explosive Act & Rules:

- Handling, precautions & general provisions of explosive rules 1983, classification of explosives & safety distances, magazines & store house, transport of Explosive by road.

#### 1.5 SMPV Rules :

- Definition of Design pressure, pressure vessel, compressed gas, filling density
- Test & Inspection of Pressure Vessels
- Fittings on vessels
- Provision relating to loading & unloading & other operations.
- General provision for storage & licences for storage & transport
- Any other notification under SMPV Rules 1981.

#### 1.6 Indian Boiler Act & Rules :

- Definition of Boiler, Inspection procedure & preparation of boiler for inspection & Hydraulic test, defects & repairs of boilers.

#### 1.7 Insecticide Act & Rules :

- General Provisions

#### 1.8 Gas Cylinder Rules :

- General Provisions, licence, notice of accidents, conditions for storage of LPG Cylinders.

## 2. Basic Principles of Accident Prevention

**Rationale :** Accident Prevention is an integrated programme, a series of coordinated activities directed to control unsafe personal performance & unsafe mechanical conditions so as to operate the plants & processes in a manner that protects the environment & safety of employees & the public, commitment by all levels of management for protecting & promoting the health & safety of people working at sites.

S.No.	Units	Coverage time (each of 75 Min duration)
2.1	Basic Philosophy of Industrial Accidents – Causation &	1



	Prevention	
2.2	Safety & Health Policy	1
2.3	Types of Hazards – Physical, Chemical, Electrical, Mechanical	1
2.4	Role of Supervisors in promoting Safety & Health	1
2.5	Accident Analysis	1
2.6	Principal Factors for classification	1
2.7	Formulation of Accident Prevention Programme	2
2.8	Case Study	1
		9

## Detailed Contents:

### 2.1 Basic Philosophy of Industrial Accident – Causation & Prevention:

10 axioms of Industrial Safety, theories of accident occurrence – Heinrich domino sequence & updated frank bird model, Multi-causation theory, Foundation of Major Injury, Basic Motives for the occurrence of unsafe acts, basic methods for preventing accident, Accident Causation Models.

### 2.2 Safety & Health Policy:

Legal requirement for safety policy, basis for formulation & effective implementation of safety policy, Areas to be touched in safety policy.

### 2.3 Type of Hazards:

Physical – Heat stress, Noise, Fatigue, Radiation, Vibration, Illumination

Chemical – Exposure to toxic material, contact with corrosive material, spillage

Electrical – Fire, Burn, Shock

Mechanical – Hazards due to in running nips of machinery parts & mechanism, working at height, hazards due to improper manual & mechanical handling.

### 2.4 Role of Supervisors in promoting Safety & Health:

- Responsibilities of Supervisors, Acceptance of Responsibility for safety,
- Role of Supervisor in safety.

### 2.5 Accident Analysis :

- Injuries, employment, No. of working factories, rate of injuries, injuries by states/union territories, injuries by industries, injuries by causes.
- Frequency Rate, Severity Rate, Incidence Rates, Accident free period, use of accident rates.

## 2.6 Principal Factors for Classification :

- Standard classification of factor associated with accident. (IS-3786)

## 2.7 Formulation of Accident Prevention Programme :

- Planning - Management leadership, Goal setting, budgeting
- Organising - Organisation structure, delegation of power, span of control, safety education & training and 5 min. pep talk, safety content.
- Directing - Communication system, safety committee, safety manual, SOP'S, Suggestion Scheme.
- Coordinating – Motivational Activities (safety contest, display of posters, celebration of safety day and safety week)
- Controlling – Accident reporting, record & analysis, accountability, surveillance.

## 2.8 Case Study :

Bhopal disaster, flix borough disaster, mexico disaster etc.

## 3. Techniques of Identification of Hazards

**Rationale :** Hazard identification is the process of finding all items, activities & situations that could lead to the potential of injury or illness. Supervisors should be conversant with such technique.

S.No.	Units	Coverage time (each of 75 Min)
3.1	Plant Safety Inspection	2
3.2	Accident Investigation	2
3.3	Hazard & Operability study	1
3.4	Job Safety Analysis	1
		6

### Detailed Contents :

#### 3.1 Plant Safety Inspection :

- Responsibility for inspection, types of inspection, planning for inspections, conducting inspections, inspection reports, Development of checklist for storage & process areas and Safety sampling.

#### 3.2 Accident Investigation :

Need for accident investigation, pre-accident plan, investigation at accident site, persons to make investigation, identifying key facts & causes, first aid report, supervisor's, investigation report, notification of accident, accident record register, personal injury record card.

### 3.3 Hazard & Operability Study :

- Objective, operating deviation, guide words, principles of examination, methodology, benefits of HAZOP study and a case study.

### 3.4 Job Safety Analysis :

Responsibility for J.S.A. & its use, conducting J.S.A. with an example.

### 3.5 Hazard Identification and Risk Assessment ( HIRA)

HIRA work sheets, Risk Matrix, Probability and Consequence, Prevention and Control Measures

## 4. Control Techniques

**Rationale :** The segregation & separation of materials within storage area largely depends upon classification of materials & electrical areas, industrial ventilations, other control techniques, help in improving the work environment. Knowledge of such control technique is essential for plant supervisor.

S.No.	Units	Coverage time (Each of 75 mins)
4.1	Segregation & Isolation	1
4.2	Dilution & Substitution	1
4.3	Enclosures, Barricading, Guarding	1
4.4	Industrial ventilation	1
		4

### Detailed Contents :

Engineering, Administrative and PPE controls in chemical Industries.

### 4.1 Segregation & Isolation

Segregation : Material classification for volatile liquid, Electrical Area Classification and Various methods of Isolation of equipment & pipelines.

#### 4.2 Dilution & Substitution

Substitution : Replacing material/process with less hazardous substances/process.

Dilution : Handling of material in dilute form like use of dilute nitric acid in place of concentrated fuming nitric acid & similar examples.

#### 4.3 Enclosures, Barricading, Guarding

- Equipment barricade & provision of enclosures.
- Principles of machine guarding, type of guards, selection, maintenance & repair of guards.
- Interlocks

#### 4.4 Industrial ventilation

Types of ventilation and their application.

### 5. Chemical Hazards & Specific Control Measures

**Rationale :** Unplanned, sudden release of chemicals from manufacturing processing, handling & onsite storage facilities causes pollution to the air, water or land & increase the risk of fire, explosion or pollution. Hence supervisory personnel should be aware of various requirements of safe task activities.

S.No.	Units	Coverage time (Each of 75 Min)
5.1	-Storage, handling & transportation of chemicals (Safety in bulk storage, handling of hazardous chemicals, chemical process safety)	2
	-Industrial Classification	1
5.2	Permit to work – procedure & compliance	1
5.3	Safety in shutdown & startup procedures	2
5.4	Colour coding of pipelines, cylinders & valves	1
5.5	Labelling & Hazard Communication	2
5.6	Chemical Safety data sheets / MSDS	1
5.7	Personal Protective Equipment	2

	Respiratory & Non Respiratory	1
5.8	House Keeping	1
5.9	Personal Hygiene	1
5.10	Labelling and Hazard Communication	1
5.11	Tankfarm Safety and dyke arrangements	1
5.12	Safety Instrumented System	1
		18

### 5.1 Storage, handling & transportation of chemicals :

- Handling & storage of dangerous materials & their classification (U.N.)
- HAZCHEM Code
- TREM Cards
- Types of Bulk Storage & their lay out, bunds, pressure vacuum valves, flame arrester, atmospheric vents, fire relief, inspection of storage tanks.
- Storage of chlorine, L.P.G., Ammonia, Class 'A' petroleum product, hydrogen
- Loading & unloading facilities of chemicals.
- Hazard Communication

### 5.2 Permit to Work :

Need for permit to work system, areas to be covered, types of work permit, contents of permit format, operation of permit, monitoring of permit system, confined space work permit system.

### 5.3 Safety in Shut down & Start up procedures :

- Standard operating procedure, Standard Maintenance Procedure, start up procedure (Phases of start up), typical errors on start up of plants, start up after emergency shut down
- Shut down procedure - Normal shut down, Emergency shut down
- Modification procedure – classification of modification.

### 5.4 Colour coding of pipelines, cylinders & valves :

- Pipe work & valves, inspection, examination & testing of pipelines, cylinders valves, colour coding of pipe lines (IS 2379-1990)
- Tankfarm Safety
- Dyke arrangements

## **5.5 Instrumentation**

- Basic Instrumentation & designed safety methods like
- Control of variables like temperature, pressure, level, PH, density, flow ratios etc.
- Multipoint recorders, process alarms, interlock system
- Operators records like log book, log sheet.
- Safety Instrumentation System

## **5.6 Chemical Safety data sheet :**

- Contents of M.S.D.S. of MSIHC Rules 1989 & its preparation.
- M.S.D.S. of Cl<sub>2</sub>, NH<sub>3</sub>, LPG & benzene
- Hazard Communication

## **5.7 Personal Protective Equipment (Respiratory & Non Respiratory) :**

- Non Respiratory personal protective devices – head protection, ear protection, face & eye protection, hand protection, feet protection, body protection
- Use care & maintenance of personal protective equipment & breathing apparatus
- Classification of respiratory personal protective devices & their uses, selection of respirators.

## **5.8 House Keeping :**

Typical accidents due to poor house keeping, disposal of scrap & other trade wastes, prevention of spillage, marking of gangways & other locations, clean up campaigns.

## **5.9 Personal Hygiene & health awareness:**

Washing facilities, drinking water, facilities for storing work clothings & personal clothing & drying clothes (clock room), storage of food items in plant & prohibition of consuming food etc in work room.

Special bathing accommodation, health awareness do's and don'ts.

## **6. Fire & Explosion Hazards**

**Rationals :** Fire hazard is a term which includes not only the causes of fire but embraces those circumstances which increase the probability of fire occurring or which enable or permit fire. Hence supervisory personnel must know an effective fire loss control program.

S.No.	Units	Coverage time (Each of 75 Min)
6.1	Definition – Fire, Explosion, Flash Point, Explosive limits etc	1
6.2	Chemistry of Fire, Fire Prevention and control	1
6.3	Portable & Fixed Fire Fighting Systems	2
6.4	Hazardous Area classification & safety aspects including flame proof electrical equipment	2
6.5	Dow Fire & explosion index	1
6.6	Reporting deviations for inspection, refilling, examination etc of fire fighting system	1
6.7	Health hazard due to fire and explosion and its first aid measures.	1
6.8	Electrical Safety; Hazards and its prevention and control	2
6.9	Consequence Modelling	2
		<b>TOTAL: 13</b>

## Detailed Contents :

### 6.1 Definition :

Flammability, flash point, fire point, flammable range, auto ignition, boiling point, vapour pressure, vapour density, ignition energy, spontaneous ignition.

### 6.2 Chemistry of Fire :

Factors contributing towards fire, chemistry of fires, classification of fires, common causes of industrial fires.

### 6.3 Portable & Fixed Fire Fighting System:

- Portable extinguishers, water system, CO<sub>2</sub> system, foam extinguisher system, chemical extinguishing system.

- Fire detection & alarm system – heat detector, smoke detector, detector for special purpose etc.
- Sprinkler system

#### **6.4 Hazardous Area Classification & Electrical Installation :**

Hazardous area classification, control of hazards due to static electricity, flame proof electrical equipments, precautions in their selection, maintenance & use.

#### **6.5 Dow Fire & Explosion Index :**

Knowledge of exothermic & endothermic reactions & their hazards, material factor, assessment of fire & explosion index, toxicity index.

#### **6.6 Testing & Examination of Fire Fighting System :**

Importance of Maintenance, preventive maintenance program for portable & fixed fire fighting equipment, extinguisher card, fire alarm system inspection, testing & maintenance.

#### **6.7 Health hazard due to fire and explosion and its first-aid measures.**

- Burn
- Unconsciousness
- Shock

### **7. Health Hazards due to Chemical Exposure**

**Rationale :** Industrial Hygiene activities includes surveys, measurements, evaluation, controls & recommendations. Properly documented exposure – illness records serve to determine safe or unsafe, healthy or unhealthy working conditions & limits of exposure.

Industrial hygiene integrates three elements i.e. recognition, evaluation and control of different physical and chemical stresses /agents at the work place.

The trainees should be given brief orientation at least on the following topics :



Introduction to different physical stresses /agents like heat ,noise ,illumination etc and chemical agent and their effects Chronic and acute effects , Dose Response relationship , Classification of airborne chemical agents (including based on physical nature i.e. dust, gases, fumes, mists, vapours and smoke). Routes of Entry of Hazardous Chemicals in human body, Exposure evaluation and air sampling. The concept of threshold limit values, Control techniques of airborne Contaminants, Industrial Ventilation and personal Protective Equipment.

The trainees should be demonstrated on following main laboratory exercises:

1. Detection of Carbon Monoxide, NO<sub>x</sub> Hydrogen Sulphide, Ammonia, SO<sub>2</sub> by Gas Detectors and other direct reading instruments.
2. Measurement of Concentration of Dust using Personal Sampler by Gravimetric Method.
3. Sampling and analysis of Ammonia.
4. Estimation of Hydrogen Sulphide in Air.
5. Estimation of Chlorine in Work Environment.
6. Measurement of illumination level by Photo Meter.
7. Assessment of Heat Stress in Work Environment using WBGT Intex
8. Measurement of number of air changes in a room by Velometer
9. Measurement of Sound Levels.
10. Determination of concentration of inflammable vapours.

S.No.	Units	Coverage time (Each period of 75 min)
7.1	Permissible limit of exposure, PEL, TLV, IDLH, LC <sub>50</sub> and LD <sub>50</sub>	2
7.2	The mode of entry & action of toxic materials	3
7.3	Work Environment Monitoring – Technique & Procedures	2
7.4	Demonstration of equipments	2
7.5	Health Monitoring	1
7.6	First Aid	1
7.7	Toxicology; Dose Vs. Response	1
		12

### 7.1 Permissible limit of exposure :

TLV – TWA, STEL, Ceiling, Skin, Additive effect, Nuisance Dust, Carcinogenesis.

### 7.2 The modes of entry & action of toxic materials :

Classification of contaminants & route of entry

- Physical classification – Gases & vapour, particulate matter like dust, fog, fume, smoke, smog, aerosol etc .
- Chemical classification – Irritants, Asphyxiants, Anesthetics & Narcotics, Systemic poisons, Sensitizers, particulate matter other than systemic poisons (Bacteria & other micro organisms).

### **7.3 Work Environment Monitoring – Techniques & Procedures :**

- Strategy for representative quantitative surveys.
- Air sampling – Integrated sampling, gas sampling, impingement
- Analysis of samples – Gravimetric technique, colorimeter procedure & evaluation of samples.
- Direct Reading Techniques – colorimetry, explosive meter, other electronic monitor.
- Industrial Hygiene Engineering Control.

### **7.4 Demonstration of Equipment in laboratory :**

- Measurement of dust concentration in work environment by counting method using midget sampler & microscope.
- Estimation of H<sub>2</sub>S in air
- Sampling & analysis of NH<sub>3</sub> & Cl<sub>2</sub>
- Determination of concentration of inflammable vapours.
- Visit to medical laboratory.

### **7.5 Health Monitoring :**

- Common occupational diseases & mode of causation of these disease.
- Diagnostic methods & methods of prevention.
- Pre employment & periodical medical examination.
- Monitoring of occupational health by maintaining records.

### **7.6 First Aid :**

Artificial respiration techniques and cardiac massage (CPR), bandaging, burn, fracture etc.

## **8. Chemical Emergency Procedures :**

**Rationale :** Emergency plan should be prepared for significant events that threaten the viability of the organisation, periodically tested & reviewed.

S.No.	Units	Coverage time (Each of 75 Mins)
8.1	The Onsite Emergency Plan	4
8.2	Off site E.P.	1
8.3	Other Emergency Procedures	1
8.4	Disaster Management Planning	1
		7

### 8.1 The Onsite Emergency Plan :

- The general contents of onsite emergency plan, identification of credible events, categorisation of emergency level.
- Key persons & their responsibilities, alarms, control room, evaluation, assembly points, medical organisation/responses for major accident hazard control
- Rehearsals & Rehabilitation of the effected area.
- medical response in chemical emergency.
- 

### 8.2 The off site Emergency Plan :

- Response time, contents of off site E.P. together with responsibilities
- Role of emergency planning officer.
- Rules on Emergency, Planning, Preparedness & Responses for chemical accidents-96

### 8.3 Other Emergency Procedures :

Emergency eye wash & showers, emergency kit for chlorine & ammonia.

### 8.4 Disaster Management Planning

Disaster Management Planning in Chemical Industries – Disaster Management Act – Legal Compliance

## 9. Motivation, Communication & Appraisal for Safety & Health

**Rationale :** Process measures provide not only a better tool for safety improvement but also a means of measuring employee involvement and commitment. Periodic audit should be conducted for a critical & appraisal of all elements of OH&S management system.

S.No.	Units	Coverage time (Each of 75 Mins)
9.1	Total quality management and ISO Series	1
9.2	Safety Audit	2
9.3	Communication skills for safety & health at work	1
9.4	At Risk Behaviour	1
9.5	Discretionary Performance	1
9.6	Motivational Models	1
9.7	Human Errors – Prediction, Prevention and control	1
		8

### **9.1 Total quality management and ISO Series. .**

### **9.2 Safety Audit :**

Safety Audit – Definition, Objectives, Types of Audit, Methodology, Developing checklist for safety audit – technical aspects & management aspects.

### **9.3 Communication skills for safety & health at work :**

Types of communication, barriers of effective communication and how to overcome these barriers.

### **9.4 Total Safety Culture**

At Risk Behaviour – Discretionary Performance - Motivational Models – Human Error – Prediction, Prevention and Control

## **10. Others**

Behavioural aspects of safety, Physiological aspects of safety – Resilience Engineering

S.No.	Units	Coverage time (Each of 75 Mins)
9.1	Behavioural aspects of safety	2
9.2	Physiological aspects of safety	1

9.3	Resilience Engineering	1
		4

**Basic Laboratory facilities/equipments to be maintained:**

**I- Industrial Hygiene Laboratory**

1. Personal Samplers
2. Filter Discs
3. Analytical Balance
4. Rotameter
5. Detector tubes for Carbon Monoxide , ammonia, Chlorine etc
6. Gas Monitors for common chemical gases like Carbon Monoxide , ammonia, Chlorine etc
7. Glassware and chemicals
8. Analytical Instruments like Spectrophotometer etc
9. WBGT Meter or Globe Thermometer and Whirling Hygrometer
10. Explosimeter

**II -Safety Engineering Laboratory**

1. Sound Level Meter
2. Illumination Level Meter
3. Vibration Meter
4. Static Electricity Meter

**III- Industrial Medicine Laboratory**

1. Audiometry
2. Titmus Vision Test
3. PFT

## ANNEXURE-VI

**Study & Evaluation Scheme for Certificate Course in Safety & Health for Supervisory Personnel Working in Hazardous Process**

<b>Curriculum</b> (Total periods) (Each of 75 Mins) Theory Practical		<b>Subject</b>	<b>Scheme of Examination</b>		
			<b>Theory</b>	<b>Practical</b>	<b>Total</b>
			<b>Max. Marks</b>	<b>Max. Marks</b>	
11	-	1. Statutory Provision	20	-	20
9	-	2. Basic Principles of Accident Prevention	15	-	15
6	4	3. Techniques of Identification of Hazards	15	10	25
4	-	4. Control Techniques	10	-	10
18	4	5. Chemical Hazards & Specific Control Measures	20	10	30
13	-	6. Fire & Explosion Hazards	20	-	20
12	4	7. Health Hazards due to Chemical Exposures	20	10	30
7	-	8. Chemical Emergency Preparedness	10	-	10
8	-	9. Motivation, Communication & Appraisal for Safety & Health	10	-	10
4	-	Others	10	-	10
-	8	10. Factory visit & preparation of Report		10	10
-	8	11. Student Centered Activities (Films, visits to safety centre etc)	-	-	-
		Oral Examination	-	10	10
92	28		150	50	200
120		<b>Total</b>	Maximum Marks = 200		