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MEVE-004
Industrial Sector

Industrial Risk Assessment and Safety Acts

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Indira Gandhi National Open University
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Industrial Sector

Block

3

INDUSTRIAL RISK ASSESSMENT AND SAFETY ACTS

PROGRAMME DESIGN AND EXPERT COMMITTEE

Dr. (Ms.) Shyamala Mani
Professor, National Institute of Urban Affairs (NIUA) India Habitat Centre New Delhi

Prof. R. Baskar
Department of Environmental Science & Engineering, Guru Jambheshwar University of Science & Technology, Hisar Haryana

Prof. H.J. Shiva Prasad
Professor of Civil Engineering College of Technology, G.B. Pant University of Agriculture & Technology Pant Nagar, Uttarakhand

Dr. T.K. Joshi
Director, Occupational & Environmental Programme, Centre for Occupational & Environmental Health, Maulana Azad Medical College, New Delhi

Prof. Nilima Srivastava
School of Gender and Development Studies, Indira Gandhi National Open University, New Delhi

Prof. S.K. Yadav
School of Agriculture
Indira Gandhi National Open University, New Delhi

Dr. Rachna Agarwal
School of Vocational Education and Training, Indira Gandhi National Open University,
New Delhi

Prof. Daizy R Batish
Department of Botany, Panjab University, Chandigarh

Prof. M. Krishnan
Vice Chancellor, Madurai Kamraj University, Madurai, Tamil Nadu

Dr. Chirashree Ghosh
Department of Environmental Studies, University of Delhi,
New Delhi

Mr. Ravi Agarwal
Director, Toxic Link, Jangpura Extension, New Delhi

Prof. Jaswant Sokhi
School of Sciences, Indira Gandhi National Open University,
New Delhi

Dr. B. Rupini
Environmental Studies, School of Interdisciplinary and Trans-disciplinary Studies, Indira Gandhi National Open University,
New Delhi

Dr. Sushmitha Baskar
Environmental Studies
School of Interdisciplinary and Trans-disciplinary Studies
Indira Gandhi National Open University, New Delhi

Prof. Ruchika Kuba
School of Health Sciences, Indira Gandhi National Open University, New Delhi

Prof. Nandini Sinha Kapur
School of Interdisciplinary and Trans-disciplinary Studies,
Indira Gandhi National Open University, New Delhi

Dr. Shachi Shah
Environmental Studies,
School of Interdisciplinary and Trans-disciplinary Studies
Indira Gandhi National Open University, New Delhi

Dr. V. Venkat Ramanan
Environmental Studies
School of Interdisciplinary and Trans-disciplinary Studies
Indira Gandhi National Open University, New Delhi

Dr. Deeksha Dave
Environmental Studies, School of Interdisciplinary and Trans-disciplinary Studies,
Indira Gandhi National Open University, New Delhi

Dr. Shubhangi Vaidya
School of Interdisciplinary and Trans-disciplinary Studies, Indira Gandhi National Open University
New Delhi

Dr. Y.S.C. Khuman
School of Interdisciplinary and Trans-disciplinary Studies, Indira Gandhi National Open University
New Delhi

Dr. Sadananda Sahoo
School of Interdisciplinary and Trans-disciplinary Studies, Indira Gandhi National Open University
New Delhi

BLOCK PREPARATION TEAM

Unit 1
Dr. Shachi Shah
Environmental Studies, School of Interdisciplinary and Trans-disciplinary Studies, Indira Gandhi National Open University, New Delhi

Unit 2
Dr Rachna Bhateria,Department of Environmental Sciences, Maharshi Dayanand University, Rohtak Haryana

Unit 3
Prof Tanu jindal, Director, Amity Institute of Environmental Sciences, Amity Institute of Environmental Toxicology, Safety and Management, Amity University, Noida
Dr. Khushbu Gulati, Research Scientist, Amity Institute of Environmental Toxicology Safety and Management, Amity University, NOIDA

PROGRAMME COORDINATORS

Dr. B. Rupini
Environmental Studies, School of Interdisciplinary and Trans-disciplinary Studies, Indira Gandhi National Open University,
New Delhi

Dr. Sushmitha Baskar
Environmental Studies, School of Interdisciplinary and Trans-disciplinary Studies, Indira Gandhi National Open University,
New Delhi

Prof. Ruchika Kuba
School of Health Sciences, Indira Gandhi National Open University,
New Delhi

COURSE COORDINATOR

Dr. Deeksha Dave
Environmental Studies
SOITS, IGNOU, New Delhi

CONTENT EDITORS

Dr. Geetha Srikanth, Amrita Viswhwa Vidyapeetam, Coimbatore, Tamil Nadu

Dr. B. Rupini, Environmental Studies, SOITS, IGNOU, New Delhi

Prof. Ruchika Kuba School of Health Science, IGNOU, New Delhi

Dr.Sushmitha Baskar, Environmental Studies, SOITS, IGNOU, New Delhi

FORMAT EDITORS

Dr. B. Rupini
Environmental Studies, School of Interdisciplinary and Trans-disciplinary Studies, Indira Gandhi National Open University, New Delhi

Dr. Sushmitha Baskar
Environmental Studies, School of Interdisciplinary and Trans-disciplinary Studies, Indira Gandhi National Open University,
New Delhi

Secretarial/Technical Assistance: Ms. Sonali, SOITS, IGNOU, New Delhi; Mr. Vikram, SOITS, IGNOU, New Delhi

PRINT PRODUCTION

Mr. S. Burman
Deputy Registrar (P), IGNOU, New Delhi

Mr. Y. N. Sharma
Asst. Registrar (P), IGNOU, New Delhi

Mr. Sudhir
Section Officer (P) IGNOU, New Delhi

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INTRODUCTION TO BLOCK 3

This block focuses on the industrial risk assessment and safety acts. Hazard evaluation studies provide industries useful information that help in making decisions for improving safety and managing the risk of various industrial operations. Hazard evaluations usually focus on process safety issues. Hazard evaluation techniques can also be used to investigate operability, economic, and environmental concerns. The block explains in detail the industrial risk assessment and hazard identification, laws and standards for managing the safety of workers and employees in the industrial sector.

Unit 1 deals with the industrial risk assessment and hazard identification at a given workplace. The various hazard analysis techniques have been described. The various methods discussed in this unit are Preliminary Hazard Analysis (PHA), Safety Review, Relative Ranking Analysis (RRA), What-If Analysis, What-lf/Checklist Analysis, Hazard and Operability (HAZOP) Studies, Failure Modes and Effects Analysis (FMEA), Fault Tree Analysis (FTA) Event Tree Analysis (ETA), Cause-Consequence Analysis (CCA), Human Reliability Analysis (HRA). Each method has their limitation and advantages.

Unit 2 deals with industrial safety legislations. The various acts that have been detailed include the Factories Act**,** Workman's Compensation Act, 1943, Employees State Insurance Act, 1948. Mines Act, Boiler Vessels Act. Child Labour and Women Employee Act and the Hazardous waste Management Act, 2008. It is important for employers and employees to know about these acts for their well-being.

Unit 3 deals with the industrial standards. Industrial standards are a set of criteria within different industries for the smooth functioning and carrying out of operations for productivity. The unit explicitly details on the Bureau of Indian standards on safety and health 14489 - 1998 and 15001 – 2000 OSHA, Process Safety Management (PSM), OHSAS – 18001 and EPA Standards. The unit explains that standards are important for establishing certain criteria and practices, and provides guidelines for planning, conducting and documenting of audits on occupational safety and health systems at any workplace. The unit emphasizes that every organization should develop its own specific procedures for implementing standards at the workplace.

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UNIT 1 INDUSTRIAL RISK ASSESSMENT AND HAZARD IDENTIFICATION

Structure

1.0 INTRODUCTION

A hazard evaluation is a well designed effort to identify and analyze the significance of hazardous situations or risk associated with a process or activity. The hazard evaluations are used to find out the weaknesses in the design and operation of facilities which could lead to chemical releases, fires, explosions or some other accidents. In other words hazard evaluation is the cornerstone of an Industries/ operations overall process safety management (PSM) program. Hazard evaluation studies provide industries required information which aid in making decisions for improving safety and managing the risk of various industrial operations. Hazard evaluations usually focus on process safety issues. Hazard evaluation techniques can also be used to investigate operability, economic, and environmental concerns. Though hazard evaluations basically involve the use of qualitative techniques to analyze potential equipment failures and human errors that can lead to incidents, the studies can also highlight gaps in the management systems of a process safety program.

1.1 OBJECTIVES

After completing this unit, you will be able to:

- define hazard evaluation
- identify various techniques to evaluate hazards
- selection of a successful hazed evaluation programme

1.2 HAZARD EVALAUATION PROCEDURES

A hazard can be defined as any physical or chemical condition which has the potential for causing harm to people, property, or the environment. A hazard evaluation is a structured effort to identify and analyze the significance of hazardous situations/ conditions associated with a process or activity. Specifically, hazard evaluations are used to find out the weaknesses in the design and operation of facilities that could further lead to hazardous material releases, fires, or explosions. These studies provide organizations with information to help them improve the safety and manage the risk of their operations.

Hazard evaluations:

1) Focus on process safety issues, like the acute effects of unplanned chemical releases on plant personnel or the public.

2) Complement more traditional industrial health and safety activities, such as protection against slips or falls, use of personal protective equipment, monitoring for employee exposure to industrial chemical etc.

3) Can also be used to help satisfy related needs (e.g., operability, economic, and environmental concerns).

4) Analyze potential equipment failures and human errors that can lead to incidents,

5) Highlight gaps in the management systems of an organization's process safety program.

Hazard analyses are performed to:

1) Identify hazards, hazard effects, and hazard causal factors.

2) Determine system risk and thereby ascertain the significance of hazards so that safety design measures can be established to eliminate or mitigate the hazard.

3) Systematically examine the system, subsystem, facility, components, software, personnel, and their interrelationships.

A number of techniques have been developed to identify and evaluate most hazards during the design stage of equipment and during operation or processes. The techniques discuss in this unit are:

1) Preliminary Hazard Analysis (PHA)

2) Safety Review
3) Relative Ranking Analysis (RRA)
4) What-If Analysis
5) What-lf/Checklist Analysis
6) Hazard and Operability (HAZOP) Studies
7) Failure Modes and Effects Analysis (FMEA)
8) Fault Tree Analysis (FTA)
9) Event Tree Analysis (ETA)
10) Cause-Consequence Analysis (CCA)
11) Human Reliability Analysis (HRA)

1.3 PRELIMINARY HAZARD ANALYSIS (PHA)

A Preliminary Hazard Analysis (PHA) technique derived from the U.S. Military Standard System Safety Program Requirements. It focuses on the hazardous materials and major process areas of a plant. It is most often conducted early in the development of a process when there is little information on design details or operating procedures, and is often a precursor to further hazard analyses. This criticality ranking is used to prioritize any recommendations for improving safety that emerge from the team's analysis.

The Preliminary Hazard Analysis is often used to:

- Evaluate hazards early in the life of a process.
- Generally applied during the conceptual design or R&D phase of a process plant and can be very useful when making site selection decisions.

A hazard evaluation team performing the Preliminary Hazard Analysis should consider the following factors:

1) Hazardous plant equipment and materials (e.g., fuels, highly reactive chemicals, toxic substances, explosives, high pressure systems, and other energy storage systems).

2) Safety-related interfaces between plant equipment items and materials (e.g., material interactions, fire explosion initiation and propagation, and instrumented protective systems).

3) Environmental factors that may influence the plant equipment and materials (e.g., earthquake, vibration, flooding, extreme temperatures, electrostatic discharge, and humidity).

4) Operating, testing, maintenance, and emergency procedures (e.g., human error importance, operator functions to be accomplished, equipment layout/ accessibility, and personnel safety protection).

5) Facility support (e.g., storage, testing equipment, training, and utilities) Safety-related equipment (e.g., mitigating systems, redundancy, fire suppression, and personal protective equipment).

A PHA formulates a list of hazards and generic hazardous situations by considering the following process characteristics:

- Raw materials, intermediate
- Operating environment and final products, and their reactivity
- Operational activities (testing, maintenance, etc.)
- Plant equipment
- Interfaces among system
- Facility layout components

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- Safety-related interfaces between plant equipment items and materials (e.g., material interactions, fire explosion initiation and propagation, and instrumented protective systems).
- Environmental factors that may influence the plant equipment and materials (e.g., earthquake, vibration, flooding, extreme temperatures, electrostatic discharge, and humidity).
- Operating, testing, maintenance, and emergency procedures (e.g., human error importance, operator functions to be accomplished, equipment layout/ accessibility, and personnel safety protection).
- Facility support (e.g., storage, testing equipment, training, and utilities)
- Safety-related equipment (e.g., mitigating systems, redundancy, fire suppression, and personal protective equipment).

1.4 SAFETY REVIEW METHOD

The Safety Review technique was the first hazard evaluation method used. It is also referred to as a Process Safety Review, a Design Review, or a Loss Prevention Review. It can be used at any stage of the life of a process. The Safety Review involves a walk-through inspection that can vary from an informal, routine visual examination, to a formal examination, performed by a team that takes several weeks. For processes that are still being designed, a design project team might, for example, review a set of drawings during a meeting. The Safety Review technique is often used to perform a pre startup safety review of a process.

Safety Reviews

1) Is done basically to identify the conditions plant or operating procedures which could lead to an accident and result in injuries, significant property damage, or environmental impacts.
2) Includes interviews with many people in the plant including operators, maintenance staff, engineers, management, safety staff, and others which depends upon the plant organization.

3) Is a cooperative effort to improve the overall safety and performance of the plant. The Safety Review usually focuses on major risk situations.

4) Should complement other process safety activities, such as routine visual inspections, and other HE techniques such as Checklist Analysis and What-If Analysis.

At the end of the Safety Review, the analyst makes recommendations for specific actions that are needed, justifies the recommendations, recommends responsibilities, and lists completion dates. A follow-up evaluation or re-inspection may be planned to verify that corrective actions have been completed correctly.

Safety Reviews can be used to ensure that the plant and its operating and maintenance practices match the design intent and construction standards.

The Safety Review procedure

1) Keeps operating personnel alert to the process hazards,

2) Reviews operating procedures for necessary revisions,

3) Seeks to identify equipment or process changes that could have introduced new hazards,

4) Evaluates the design basis of control and safety systems,

5) Reviews the application of new technology to existing hazards, and

6) Reviews the adequacy of maintenance and safety inspections.

1.5 RELATIVE RANKING ANALYSIS (RRA)

Relative Ranking is an analysis strategy rather than a single, well-defined analysis method. This strategy allows hazard analysts to compare the attributes of several processes or activities to determine whether they possess hazardous characteristics that are significant enough to warrant further study. Relative Ranking can also be used to compare several process siting, generic design, or equipment layout options, and provide information concerning which alternative appears to be the "best," or least hazardous, option. These comparisons are based on numerical values that represent the relative level of significance that the analyst gives to each hazard. Relative Ranking studies should normally be performed early in the life of a process, before the detailed design is completed, or early in the development of an existing facility's hazard analysis program. However, the Relative Ranking method can also be applied to an existing process to pinpoint the hazards of various aspects of process operation. In this method the analyst divides a process or activity into separate process units and assigns indexes based on material, physical, and chemical characteristics; process conditions; plant arrangement and equipment layout considerations and other factors.

Relative Ranking methods

- Address fire, explosion, and/or toxicity hazards and associated safety, health, environmental, and economic effects for a process or activity.
- Compare more than one process area, or several designs of the same process area.=

Relative Ranking techniques may be used during any phase of a plant or process lifetime to:

- Identify the individual process areas that contribute most to the anticipated overall hazard and incident attributes of a facility.
- Identify the key material properties, process conditions, and or process characteristics that contribute most to the anticipated hazard and incident attributes of a single process area or an entire facility.
- Use the anticipated hazard and incident attributes to discriminate among competing design, siting, or operating options.
- Compare the anticipated hazard and incident attributes of process areas or facilities to others whose attributes are better understood and/or more commonly accepted.

Table 1.1: Relative Ranking Indexes

Index	
Dow Fire and Explosion Index (F&EI)	Evaluates the fire and explosion hazards associated with discrete "process units" (collections of equipment containing a flammable or explosive material).
Mond Index	Developed by ICl's Mond Division, it is an extension of the Dow F&EI. The Mond Index specifically includes factors that address the toxicity hazards associated with materials in process units.
Substance Hazard Index (SH1)	Proposed by the Organization Resources Counselors (ORC) in their advice to OSHA on PSM as a way of ranking material hazards
Material Hazard Index (MH1)	Used by the State of California to determine threshold quantities of acutely hazardous materials for which risk management and prevention programs must be developed.
Chemical Exposure INDEX CEI	Developed by Dow Chemical Company. Address five types of factors that can influence the effects of release of the material: (1) acute toxicity, (2) volatileportion of material that could be released, (3) distance to areas of concern, (4) molecular weight of the substance, and (5) various process parameters such as temperature, pressure, reactivity, and so forth.
SARA Title 111 Threshold Planning Quantity (TPQ) Index7	Developed by the U.S. Environmental Protection Agency to determine which extremely hazardous substances and threshold quantities should be covered under SARA Title 111.

Source: Guidelines for Hazard Evaluation Procedures, Third Edition by Center for Chemical Process Safety Copyright, 2008 American Institute of Chemical Engineers, Inc.

The main purpose of using Relative Ranking methods is to determine the process areas or operations that are the most significant with respect to the hazard of concern in a given study. Relative Ranking approaches is to address these risk analysis questions to determine the relative importance of processes and activities from a safety standpoint before performing additional and more costly hazard evaluation or risk analysis studies.

The table 1.1 gives few important relative ranking indexes.

Check Your Progress 1

Note: a) Write your answer in about 50 words.

b) Check your progress with possible answers given at the end of the unit.

1) What is hazard evaluation? List down various hazard evaluation procedures?

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2) Discuss the main purpose of using Relative Ranking methods?

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1.6 CHECKLIST ANALYSIS

A Checklist Analysis uses a written list of items or procedural steps to verify the status of a system. Traditional checklists vary widely in level of detail and are frequently used to indicate compliance with standards and practices.

The Checklist Analysis approach

- is easy to use and can be applied at any stage of the process's lifetime.
- can be used to familiarize inexperienced personnel with a process by having them compare a process's attributes to various checklist requirements.
- also provide a common basis for management review of the analyst's assessments of a process or operation.

Features of Checklist Analysis approach:

1) A detailed checklist provides the basis for a standard evaluation of process hazards.

2) It can be as extensive as necessary to satisfy the specific situation, but it should be applied conscientiously in order to identify problems that require further attention. Generic hazard checklists are often combined with other HE techniques to evaluate hazardous situations.

3) Checklists are limited by their authors' experience; therefore, they should be developed by authors with varied backgrounds who have extensive experience with the systems they are analyzing.

4) Frequently, checklists are created by simply organizing information from current relevant codes, standards, and regulations. Checklists should be viewed as living documents and should be audited and updated regularly.

Many organizations/ Industries use standard checklists to control the development of a project from initial design through plant decommissioning. The completed checklist must frequently be approved by various staff members and managers before a project can move from one stage to the next. So it serves as both, a means of communication and as a form of control. Checklists are normally used in hard copy form, although in some cases computer-based versions can be used.

Traditional checklists are used primarily to ensure that organizations are complying with standard practices. In some cases, analysts use a more general checklist in combination with another HE method to discover common hazards that the checklist alone might miss. The Checklist Analysis method is versatile. The type of evaluation performed with a checklist can vary. It can be used quickly for simple evaluations or for more expensive in depth evaluations. It is a highly cost-effective way to identify customarily recognized hazards.

1.7 WHAT - IF ANALYSIS

1) The What-If Analysis technique is a brainstorming approach in which a group of experienced people familiar with the subject process ask questions or voice concerns about possible undesired events.

2) It is not as inherently structured as some other techniques (e.g., HAZOP Analysis and FMEA). Instead, it requires the analyst to adapt the basic concept to the specific application.

3) Very little information has been published on the What-If Analysis method or its application. However, it is frequently used by industry at nearly every stage of the life of a process and has a good reputation among those skilled in its use.

4) The What-If Analysis concept encourages the HE team to think of questions that begin with "What-If." However, any process safety concern can be voiced, even if it is not phrased as a question.

1.8 WHAT-IF/ CHECKLIST ANALYSIS

1) The What-if/Checklist Analysis technique combines the brainstorming features of the What-If Analysis method with the systematic features of the Checklist Analysis method.

2) This hybrid method works on the strengths and compensates for the individual shortcomings of the separate approaches. For example, the Checklist Analysis method is an experience-based technique, and the quality of an HE study performed using this approach is highly dependent on the experience of the checklist's authors. If the checklist is not complete, then the analysis may not effectively address a hazardous situation. The What-If Analysis segment of the technique encourages the HE team to consider potential accident events and consequences that are beyond the experience of the authors of a good checklist, and thus are not covered on the checklist. The checklist portion of this technique lends a more systematic nature to the What-If Analysis.

3) The What If/Checklist Analysis technique may be used at any stage of a process's life. Like most other HE methods, the method works best when performed by a team experienced in the subject process.

4) This technique is generally used to analyze the most common hazards that exist in a process. The time and cost of a What-If Analysis are proportional to the plant complexity and number of areas to be analyzed. Once an organization has gained experience with it, the What-If Analysis method can become a cost-efficient means for evaluating hazards during any project phase.

5) The purpose of a What-IF Checklist Analysis is to identify hazards, consider the general types of accidents that can occur in a process or activity, evaluate in a qualitative fashion the effects of these accidents, and determine whether the safeguards against these potential accident situations appear adequate. Frequently, the HE team members will suggest ways for reducing the risk of operating the process.

6) What-If Checklist Analyses are mostly performed by a team of personnel experienced in the design, operation, and maintenance of the subject process. The number of people needed for such a study depends upon the complexity of the process, and to some extent, the stage of life at which the process is being evaluated.

7) An HE study using this technique requires fewer people and shorter meetings than does a more structured technique such as HAZOP Analysis.

1.9 HAZARD AND OPERABILITY ANALYSIS (HAZOP)

The Hazard and Operability Analysis (HAZOP) technique was developed to:

- identify and evaluate safety hazards in a process plant;

- to identify Operability problems which, although not hazardous, could compromise the plant's ability to achieve design productivity.

Use of the HAZOP Analysis technique requires a detailed source of information concerning the design and operation of a process. Thus, it is most often used to analyze processes during or after the detailed design stage. Several variations of the HAZOP Analysis technique are in practice in the chemical industry. Although originally developed to anticipate hazards and Operability problems for technology with which organizations have little experience, it has been found to be very effective for use with existing operations.

1) In HAZOP Analysis, an interdisciplinary team uses a creative, systematic approach to identify hazard and Operability problems resulting from deviations from the process's design intent that could lead to undesirable consequences.

2) An experienced team leader systematically guides the team through the plant design using a fixed set of words (called "guide words").

3) These guide words are applied at specific points or "study nodes" in the plant design and are combined with specific process parameters to identify potential deviations from the plant's intended operation. For example, the guide word "No" combined with the process parameter "Flow" results in the deviation "No Flow." Sometimes, a leader will use checklists or process experience to help the team develop the necessary list of deviations that the team will consider in the HAZOP meetings.

4) The team then agrees on possible causes of the deviations (e.g., operator error blocks in pump), the consequences of deviations (e.g., pump overheats), and the safeguards applicable to the deviations (e.g., pressure relief valve on the pump discharge line).

5) If the causes and consequences are significant and the safeguards are inadequate, the team may recommend a follow-up action for management consideration. In some cases, the team may identify a deviation with a realistic cause but unknown consequences (e.g., an unknown reaction product) and recommend follow-up studies to determine the possible consequences.

The purpose of a HAZOP Analysis is to carefully review a process or operation in a systematic fashion to determine whether process deviations can lead to undesirable consequences. This technique can be used for continuous or batch processes and can be adapted to evaluate written procedures. The HAZOP team lists potential causes and consequences of the deviation as well as existing safeguards protecting against the deviation. When the team determines that inadequate protection exists for a credible deviation, it usually recommends that action be taken to reduce the risk.

The results of a HAZOP Analysis are the team's findings, which include:

- identification of hazards and operating problems;
- recommendation's for changes in design, procedures, etc.,
- to improve the system; and recommendations

- to conduct studies of areas where no conclusion was possible due to a lack of information.

1.10 FAILURE MODES AND EFFECTS ANALYSIS (FMEA)

1) A Failure Modes and Effects Analysis (FMEA) tabulate failure modes of equipment and their effects on a system or plant.

2) The failure mode describes how equipment fails (open, closed, on, off, leaks, etc.).

3) The effect of the failure mode is determined by the system's response to the equipment failure. An FMEA identifies single failure modes that either directly result in or contribute significantly to an accident. Human operator errors are usually not examined directly in an FMEA; however, the effects of a mis operation as a result of human error are usually indicated by an equipment failure mode.

4) An FMEA is not efficient for identifying an exhaustive list of combinations of equipment failures that lead to accidents.

5) The purpose of an FMEA is to identify single equipment and system failure modes and each failure mode's potential effect(s) on the system or plant. This analysis typically generates recommendations for increasing equipment reliability, thus improving process safety.

1.11 FAULT TREE ANALYSIS (FTA)

Fault Tree Analysis (FTA) is a deductive technique that:

1) focuses on one particular accident or main system failure,
2) provides a method for determining causes of that event.

The fault tree is a graphical model that displays the various combinations of equipment failures and human errors that can result in the main system failure of interest (called the Tbp event).

The strength of FTA as a qualitative tool is:

- its ability to identify the combinations of basic equipment failures and human errors that can lead to an accident

- allows the hazard analyst to focus preventive or mitigative measures on significant basic causes to reduce the likelihood of an accident.

FTA is well suited for analyses of highly redundant systems. For systems particularly vulnerable to single failures that can lead to accidents, it is better to use a single-failure-oriented technique such as FMEA or HAZOP Analysis. FTA is often employed in situations where another HE technique (e.g., HAZOP Analysis) has pinpointed an important accident of interest that requires more detailed analysis.

1.12 EVENT TREE ANALYSIS (ETA)

1) An event tree graphically shows the possible outcomes of an accident those results from an initiating event (a specific equipment failure or human error).

2) An Event Tree Analysis (ETA) considers the responses of safety systems and operators to the initiating event when determining the accident's potential outcomes.

3) The results of the Event Tee Analysis are accident sequences; that is, sets of failures or errors that lead to an accident.

4) These results describe the possible accident outcomes in terms of the sequence of events (successes or failures of safety functions) that follow an initiating event.

5) An Event Tråå Analysis is well suited for analyzing complex processes that have several layers of safety systems or emergency procedures in place to respond to specific initiating events.

6) Event trees are used to identify the various accidents that can occur in a complex process.

7) After these individual accident sequences are identified, the specific combinations of failures that can lead to the accidents can then be determined using Fault tree Analysis.

1.13 CAUSE - CONSEQUENCE ANALYSIS (CCA)

1) A Cause-Consequence Analysis (CCA) is a blend of Fault Tree and Event Tree Analyses.

2) A major strength of a Cause-Consequence Analysis is its use as a communication tool.

3) The cause consequence diagram displays the relationships between the accident outcomes (consequences) and their basic causes.

4) This technique is most commonly used when the failure logic of the analyzed accidents is rather simple, since the graphical form, which combines both fault trees and event trees on the same diagram, can become quite detailed.

5) As the name suggests, the purpose of a Cause-Consequence Analysis is to identify the basic causes and consequences of potential accidents.

1.14 HUMAN RELIABILITY ANALYSIS (HRA)

1) A Human Reliability Analysis (HRA) is a systematic evaluation of the factors that influence the performance of operators, maintenance staff, technicians, and other plant personnel.

2) It involves one of several types of task analyses; these types of analyses describe a task's physical and environmental characteristics, along with

the skills, knowledge, and capabilities required of those who perform the tasks.

3) A Human Reliability Analysis will identify error-likely situations that can cause or lead to accidents.

4) A Human Reliability Analysis can also be used to trace the causes of human errors.

5) Human Reliability Analysis is usually performed in conjunction with other hazard evaluation techniques.

6) The purpose of Human Reliability Analysis is to identify potential human errors and their effects, or to identify the underlying causes of human errors.

Table 1.2: Comparative Analysis of few hazard evaluation Methods

Name	Advantages	Disadvantages
HAZOP	Ends with a final report based on a template for registration under IEC Standard 61882.Able to foresee all hazards and possible accidents. Immediate data available for analysis ofquantitative risk assessment.	Requires a group of 5-6 persons experienced in this technique and with knowledge of analyzed system. Time and resource consuming (about 6 people).
FMEA	Provides a systematic image of the important failures in the system. Basis for quantitative analysis. It is a start for the FTA method.	Does not guarantee detection of all failures in the system (especially the people's errors are excluded). Requires knowledge to be applied. Does not indicate the likelihood of system error.
FTA	Logical view of the process.Optimal identification of hazards.	It is used together with other methods of risk analysis.
ETA	The approach is in a logical form.Often used and well known.	It is inefficient when several events occur simultaneously.
PRA	Provides a quantitative description of thedegree of variation or uncertainty (or both) inassessing risks.Additional information and potentialflexibility offered	Holding data describing the input parameters properly.The general lack of data can have negative impact on health and the environment.Takes time, resources, and effort from the evaluator.

Souce: Modified from: Monica Izvercian, Larisa Ivascu, Serban Miclea and Alina Radu, 2012. Hazard Identification and Risk Assessment in Sustainable Enterprise V52. 12

1.15 SELECTION OF A SUCCESSFUL HAZARD EVALUATION PROGRAMME

A successful hazard evaluation program requires

- tangible management support;
- Sufficient technically competent people (some of whom must be trained to use hazard evaluation techniques);
- An adequate, up-to-date information database;
- the right tools to perform hazard evaluations.

A variety of flexible hazard evaluation techniques exist presently. In an effective hazard evaluation program, excellent performance is based on successfully executing individual hazard evaluations. A successful hazard evaluation can be defined as one in which

1) the need for risk information has been met,
2) the results are of high quality and are easy for decision makers to use
3) the study has been performed with the minimum resources needed to get the job done.

Many factors can affect which hazard evaluation technique is chosen. It is appropriate and necessary that management define the basic charter for a hazard evaluation: the main objective of the study, the type of decision-making information (results) needed, and the initial resources and deadlines for performing the work.

Check Your Progress 2

Note: a) Write your answer in about 50 words.

b) Check your progress with possible answers given at the end of the unit.

1) Discuss the advantages and disadvantages of HAZOP?

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2) What are the requirement of a successful hazard evaluation program ?

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1.16 LET US SUM UP

Hazard evaluation is defined as identification of individual hazards of a system, determination of the mechanisms by which they could give rise to undesired events, and evaluation of the consequences of these events on health (including public health), environment, and property. It uses qualitative techniques to pinpoint weaknesses in the design and operation of facilities that could lead to incidents. The methods discussed in this unit are Preliminary Hazard Analysis (PHA), Safety Review, Relative Ranking Analysis (RRA), What-If Analysis, What-lf/Checklist Analysis, Hazard and Operability (HAZOP) Studies, Failure Modes and Effects Analysis (FMEA), Fault Tree Analysis (FTA) Event Tree Analysis (ETA), Cause-Consequence Analysis (CCA) , Human Reliability Analysis (HRA). Each method has their limitation and advantages. A subjective assessment of the various methods is discussed in the unit in brief.

1.17 KEY WORDS

Checklist (traditional): A detailed list of desired system attributes or steps for a system or operator to perform. Usually written from experience and used to assess the acceptability or status of the system or operation compared to established norms.

Hazard: A system condition that could lead to an accident.

Hazard checklist: An experience-based list of hazards, potential incident situations, or other process safety concerns used to stimulate the identification of hazardous situations for a process or operation.

Hazard evaluation: Identification of individual hazards of a system, determination of the mechanisms by which they could give rise to undesired events, and evaluation of the consequences of these events on health (including public health), environment, and property.

Hazard identification: The pinpointing of material, system, process, and plant characteristics that can produce undesirable consequences through the occurrence of an incident.

Risk analysis: The systematic use of all available information to identify hazards and to estimate the risk.

Risk assessment: The overall process comprising a risk analysis and a risk evaluation.

Risk evaluation: A procedure based on the risk analysis to determine whether the acceptable risk has been achieved

What-If Analysis: A scenario-based hazard evaluation procedure using a brainstorming approach in which typically a team that includes one or more persons familiar with the subject process asks questions or voices concerns about what could go wrong, what consequences could ensue, and whether the existing safeguards are adequate.

What-If/Checklist Analysis: A What-If Analysis that uses some form of checklist or other listing of broad categories of concern to structure the what-if questioning.

1.18 REFERENCES AND SUGGESTED FURTHER READINGS

Guidelines for Hazard Evaluation Procedures, Third Edition by Center for Chemical Process Safety Copyright, 2008 American Institute of Chemical Engineers, Inc.

H. R. Greenberg and J. J. Cramer (eds.), 1991, Risk Assessment and Risk Management for the Chemical Process Industry, ISBN 0-442-23438-4, Van Nostrand Reinhold, New York.

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Y.Y. Haimes. 2001. Risk Modelling Assessment and Management, New York, Harvard University Press Cambridge.

1.19 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

1) A hazard evaluation is a well designed effort to identify and analyze the significance of hazardous situations or risk associated with a process or activity. The hazard evaluations are used to find out the weaknesses in the design and operation of facilities which could lead to chemical releases, fires, explosions or some other accidents.

Hazard evaluation procedures are:

- Preliminary Hazard Analysis (PHA)
- Safety Review
- Relative Ranking Analysis (RRA)
- What-If Analysis
- What-lf/Checklist Analysis
- Hazard and Operability (HAZOP) Studies
- Failure Modes and Effects Analysis (FMEA)
- Fault Tree Analysis (FTA)
- Event Tree Analysis (ETA)
- Cause-Consequence Analysis (CCA)
- Human Reliability Analysis (HRA)

2) The main purpose of using Relative Ranking methods is to determine the process areas or operations that are the most significant with respect to the hazard of concern in a given study. Relative Ranking approaches is to address these risk analysis questions to determine the relative importance of processes and activities from a safety standpoint before performing additional and more costly hazard evaluation or risk analysis studies.

Check Your Progress 2

1) Advantages of HAZOP:

- Ends with a final report based on a template for registration under IEC Standard 61882.
- Able to foresee all hazards and possible accidents. Immediate data available for analysis of quantitative risk assessment.

ii) Disadvantages of HAZOP:

- Requires a group of 5-6 persons experienced in this technique and with knowledge of analyzed system.
- Time and resource consuming (about 6 people).

2) A successful hazard evaluation program requires

- tangible management support;
- Sufficient technically competent people (some of whom must be trained to use hazard evaluation techniques);
- An adequate, up-to-date information database;
- right tools to perform hazard evaluations

UNIT 2 INDUSTRIAL SAFETY LEGISLATIONS

Structure

2.0 INTRODUCTION

The right legislation and regulations, along with adequate means of enforcement, are important policies for the protection of workers. They form a basis to improve working conditions and the workplace environment. Labour legislation lays down minimum standards which are compulsory and applicable to all workers. As employers and plant managers have to fulfill these stipulations, proper techniques, are adopted for the safety measures. Further, the organizations of employers and workers should be consulted in the preparation of laws and regulations. It has been noted, in countries with good safety records, that it is more effective to stipulate the duties of those with primary responsibility for Occupational Health and Safety measures in general terms, rather than to attempt to regulate a multitude of hazards in minute detail. This approach is important because technology is developing at an increasingly rapid pace, and it often proves difficult for the legislation to keep abreast of progress. "Standards, specifications and codes of practice issued by national standards organizations or professional or specialized institutions are generally not binding, but in some cases they have been given the force of law by the competent authority". This practice, which is more common in countries where such organizations and institutions are public bodies rather than private concerns, considerably lighten the legislator's task, but it may increase the burden on the Occupational Health and Safety administrators unless they can rely on approved bodies or institutions for the application and monitoring of these standards and specifications

(Benjamin O. Ali, 2008 Fundamental principles of occupational health and safety, International Labour Office, Geneva.

2.1 OBJECTIVES

After reading this unit, you should be able to:

- understand acts and laws enacted by the government for the betterment of employees working in different institutes and organizations.

The Acts explained in this unit provides a brief idea of the provisions given in constitution about health, safety and welfare of the workers employed in the factories/ industries.

2.1 FACTORIES ACT, 1948

Introduction

In India, the First factories Act was passed in 1881.This Act was basically designed to protect children and to provide few measures for health and safety of the workers. This law was applicable to only those factories, which employed 100 or more workers. In 1891, another Factories Act was passed which extended to the factories employee 50 or more workers. Factories act includes: Annual Leave with wages, working hours of Adults, Welfare, Safety, Health.

Objectives

The main objective of Factories Act, 1948 is to ensure adequate safety measures and to promote the health, safety and welfare of the workers employed in factories. The act also makes provisions regarding employment of women and young persons (including children and adolescents), annual leave with wages etc. The Act extended to whole of India including Jammu and Kashmir and covers all manufacturing processes and establishments falling within the definitions of "factory" as defined u/s 2(m) of the act. Unless otherwise provided, it is also applicable to factories belonging to Central/State Government (Section 116).

Requirement

The Factories Act, 1948 serves to help in formulating national policies in India with respect to occupational safety and health in factories and docks in India. It deals with various problems relating to safety, health, efficiency and well-being of the persons at work places.

The Act is divided into 11 Chapters and120 Sections.

Chapter No.	Name of the Chapter	Sections
I	Preliminary	1-7
II	The Inspecting Staff	7A-10
III	Health	11-20
IV	Safety	21-41
IV A	Provisions relating to Hazardous Processes	41A-41H
V	Welfare	42-50
VI	Working Hours of Adults	51-66
VII	Employment of Young Persons	67-77
VIII	Annual Leave with Wages	78-84
IX	Special Provisions	85-91A
X	Penalties and Procedure	92-106A
XI	Supplemental	107-120

Definitions: "Factory" is defined in Section 2(m) of the Act. It means that any premises including the limits where 10 or more than 10 workers are working for 12 months and manufacturing process is carried out in any part assisted with power. But in case of 20 or more workers, it does not include a mine subject to the Mines Act, 1952 or a moving unit which belongs to the Union Armed Forces, a Railway running shed or a Hotel, Restaurant or Eating place.

Further definitions include "**Manufacturing process**" that means any process for -

a) Ornamenting, making, repairing, altering, finishing, packing, washing, cleaning, breaking up, oiling, demolishing or otherwise treating or adapting any article or substance with a view to its use, sale, transport, delivery or disposal ; or

b) Pumping of oil, water, sewage or any other substance

c) Generating, transforming or transmitting power

d) Composing types for printing by letter press, lithography, photogravure (or other similar process or book binding), reconstructing, constructing, repairing, finishing refitting or breaking up ships or vessels.

"Prime mover" means any motor, engine or other appliance which generates power.

"Power" means electrical energy or any other form of energy which is mechanically transmitted and is not generated by human.

"Calendar year" means the period of 12 months beginning with the first day of January in any year.

"Week" means a period of 7 days beginning at midnight on Saturday night.

"Day" means a period of 24 hours beginning at midnight.

Provisions regarding Health: 1) Spittoons 2) Disposal of Wastes and Effluents 3) Drinking Water 4) Dust and Fumes 5) Artificial Humidification 6) Overcrowding 7) Lighting 8) Ventilations and Temperature 9) Latrines and Urinals 10) Cleanliness

Provisions regarding Safety: 1) Frame of Machinery 2) Work on or close to Machinery in movement 3) Employment of young Persons on dangerous Machines 4) Striking Gear and Devices for cutting off power 5) Self Acting Machines 6) Casing of New Machinery 7) Prevention of Employment of Women and Children near Cotton openers 8) Hoists, lifts, Lifting Machines and others 9) Revolving Machinery 10) Pressure Plant

1) Floors, Stairs and Means or Access 2) Pits, Sumps, Opening in Floors and others 3) Excessive Weights 4) Protection of Eyes precautions against dangerous Fumes, Gases and others 5) Precautions regarding use of portable electric light 6) Explosive or Inflammable dust, gas 7) Precautions in case of fire 8) Specifications of Defective Parts or Tests of Stability 9) Safety of Buildings and machines 10) Safety officers

Provisions regarding Welfare of Workers: 1) Washing Facilities 2) Facilities for Storing and Drying clothing 3) Facilities for Sitting 4) First Aid facilities 5) Canteens, Shelters, Rest Rooms and Lunch Rooms 6) Creches 7) Welfare Officers

Hazardous processes: Provisions regarding Hazardous Process were instructed in the Act under a new chapter by the Factories (Amendment) Act, 1987.This Act instructed two new schedules:

I) Listing the industries involving hazardous process

II) Relating to permissible levels of certain chemical substances in work environment

Provisions regarding hazardous processes

- Constitution of Site Appraisal Committee
- Compulsory Disclosure of Information
- Special Responsibility of the occupier in relation to Hazardous processes
- Maintaining accurate and up-to-date health and medical records of workers exposed to any chemical, toxic or any other harmful substances manufactured, stored, handled or transported
- Appointing qualified, experienced and compete persons in handling such substances to supervise handling and for protecting the workers from the hazard
- Providing for medical examination of every worker at intervals
- Right of workers to warn about imminent danger
- Workers participation in safety management
- Permissible Limits of exposure of chemical and toxic Substances
- Emergency Standards
- Appointment of Inquiry Committee

Working hours of Adults

- Weekly Hours: < 48 hours
- Weekly Holidays: at least 1 holiday in a week, substitute holidays
- Compensatory Holidays
- Daily Hours: < 9 hours
- Intervals for rest: at least half an hour
- Spread Over
- Night Shifts
- Prohibition of not more than 2 continuous shifts
- Extra wages for overtime: wages at the rate of twice at his ordinary rate of wages for overtime
- Notice of period of work

Restriction on employment of Women and Children

- Work between 6 a.m. to 7 p.m. only.
- Strictly restriction for women for employment between 10 p.m. to 5 a.m.
- Employment of women in night shift is permitted only in the case of fish-curring and fish-canning.

Annual leave with wage

- Power to make rules
- Mode of Recovery of unpaid wages
- Payment in advance in certain cases
- Wages during leave period
- Annual leave with wages

Offences: A court can take cognizance of the offence only when the complaint is made within 3 months of the date on which the alleged commission of the offence came to the knowledge of the inspector, but where the offence consist of disobeying a written order made by an Inspector, complaint may be made within 6 months of the commission of the offence.

Penalties for Offences by workers

- Penalty relating to casing of new machinery
- Penalty for wrongfully disclosing Results of Analysis
- Penalty for obstructing Inspector
- Penalty for the contravention of Provisions relating to Hazardous process
- General penalties for offence
- Penalty for employing child labor
- Penalty for offence by a medical practitioner

Check Your Progress 1

Note: a) Write your answer in about 50 words.

b) Check your progress with possible answers given at the end of the unit.

1) What is the objective of Factories Act 1948?

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2) What are the penalties for offences done by the workers under Factories Act 1948?

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2.2 THE WORKMEN'S COMPENSATION ACT, 1923

Introduction

The Workmen Compensation Act was firstly introduced in 1923 for social security and it came into force on 1st July 1924. This act provides provision for paying compensation by certain classes of employers to their workmen for injury or accident.

Objectives

The Workmen's Compensation Act, 1923, aims to provide workmen and/or their dependents some relief in case of accidents arising out of and in the course of employment and causing either death or disablement of workmen.

Scope and Coverage

- The Act extends to the whole of India.
- The hazardous occupation of workmen should be included within the scope of this Act.
- It applies to workmen employed in factories, mines, plantations, transport establishments, construction work, railways, ships, circuses, and other hazardous occupations and employments specified in Schedule II of the Act.
- The Act does not apply to members of Armed Forces of the Union and those workers who are insured under the Employees State Insurance Act, 1948.
- The coverage of this act is also for Cooks employed in Hotels and Restaurants.

Requirement

The policy aims at protecting the workmen and their dependent in case they meet any accident or injury while working in the organization. It helps the workmen as it bears the cost of treatment in the event any employee dies or encounters permanent disablement due to any course of employment.

The Act is divided into 8 Chapters and 41 Sections:

Chapter No.	Name of the Chapter	Sections
I	Preliminary	**1-2**
II	Compensation	**3-11**
III	Conditions of Compensation	**12-18**
IV	Alternative Remedies	**19-20**
V	Insolvency or Bankruptcy of Employer	**21-22**
VI	Application to Special Classes of Persons	**23-25**
VII	Procedure	**26-32**
VIII	Miscellaneous	**33-41**

Definitions (Section 2)

A "Commissioner " means a Commissioner for Workmen's Compensation appointed under Sec. 2(1) (b).

Dependent [Sec.2 (1) (d)] Dependent means any of the following relatives of a deceased workman, namely:

1) A Widow, a Minor Legitimate or adopted son and unmarried legitimate or adopted daughter, or a widowed mother.

2) If Wholly Dependent on the earnings of the workman at the time of his death, a son or a daughter who has attained the age of 18 years and who is infirm.

3) And any of the following were wholly or partly dependent on the workman at the time of his death:

- Unmarried illegitimate daughter or a daughter legitimate or illegitimate or adopted if married
- a minor illegitimate son,
- A parent other than a widowed mother,
- A widower,
- A minor or if widowed and a minor child of pre-deceased son
- A widowed daughter-in-law,
- A minor brother or an unmarried sister or a widowed sister if a minor,
- Minor and daughter, where no parent of the child is alive and a paternal grandparent if not the parent of the workman is alive.

Employer [Sec.2 (1) (e)] "Employer" includes

- Any person or body of persons whether incorporated or not.
- Any managing agent of an employer.
- The legal representative of a deceased employer.
- A person to whom services of a workman are temporarily lent or let on hire.

Disablement [Sec.2(1)(g)]means reduction in earning capacity. It may be partial or total disablement.

- Temporary partial disablement means that which reduces the earning capacity of the workmen in the employment in which he was engaged at the time of accident.
- Permanent partial disablement means that which reduces, for all time, the earning capacity of a workmen in every employment in which he was capable of undertaking at the time.
- Total disablement means whether of a temporary or permanent nature, which incapacitates workmen for all work which he was capable of performing at the time of accident.
- A railway servant as defined in clause (34) of section 2 of the Railways Act, 1989 (24 of 1989), not permanently employed in any administrative, district or sub-divisional office of a railway and not employed in any such capacity as is specified in Schedule II.

Workman [Sec.2 (1) (n)] Workmen mean any person who is:

- A person recruited for work abroad by company as is mentioned in schedule ll.
- A person recruited as driver, helper, and mechanic, cleaner or in any other capacity in connection with a motor vehicle.
- A captain or other member of the crew on an aircraft.
- Person to be treated as workmen if there must be a contract of employment, relationship of master and servant between the employer and the employee. The employment is for the purpose of employer's trade or business.

The act does not include

- A person whose employment is of casual nature.
- a master, seaman or other member of the crew of a ship, etc

Employer's liability to pay compensation (Sec 3)

As per Section 3(1) of the act, the following conditions must necessarily be satisfied in order to qualify for compensation:

1) He must be workmen within the meaning of this act.
2) Personal injury must have been caused by accident.
3) The injury must have been caused by accident.
4) The accident must have arisen out of and in the course of employment.
5) The injury caused by the accident must have resulted in the workman's death or permanent total disablement or temporary disablement.

Accident arising out of and in the course of his Employment

- The employer is liable to pay compensation in case of personal injury and occupational disease.
- Personal injury includes physical/mental injury, strain or shock caused by excitement.

Incidental to his employment and injured, then arises out of employment An injury could be held to have arisen out of employment if it is established that: 1. It must have resulted from some risk incidental to the duties of the service / inherent in the nature of employment. 2. At the time of injury the worker must have been engaged in the business of the employer and must not be doing something for his personal advantages.

Doctrine of Notional Extension of Employment

It means when the employer provides the employee with a particular conveyance to and from the place of employment, the employee is regarded as in the course employment even though he has not reached or has left his employer's premises.

Employer not Liable

i) The injury does not result in the disablement for a period exceeding 3 days

ii) The injury results in death or permanent total disability due to-

   a) The worker was at the time of accident, under the influence of drink or drugs

b) The worker willfully disobeyed any order expressly given for ensuring safety.

c) The worker willfully removed any safety devices which he knew would harm.

Contractual employment (Sec-12(1))

If any employer takes the help of contractor in order to engage some workmen, workmen who are injured are entitled to compensation from the Principal. When the Principal is held liable for compensation, he shall be entitled to be indemnified by the contractor.

Contracting Out (Sec-17) any contract where by a worker relinquishes in the right of compensation from the employer for personal injury arising out of and in the course of employment will be null and void. Employer can't use it as a defense.

Authorities under the act (Sec-19-31) these sections provides for appointment of commissioners for the enforcement of provisions of the act. Sec 20 authorizes the State Government to appoint commissioners under the act.

Check Your Progress 2

Note: a) Write your answer in about 50 words.

b) Check your progress with possible answers given at the end of the unit.

1) Enlist the provisions which are excluded in Workmen's Compensation Act 1923?

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2) What is the objective of the Workmen's Compensation Act 1923?

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2.3 THE EMPLOYEES STATE INSURANCE ACT, 1948

Introduction

The Employee State Insurance Act was enacted by the Parliament of India in the year 1948. To start with the ESI scheme was primarily launched on 2nd February

1952 at just two Industrial Centers in the country namely Kanpur and Delhi with a total coverage of about 1.20 lakh workers. There after the scheme was implemented in a phased manner across the country with the active involvement of the state governments.

Objective of the act: To provide for certain benefits to employees in case of sickness, maternity and injury during employment and to make provision for certain other matters in relation thereto.

The Act is divided into 8 Chapters and 100 Sections:

Chapter No.	Name of the Chapter	Sections
I	Preliminary	**1-2A**
II	Corporation, Standing Committee and Medical Benefit Council	**3-25**
III	Finance and Audit	**26-37**
IV	Contributions	**38-45 I**
V	Benefits	**46-73**
V A	Transitory Provisions	**73A-73I**
VI	Adjudication of Dispute and Claims	**74-83**
VII	Penalties	**84-86A**
VIII	Miscellaneous	**87-100**

Requirement

This act introduces a scheme of health insurance for industrial workers. The scheme envisaged by it is one of compulsory State Insurance providing for certain profit in the event of sickness, maternity and employment injury to workmen engaged in or in connection with the work in factories other than seasonal factories.

Preliminary Applicability of the Act: All factories and shops employing 20 or more persons. Such other Govt. specified establishments.

Act does not apply to: Seasonal factories occupied exclusively in any of the activities like: cotton ginning, cotton or jute pressing, decoration of ground nuts, manufacturing coffee, indigo, lac, rubber, sugar, or tea or any manufacturing process incidental to or associated with any of the afore said activities, and including factories engaged for a period not exceeding seven months in a year in blending, packing or repackaging tea or coffee, or in such other processes as may be specified by the central govt. The factories exempted as seasonal from the provisions of the act. This act also does not apply to Railway running sheds, Govt. factories or establishments and Indian naval, military, or air force, other Govt. notified exempted establishments.

Act authorization

1) To promote and measure for health and welfare of Insured Employees (IE)
2) Intervene for the rehabilitation and re-employment for disabled / injured
3) To appoint inspectors for purposed of the act
4) To determine the amount of contribution and relevant verification

Standing committee empowered to-

1) Shall administer the affair of the corporation
2) Shall submit the consideration and decision of the corporations
3) Have discretion on other issues of corporation

Medical Benefit Council

1) Advise to administration on Medical benefit, purpose of grants and related matter.
2) Have power and duties of investigation on empanelled Medical Practitioner, its treatment and attendance.
3) Perform additional duties

Inspectors- Duties and Powers

Duties

1) Inquiring into the correctness in any return of contribution
2) Ascertaining Provision of the Act has been complied
3) Other authorized / specified duties by the corporation.

Powers

1) To gather relevant information of employer / contractor or both
2) To enter organization / contractor premises at reasonable time and examined relevant account books and relevant documents, payment of wages etc.
3) To examine employer, contractor, his agent / servant in factory / office
4) To make copies of extracts from any registrar, account books and other books of maintenance of organization.

Employer/ Employee's Contribution

It is the principle Employer's responsibility to deposit his own as well as employee's contribution in respect of all employees including the contract labour, into the Employees State Insurance (ESI) Account. Non-availability of funds cannot be a ground for non-payment of contributions under the act. There is no provision to waive the contribution, damages and interest. The employer is required to contribute at the rate of 4.75% of the wages paid/ payable in respect of every wage period. The employees are also required to contribute at the rate of 1.75% of their wages except when the "average daily wages in a wage period" are equal to or less than Rs.40.

Employer/ Employee's Contribution

The employer should get his factory or establishments registered with the ESI Corporation within 15 days after the Act becoming applicable to it, and obtain the employer's Code Number. The regional officer will allot a code number to the employer, which must be quoted in all documents and correspondence.

Benefits available to Insured Employee

The purpose of the Employee State Insurance Act is to provide benefits as detailed in the Act particularly in Section 46, to the insured person or their dependants which are as follows:

1) Sickness Benefit

Every insured employee is entitled to the cash benefit for the period of sickness certified by a duly appointed medical practitioner if the contributions in respect of him were payable for not less than 78 days in the corresponding contribution period. Cash benefit takes the form of periodical payment made to an insured person which is payable for maximum numbers of 91 days in any two consecutive benefit periods. The benefit is not paid for the first two days of sickness which is treated as the waiting period. Insured persons suffering from long term diseases like Tuberculosis, leprosy, Mental, Heart etc. and who have been in continuous employment for two years are entitled to get sickness benefit up to 309 days.

2) Maternity Benefit

A periodical cash benefit is payable to an insured woman employees, in cash of confinement, miscarriage, medical termination of pregnancy, premature birth of a child or sickness arising from pregnancy etc. If the contribution in respect of her was payable for at least 70days in the two immediately preceding contribution periods. The benefit is payable of twice the standard benefit rate or Rs.20, whichever is higher for all days on which she does not work during the prescribed period.

3) Disablement Benefit

It is payable to an employee who is injured in the course of his employment and is permanently or temporarily disabled or contacts any occupational disease. A person who sustains temporary disablement for not less than 3days (excluding the day of accident) shall be entitled to periodical payment as may be prescribed by the Central Govt. The benefit of temporary disablement is, however, not payable for any day on which the employee works, remains on lease, holiday or strike in respect of which he receives wages.

4) **Dependents Benefit**

If any employee dies during any period for which he is entitled to a cash benefit, the amount of such benefit shall be payable up to and including the day of his death. The amount of benefit shall be paid to the nominee or, where there is no nomination, to the heir or legal representative of the deceased employee.

5) Medical Benefit

An insured person or a member of his family whose condition requires medical treatment and attendance entitled to receive medical benefit. Rs.250 on account of confinement expenses shall be paid to an insured person or his wife if confinement occurs at a place where necessary medical facilities under ESI Corporation schemes are not available. Employer will not be dismissed or punished during period of sickness (Section73).

6) Funeral Expenses

If an insured employee dies, the eldest serving member of his family is entitled to reimbursement of such expenditure subject to maximum of Rs.2500 (w.e.f. December, 2000). The claim for the funeral expenses should

be submitted with prescribed document and form within three months of the death of the insured employee.

Adjudication of dispute and claims

- Employees Insurance Court
- Institutions of Proceedings etc.
- Powers of employees' Insurance Court
- Reference to High Court
- Appeal
- Stay of payment during pending of appeal

Offences and Penalties

- Punishment for False Statement: - In this case, any false statement or false representation shall be punishable with imprisonment up to Rs.2000 or with both.
- Punishments for failure to pay Contributions: - if any person fails to pay any contribution which under to this act he is liable to pay, he shall be punishable with imprisonment up to three years.
- Punishment for other Contravention: - in contraventions like dismisses, discharges, reduces or otherwise punishes an employee, shall be punishable with imprisonment up to one year or with fine up to Rs.4000 or with both
- Power to recover damages: - If employer fails to pay the amount of contribution then corporation may recover from the employer by way of penalty.
- Power of court to make orders :- If court makes order for employer- if employer is not able to make this order within period then employer shall be punishable with imprisonment in respect thereof U/S.85 and shall also be liable to pay fine up to Rs.1000 for everyday.

Miscellaneous Provisions

Exemption of a factory or establishment (Sec.87) Exemption may be granted to any factory or establishment for maximum period of one year. Any exemption granted shall be notified by the notification in the Official Gazette. The appropriate Govt. while granting exemption can improve any terms and conditions upon the factory/establishment. If required, any exemption can be renewed for maximum. One year before granting any exemption, Corporation must be given opportunity to make representation which has to be considered by the Govt.

Exemption of Persons or Class of Persons (Sec.88) Appropriate Govt. is authorized to exempt any person or class of person from the operation of the act. Any exemption granted shall be notified by the notification in the Official Gazette. Such person or class of persons must be working in a factory/establishment. Any exemption, granted shall be accompanied with such conditions as the appropriate Govt. may think fit to impose

Exemption of a Factory or Establishment belonging to Govt./any local authority- Appropriate Govt. must consult the Corporation, any exemption granted shall be notified by the notification in the Official Gazette. Exemptions

shall always be subject to the conditions imposed by the Govt. Exemptions shall always be in order only if the employees in any such Factory/Establishment are already in receipt of benefits substantially similar or superior to the benefits provided under this act.

Exemption from one or more provisions of the act (Sec.91) Exemption may be granted to any Factory or Establishment or any person or class of person by appropriate Govt. Any exemption granted shall be notified by the notification in the Official Gazette. Any exemption granted under the Sec.87,88,90 or 91 in respect of any person or class of person may be enforced either prospectively or retrospectively the date of its enforcement has to be specified (Sec.91-A).

Obligation of the Employers

1) Get your Factory / Establishment registered within 15 days after the Act becomes applicable. Submit Form 01 to the Regional office for this purpose. Obtain Employer's Code No. for use in all ESIC Forms / documents and correspondence with the offices of the ESI Corporation.

2) Fill up Declaration Forms in respect of all coverable employees and submit the same to the Regional Office/ Local Office of the corporation well before the 'Appointed Day' and obtain Insurance Numbers from the concerned Local Office/ Regional Office, In respect of newly appointed employees, fill up the declaration form soon after appointment of such employees and submit the same to the Local Office concerned.

3) Pending receipt of Identity Cards/ Identity Certificates you may issue "Certificate of Employment" in Form 86 to the covered employee(s) enabling them to avail Cash/Medical benefits.

4) Pay ESI contribution (Employee's Share @4.75% and the Employer's share @ 1.75% of the wages) within 21 days of the month following, in which the wages fall due.

5) Maintain an Accident Book as prescribed under the Factory Act / ESI Act.

6) Submit an Accident Report to the Local Office / ESI Dispensary concerned immediately in respect of accidents that could result in death or disablement and within 24 hours of its occurrence otherwise. Minor accidents which do not cause absence from work need not be reported.

7) Grant leave to insured employees on the basis of Sickness Certificates issued by any authorized ESI doctor.

Check Your Progress 3

Note: a) Write your answer in about 50 words.

b) Check your progress with possible answers given at the end of the unit.

1) Mention the applicability of Employee's State Insurance act, 1948?

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2) Enlist the benefits which are provided to insured employee under Section 46 of Employees State Insurance Act, 1948?

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2.4 MINES ACT, 1952

Introduction

The Mines Act, 1952 contains provisions for measures relating to the Health, Safety and Welfare of workers in the coal, metalliferous and oil mines. It is divided into 10 Chapters and 88 Sections. According to the Act, the term 'mine' means "any excavation where any operation for the purpose of searching for or obtaining minerals has been or is being carried on and includes all borings, bore holes, oil wells and accessory crude conditioning plants, shafts, opencast workings, conveyors or aerial ropeways, planes, machinery works, railways, tramways, sliding, workshops, power stations, etc. or any premises connected with mining operations and near or in the mining area". The Act prescribes the duties of the owner to manage mines and mining operation and the health and safety in mines. It also prescribes the number of working hours in mines, the minimum wage rates, and other related matters

Objective

The Mines Act, 1952 was enacted to enforce the measures of safety and welfare of labourers working in coal, metallic, ferrous and oil mines.

The Act is divided into 9 chapters with 81 Sections:

Chapter No.	Name of the Chapter	Sections
I	Preliminary	**1-4**
II	Inspectors and Certifying Surgeons	**5-11**
III	Mining Boards and Committees	**12-15**
IV	Mining Operations and Management of Mines	**16-18**
V	Provisions as to Health and Safety	**19-27**
VI	Hours and Limitation of Employment	**28-48**
VII	Leave with Wages	**49-56**
VIII	Regulations, Rules and Bye-Laws	**57-62**
IX	Penalties and Procedure	**63-81**

Preliminary

1) This Act may be called the Mines Act, 1952**.**

2) It extends to the whole of India except the State of Jammu and Kashmir**.**

3) It shall come into force on such date or dates as the Central Government may, by notification in the Official Gazette, appoint, and different dates may be appointed for different provisions of this Act and for different States but not later than 31st December, 1953**.**

Definitions

In this Act, unless the context otherwise requires,-

"Chief Inspector" means the Chief Inspector of Mines appointed under this Act;

"District magistrate" means, in a presidency-town, the person appointed by the Central Government to perform the duties of a District Magistrate under this Act in that town;

"Inspector" means an Inspector of Mines appointed under this Act, and includes a District Magistrate when exercising any power or performing any duty of an Inspector which he is empowered by this

Act to exercise or perform; "Mine" means any excavation where any operation for the purpose of searching for or obtaining minerals has been or is being carried on, and includes-

i) Every shaft in the course of being sunk;

ii) Every level and inclined plane in the course of being driven;

iii) All shafts, levels, planes, machinery, works, tramways and sidings, whether above or belowground, in or adjacent to, and belonging to, the mine.

Features of the Act

- Inspectors were empowered to enter and inspect mines, and to enquire into accidents,
- The employment of competent managers in mines was required. Managers Competency Certificates were instituted,
- The Government was empowered to frame rules, etc. for regulating work in the mines,
- Penalties were prescribed for contravention of its various provisions.

Rules for Coal and Metalliferous Mines were made under Section 30 of the Indian Mines Act by the various Provincial Governments. These rules provide for:

- Sanitary and Health provisions;
- Ambulance, First-Aid and Rescue work;
- Registration of work-persons;
- Safety of surface;

- Abandonment of Mines;
- Inquiry in the case of accidents ;
- Certificates of fitness for persons who have not completed 17 years of age for employment in below ground works.

Check Your Progress 4

Note: a) Write your answer in about 50 words.

b) Check your progress with answers given at the end of the unit.

1) What are the main features of Mine Act 1952?

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2) Define District Magistrate?

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2.5 BOILERS VESSELS ACT, 1923

Introduction

It is an Act to consolidate and amend the law relating to steam-boilers**.** This Act may be called the Indian Boilers Act, 1923. It extends to the whole of India except the State of Jammu and Kashmir. It shall come into force on such date as the Central Government may, by notification in the Official Gazette, appoint. The Boiler and Pressure Vessel Safety Board established pursuant to section 44. Boiler act contain the law related to registration and inspection of Steam Boiler. This act is applicable to all Boilers (water tube and fire tube boilers).

Definitions

- "Boiler" means a vessel in which steam is or may be generated or hot water formed under pressure, and includes any high pressure boiler or low pressure boiler and any pipe, fitting, prime mover, machinery or other equipment attached to the vessel or used in connection with the vessel.
- "Compressed gas" means liquefied petroleum gas, oxygen, acetylene, ammonia, chlorine or any other gas, whether in a liquid, vapour or dissolved

state, that is explosive, flammable or toxic or contained under pressure exceeding 103 kilopascals;

- "Compressed gas plant" means a plant used for producing, manufacturing, transferring, storing, distributing or otherwise handling compressed gas, and includes all pressure vessels, pipes, fittings, machinery and other equipment used in connection with the plant;
- "Department" means the department over which the minister presides.
- "Expansible fluid" means: (i) any vapour or gas; or (ii) any liquid that will change to a vapour or gas at atmospheric conditions.
- "Fitting" means a valve, gauge, regulating or controlling device, flange, pipe fitting, nozzle or thing that is attached to or forms part of a boiler, pressure vessel or pressure piping system or any combination of them.
- "Chief inspector" means the chief inspector appointed pursuant to Section 4, and includes an acting chief inspector.
- "Economiser" means any part of a feed-pipe that is wholly or partially exposed to the action of flue gases for the purpose of recovery of waste heat.

Penalties for Illegal Use of Boiler

Any owner of a boiler who, in any case in which a certificate or provisional order is required

for the uses of the boiler under this Act, uses the boiler either without any such certificate or order being in force or at a higher pressure than that allowed thereby, shall be punishable with fine which may extend to five hundred rupees, and in the case of a continuing offence, with an additional fine which may extend to one hundred rupees for each day after the first day in regard to which he is convicted of having persisted in the offence.

Exemptions

1) The State Government may, by notification in the Official Gazette, exempt from the operation of this Act, subject to such conditions and restrictions as it thinks fit, any boilers or classes or types of boilers used exclusively for the heating of buildings or the supply of hot water.

2) In case of any emergency, the State Government may, by general or special order in writing, exempt any boilers or steam-pipes or any class of boilers or steam-pipes or any boiler or steam-pipes from the operation of all or any of the provisions of this Act.

3) If the State Government is satisfied that, having regard to the material, design or construction of boilers and to the need for the rapid industrialization of the country, it is necessary to do so, it may, by notification in the Official Gazette and subject to such conditions and restrictions as may be specified in the notification, exclude any specified

Limitation of application

1) Nothing in this Act shall apply in the case of any Boiler or Steam-pipe.

a) In any steam-pipe as defined in Section 3 of the '[Indian Steamships Act, 1884 (7 of 1884)], or in any steam-vessel as defined in Section 2 of the Inland Steam- vessels Act, 1917 (1 of 1917).

b) Belonging to, or under the control of the Army, Navy or Air Force.

c) Appertaining to a Sterilizer or Disinfector of a type such as is commonly used in hospitals, if the boiler does not exceed ninety one liters in capacity.

2) The Central Government may, by notification in the Official Gazette, declare that the provisions of this Act shall not apply in the case of boilers or steam-pipes, or any specified class of boilers or steam-pipes, belonging to or under the control of any railway administered by the Central Government or by any State Government or by any railway company as defined in clause (5) of section 3 of the '[Indian Railways Act, 1890 (9 of 1890)].

Prohibition on use of unregistered of uncertificate boiler

Save as otherwise expressly provided in the Act, no owner of a boiler shall use the boiler or permit it to be used-

- Unless it has been registered in accord with the provisions of this Act;
- in the case of any boiler which has been transferred from one State to another, Until the transfer has been reported in the prescribed manner;
- unless a certificate or provisional order authorizing the use of the boiler is for the time being in force under this Act;
- at a pressure higher than the maximum pressure recorded in such certificate or provisional order;
- Where the State Government has made rules requiring that boilers shall be in charge of persons holding Certificates of proficiency or competency, unless the boiler is in charge of a person holding the certificate required by such rules.

Check Your Progress 5

Note: a) Use the space below for your answer.

b) Compare your answers with those given at the end of the unit.

1) What is Boilers Vessel Act?

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2.6 CHILD LABOUR ACT, 1986

Introduction

Practice of having children engage in economic activity, on part or full time basis. The practice deprives children of their childhood, their potential and their dignity and that is harmful to their physical, mental and social development. The constitution of India, in the fundamental right Article number 24, prohibits child labour.India accounts for the second highest number in reference to child labour in the world. Africa stands for highest. According to statistics given by Indian government, there are almost 20 million bonded child labourers in the country. The problem of child labour continues to pose a challenge before the nation. Government has been taking various pro-active measures to tackle this problem. However, considering the magnitude and extent of the problem, it is essentially a socio-economic problem inextricably linked to poverty and illiteracy; it requires intensive efforts from all sections of the society to make a dent in the problem.

Objectives

- To prohibit the engagement of children in certain employments.
- To regulate the condition of work of children in certain other employments.

Need of Child Act

- Child below the age of 14 shall be employed.
- Central and State Policy towards securing the health and the strength of child and prevent Child Abuse.
- Children are given opportunities and facilities for their development in healthy manner.

The Act is divided into 4 Chapters and 26 Sections and two Schedules A and B.

Chapter No.	Name of the Chapter	Sections
I	Preliminary	1 and 2
II	Prohibition of employment of children in certain occupations and processes	3,4 and 5 and also two articles A and B concern with section 3.
III	Regulation of conditions of work of children	6 to 13
IV	Miscellaneous	14 to 26

Section-1 Short title, extent and commencement. This Act may be called the Child Labour (Prohibition and Regulation) Act, 1986. It extends to the whole of India. The provisions of this Act shall come into force at once.

Section-2 This section defines the various words and expressions occurring in the Act.

Child: means a person who has not completed his 14 year of age.

Establishment: includes a shop, commercial establishment, work-shop, farm, residential hotel, restaurant, eating-house, theatre or other place of public amusement or entertainment.

Workshop: any premises where any industrial process is carried on.

Occupier: the person who has the ultimate control over the establishment or workshop.

Section-3 This section imposes prohibition on employment of children in the occupation and processes specified in the Schedule, PART A and PART B.

The schedule-part A Occupations

1) Transport of passengers, goods or mails by railways.
2) Cinder picking, clearing of an ash pit or building operation in the railway premises.
3) Work in a catering establishment at a railway station, involving the movement of a vendor or any other employee of the establishment from the one platform to another or in to or out of a moving train.
4) Work relating to the construction of a railway station or with any other work where such work is done in close proximity to or between the railway lines.
5) A port authority within the limits of any port.
6) Work relating to selling of crackers and fireworks in shops with temporary licenses.
7) Abattoirs/Slaughter House.
8) Automobile workshops and garages.
9) Foundries.
10) Handling of toxic or inflammable substances or explosives.
11) Handloom and power loom industry.
12) Mines (underground and under water) and collieries
13) Plastic units and fiberglass workshops.
14) Employment of child as a domestic worker or servant
15) Employment of child in dhabas, restaurants, hotels, motels, tea shops, resorts, spas or other recreational centres.

The schedule-part B Processes

1) Beedi-making.
2) Carpet-weaving.
3) Cement manufacture, including bagging of cement.
4) Cloth printing, dyeing and weaving.
5) Manufacture of matches, explosives and fire-works.
6) Mica-cutting and splitting.
7) Shellac manufacture.
8) Soap manufacture.
9) Tanning.

Program initiated by Govt of India at national level

The Government of India has been implementing a successful programme:

The national child labour project (NCLP) since 1988 where in 7328 special schools were opened for the children withdrawn from work and providing them education, nutrition, vocational training, stipend, health care etc. India was the first country to join the "International programme on the elimination of child labour" in 1992. This is a global programme launched by International Labour Organization (ILO) in 1991. Global action plan to eliminate the worst forms of child labour by 2016 no one is born as a Labour in the real sense of the world. It is the society and the evils of the systems that shape the children into labourers.

Check Your Progress 6

Note: a) Write your answer in about 50 words.

b) Check your progress with possible answers given at the end of the unit.

1) What was the need of Child labour Act 1986?

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2.7 HAZARDOUS WASTE MANAGEMENT RULES, 2008

Introduction

Any waste which by reason of any of its physical, chemical, reactive, toxic, flammable, physical, chemical, reactive, toxic, flammable, explosive or corrosive explosive or corrosive characteristics causes danger or is likely to cause danger to health or environment, whether alone or when in or environment, whether alone or when in contact with other wastes or substances, and shall include wastes listed in Schedules I, II and III of the Rules.

The Hazardous Waste (Management & Handling) Rules, 1989 and amendments made thereafter are now superseded by the new Hazardous Waste (Management, Hazardous Waste (Management, Handling and Transboundary Handling and Transboundary Movement) Rules, 2008.

By a notification of the Government of India in the Ministry of Environment and Forests, the Hazardous Wastes (Management, Handling and Transboundary Movement) Rules, 2008 (here in after referred to as the said rules), were published in the Gazette of India, Extraordinary, vide number S.O. 2265 (E), dated the 24th September, 2008, and the same were amended from time to time. The said rules imposed restrictions and prescribed procedures for management, handling, disposal and transboundary movement of hazardous wastes. the Central Government considers it necessary in the public interest and to address sustainable development concerns, to review the rules published earlier, to enable

the recovery and/or reuse of useful materials from hazardous and other waste materials generated from a process, thereby, reducing the hazardous and other wastes destined for final disposal and to ensure the environmentally sound management of all hazardous and other waste materials.

Objective

To promote safe management and use of hazardous substances including hazardous chemicals and hazardous wastes, in order to avoid damage to health and environment.

Hazardous Wastes Management Rules, 2008 consists of following 7 chapters namely:

Chapters	Names of the chapters
1	Preliminary
2	Procedure for handling hazardous waste
3	Procedure for recycling, reprocessing or reuse of hazardous waste
4	Import and Export of hazardous waste
5	Treatment, storage and disposal facility for hazardous waste
6	Packaging, labeling and transport of hazardous waste
7	Miscellaneous

Hazardous Wastes Management Rules, 2008 consists of following 7 Schedules:

Schedules	Names of the Schedules
1	List of processes generating hazardous waste
2	List of waste constituents with concentration limits
3	List of Hazardous waste applicable for import with prior informed consent
4	List of Hazardous waste requiring Registration for Recycling / Reprocessing
5	Specification of used oil suitable for reprocessing/recycling
6	Hazardous waste prohibited for import and export
7	List of Authorities and Corresponding Duties

Forms in Hazardous Wastes Management Rules, 2008:

1) Application for obtaining authorisation for collection/reception/treatment/ transport/storage/disposal of hazardous waste.

2) Form for grant /renewal of authorization by SPCB/PCC for occupiers, reprocessors, refuses and operates of facilities for collection, reception, treatment, storage, transport and disposal of hazardous waste

3) Format for maintaining records of hazardous waste by the occupier or operator of a facility 4.Form for filling Annual Returns by the Occupier or Operator of facility

5) Form of Application for grant/renewal of registration of industrial units possessing environmentally sound management facilities for reprocessing/ recycling

6) Formfor filling annual returns and records on reyclable hazardous waste by the recyclers

Application for import or export of hazardous waste for recycling/ reprocessing/ reuse

7) Application for Transboundary movement of hazardous waste

8) Transboundary movement -Movement Document

9) Format for maintaining records of hazardous waste imported and exported

10) Transport Emergency

11) Marking of Hazardous waste container

12) Hazardous Waste Manifest

13) Format of Accident Report

14) Application for filling Appeal against the order passed by CPCB/SPCB/ PCC of the Union Territory.

1) **Waste is Hazardous if**

   i) it is listed in Schedule I

   ii) Or, if it falls in Schedule II (analysis required)

2) For the purpose of regulation of Import and Export, a waste is considered as hazardous if it is listed in Schedule-III

Storage of Hazardous Waste

1) Till disposal for recycling/ treatment/ land filling, Hazardous Waste are to be stored onsite in bags/ containers in a covered area.

2) Storage permitted for a period not exceeding 90 days – SPCB may extend the storage period, in case of:

   i) Small generator, generating Hazardous Wastes up to 10 TPA

   ii) Recyclers, reprocessors and facility operatorsup to 6 months of their annual capacity

   iii) Generators who do not have access to any TSDF in the concerned State

   iv) Wastes which need to be specifically stored for development of a process for its recycling reuse.

Transportation of Hazardous Waste

1) Hazardous Wastes to be properly packed and labeled for transport to ensure safe handling

2) Hazardous Waste Containers shall be marked as per Form-12 Information on hazardous nature of wastes and measures to be taken in case of emergency shall be provided to the transporter in Form-11

3) Transport to be in accordance with Motor Vehicles Act, 1988 and related guidelines

4) Manifest System (Form-13) to be maintained.

Import and Export of Hazardous Wastes

1) MoEF is the nodal agency

2) Schedule III to be used for regulating HW export and import.

3) Export and Import ban on 30 items (Schedule VI)

4) Import shall be permitted only for recycling or recovery or re- use and not for disposal.

5) Export may be allowed to an actual user of the waste or operator of a disposal facility with the Prior Informed consent of the importing country

6) Wastes listed in Part-D of Schedule III can be imported by traders registered with the SPCB on

Check Your Progress 7

Note: a) Use the space below for your answer.

b) Compare your answers with those given at the end of the unit.

1) How can we store the Hazardous Waste?

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2.8 LET US SUM UP

The provisions given in the various internal safety legislations for employers as well as employees makes people aware about occupational safety and health policy programme. It will contribute to all aspects of business performance as part of a demonstrable commitment to continuous improvement.

2.9 KEY WORDS

1) Act : A change of a person's legal rights, obligations, or liabilities (as in the acquisition of a right or exemption from a liability) arising from the legal effect of some event such as bankruptcy

2) **Rule** : The principle that all people and institutions are subject to and accountable to law that is fairy applied and enforced; the principle of government by law

3) **Legislation** : The exercise of the power and function of making rules (such as laws) that have the force of authority by virtue of their promulgation by an official organ of a state or other organization

4) **Schedule** : A plan of procedure, usually written, for a proposed objecti ve, especially with reference to the sequence o f and time allotted for eachitem or operation necessary to its completion:

5) **Safety** : The state of being safe; freedom from the occurrence or risk of injury, danger, or loss.

6) **Penalty** : The state of being safe; freedom from the occurrence or risk of injury,danger, or loss.

2.10 REFERENCES AND SUGGESTED FURTHER READINGS

www.esic.nic.in/Tender/ESIAct1948Amendedupto010610.pdf

http://smartlearningway.blogspot.in/2015/02/employee-state-insurance-act-1948.html

https://www.ilo.org/dyn/natlex/docs/WEBTEXT/32063/64873/E87IND01.htm

http://www.theindianlawyer.in/statutesnbareacts/acts/m40.html

https://labour.gov.in/childlabour/child-labour-acts-and-rules

https://labour.gov.in/sites/default/files/act_3.pdf

http://www.iwma.in/HWM%20Rules.pdf

http://globalrec.org/wp-content/uploads/2014/03/Hazardous-Wastes-Management-and-Handling-Rules-1989.pdf

http://labour.bih.nic.in/Acts/The-Indian-Boilers-Act-1923.pdf

2.11 ANSWERS TO CHECK YOUR PROGRESS

Check Your Progress 1

1) The major objective of Factories Act, 1948 is to provide ample safety measures and to promote the health, safety and welfare of the workers which are employed in factories. The act also makes provisions regarding employment of women and young persons (including children and adolescents), annual leave with wages etc.

2) The following penalties are given accordingly

- The Penalties for offence relating to casing of new machinery
- Penalty for wrongfully disclosing Results of Analysis
- Penalty for obstructing Inspector

- Penalty for the contravention of Provisions Relating to Hazardous process
- General penalties for offence
- Penalty for employing child labor

Check Your Progress 2

1) Workmen's Compensation Act 1923 does not include a person whose employment is of casual nature, a master, seaman or other member of the crew of a ship, etc.

2) The main objective of the Workmen's Compensation Act, 1923 is to provide workmen and/or their dependents some relief in case of accidents arising out of and in the course of employment and causing either death or disablement of workmen.

Check Your Progress 3

1) This act is preliminary applicable to all the Factories and Shops employing 20 or more persons. Such other Govt. specified Establishments.

2) The benefits of Sickness benefits of Maternity, Disablement, Dependents, Medical and Funeral expenses.

Check Your Progress 4

1) The Inspectors were empowered to enter and inspect mines, and to enquire into accidents. The employment of competent managers in mines was required. Managers Competency Certificates were instituted. The Government was empowered to frame rules, etc. for regulating work in the mines. Penalties were prescribed for contravention of its various provisions.

2) It means, in a presidency-town, the person appointed by the Central Government to perform the duties of a District Magistrate under this Act in that town.

Check Your Progress 5

1) Boiler Vessels Act is an act to consolidate and amend the law relating to steam-boilers**.** This Act may be called the Indian Boilers Act, 1923. It extends to the whole of India except the State of Jammu and Kashmir. Boiler Act contains the law related to registration and inspection of steam boiler. This act is applicable to all boilers.

Check Your Progress 6

1) The Child Labour Act was required to prohibit the engagement of children in certain employments and also to regulate the condition of work of children in certain other employments.

Check Your Progress 7

1) Hazardous waste can be storedonsite in bags and containers in a covered area till their disposal for recycling/ treatment/ land filling. Storage of hazardous waste is permitted for a period not exceeding 90 days. But SPCB may extend the storage period in some particular cases.

UNIT 3 INDUSTRIAL STANDARDS

Structure

3.0 INTRODUCTION

Industrial standards are a set of criteria within different industries for the smooth functioning and carrying out of operations for productivity. In this unit we will discuss the Bureau of Indian standards on safety and health, process safety management, element of process safety management, and EPA standards.

3.1 OBJECTIVES

After completing this unit you should be able to;

- describe the Bureau of Indian standards on safety and health 14489 – 1998;
- understand the process of safety management; and
- explain the OHSAS – 18001.

3.2 BUREAU OF INDIAN STANDARDS ON SAFETY AND HEALTH 14489 – 1998

This standard establishes audit objectives, criteria and practices, and provides guidelines for establishing, planning, conducting and documenting of audits on occupational safety and health systems at workplace. It provides guidelines for verifying the existence and implementation of elements of occupational safety and health system and for verifying the system's ability to achieve defined safety objectives. It is sufficiently general in nature to permit it to be applicable or adaptable to different kinds of organizations. Each organization should develop its own specific procedures for implementing this standard. This standard does not cover audit of environmental management system for which a separate Indian Standard IS/IS0 14001 is available.

3.3 BUREAU OF INDIAN STANDARDS ON SAFETY AND HEALTH- 15001 – 2000 OSHA

The BIS has brought out a Standard on this subject as BIS 15001-2000 for the organizations to develop a practical approach to management of Occupational Health and Safety in such a way to protect employees and general public whose health and safety may be in danger because of the organisation's activities. The Standard also directs to improve Occupational Health & Safety performance of the organizations by providing the necessary requirements and guidance for use.

India has published IS 15001: 2000 Indian Standard on Occupational Health and Safety Management Systems— Specification and Guidance for Use, which is based on OHSAS 18000 and adapted to the Indian needs.

IS 15001, similar to the other standards, names four phases of the improvement process: planning, implementation and operation, measurement and evaluation (checking and corrective action in OHSAS 18001), and management review.

Essential is the risk assessment process, which is described comprehensively in Annex C of IS 15001. It comprises of six steps: Classifying work activities, identifying hazards, determining risks, deciding if risk is tolerable, preparing risk control action plan, and reviewing adequacy of action plan.

Small companies are not required to go through the entire procedure of risk assessment that is described in IS 15001. They should carefully select which risks they would like to assess in detail. Information overkill on trivial risks that cannot be properly processed would lead to losses of important facts.

The requirements in the Standard are intended to be incorporated into any Occupational Health & Safety Management System. The extent of application and usefulness will depend on important factors such as the Occupational Health & Safety Policy of the organization, the nature of its activities and the conditions in which it operates. The Standard also provides necessary information and useful guidance.

The Standard is applicable to all economic activities to –

i) Assure itself of its conformance with its stated Occupational Health & Safety Policy

ii) Demonstrate such conformance to enforcement authorities, general public and others

iii) Implement, maintain and improve Occupational Health & Safety Management Systems

iv) Get certification/registration of its Occupational Health & Safety Management Systems

Each organization can develop its own procedure for implementing it as per the guidance available in the Standard. The Standard defines various terms like accident, hazard, risk, risk assessment, safety. It also includes Occupational Health & Safety objectives, targets and system, etc.

The specification includes commitment and policy, planning, implementation and operations, measurement and evaluation of the action taken and achievements and finally management review of Occupational Health & Safety Management System to ensure its continuing suitability, adequacy, and effectiveness. The details for the following five principles are also available in the Standard.

1) Commitment and Policy

i) Leadership and Commitment

ii) Initial Occupational Health & Safety Review

iii) Occupational Health & Safety Policy covering integration and relevance, accountability, Consultations, Prevention and Compliance.

2) Planning

i) Legal and other requirements

ii) Hazard/Risk Identification, Assessment, Prevention and Control

iii) Objectives, Targets and Performance Indicators.

iv) Accountability and Responsibility

v) Initial and Ongoing Planning

3) Implementation and Operation

i) Operation control by Design and Engineering, Contract Review, Purchasing, Emergency Preparedness and Response and Critical Incidence Recovery Plan.

ii) Support action covering Communication, Reporting, Documentation-Control, Records and Information Management.

iii) Ensuring stability by providing Resources – Human, Financial and Physical and Competence Building through Training and Awareness.

4) Measurement and Evaluation

i) Internal and External Audit

ii) Inspection and Testing

iii) Non-conformance and Preventive Action

5) Management Review

The management review shall include –

i) The overall quality and standard of performance of the Occupational Health & Safety Management System.

ii) The performance of individual element of the System

iii) The findings of Audits and

iv) Internal and external factors such as changes in organizational structure, legislation, Introduction of new technology etc. and shall identify what action is necessary to fill up the gray areas.

The Standard is very useful for the management, safety professionals and others in conducting the review of the existing Safety Management System in their organization and adopts a uniform and standardized Occupational Health & Safety System.

3.4 PROCESS SAFETY MANAGEMENT (PSM)

Clean Air Act Amendments of 1990- 304 gave OSHA directives to create standards to prevent catastrophic releases of highly hazardous chemicals. They responded in 1991 with 29CFR1910.119 or what is known as Process Safety Management for Highly Hazardous Chemicals (PSM).

The major objective of process safety management (PSM) of highly hazardous chemicals is to prevent unwanted release of hazardous chemicals especially into locations that could expose employees and others to serious hazards. An effective process safety management program requires a systematic approach to evaluating the whole chemical process. Using this approach, the process design, process technology, process changes, operational and maintenance activities and procedures, non routine activities and procedures, emergency preparedness plans and procedures, training programs, and other elements that affect the process are all considered in the evaluation.

3.5 ELEMENTS OF PROCESS SAFETY MANAGEMENT

The process safety management program is divided into 14 elements. The Occupational Safety and Health Administration (OSHA) 1910.119 define all 14 elements of the process safety management plan.

- Process Safety Information
- Process Hazard Analysis
- Operating Procedures
- Training
- Contractors
- Mechanical Integrity
- Hot Work
- Management of Change
- Incident Investigation
- Compliance Audits
- Trade Secrets
- Employee Participation
- Pre-start up Safety Review
- Emergency Planning and Response

All these elements mentioned above are interlinked and interdependent. There is a tremendous interdependency of the various elements of PSM. All elements

are related and are necessary to make up the entire PSM picture. Every element either contributes information to other elements for the completion or utilizes information from other elements in order to be completed.

Process Hazard Analysis

A process hazard analysis (PHA), or evaluation, is one of the most important elements of the process safety management program. A PHA is an organized and systematic effort to identify and analyze the significance of potential hazards associated with the processing or handling of highly hazardous chemicals. A PHA provides information that will assist employers and employees in making decisions for improving safety and reducing the consequences of unwanted or unplanned releases of hazardous chemicals.

A PHA analyzes potential causes and consequences of fires, explosions, releases of toxic or flammable chemicals, and major spills of hazardous chemicals. The PHA focuses on equipment, instrumentation, utilities, human actions (routine and nonroutine), and external factors that might affect the process.

The selection of a PHA methodology or technique will be influenced by many factors including how much is known about the process. Also, the size and complexity of the process will influence the decision as to the appropriate PHA methodology to use. All PHA methodologies are subject to certain limitations. For example, the checklist methodology works well when the process is very stable and no changes are made, but it is not as effective when the process has undergone extensive change. The checklist may miss the most recent changes and consequently they would not be evaluated. Another limitation to be considered concerns the assumptions made by the team or analyst. The PHA is dependent on good judgement and the assumptions made during the study need to be documented and understood by the team and reviewer and kept for a future PHA.

The team conducting the PHA needs to understand the methodology that is going to be used. A PHA team can vary in size from two people to a number of people with varied operational and technical backgrounds. Some team members may be part of the team for only a limited time. The team leader needs to be fully knowledgeable in the proper implementation of the PHA methodology to be used and should be impartial in the evaluation. The other full or part-time team members need to provide the team with expertise in areas such as process technology; process design; operating procedures and practices; alarms; emergency procedures; instrumentation; maintenance procedures, both routine and non routine tasks, including how the tasks are authorized; procurement of parts and supplies; safety and health; and any other relevant subjects. At least one team member must be familiar with the process.

The ideal team will have an intimate knowledge of the standards, codes, specifications, and regulations applicable to the process being studied. The selected team members need to be compatible and the team leader needs to be able to manage the team and the PHA study. The team needs to be able to work together while benefiting from the expertise of others on the team or outside the team to resolve issues and to forge a consensus on the findings of the study and recommendations.

The application of a PHA to a process may involve the use of different methodologies for various parts of the process. For example, a process involving a series of unit operations of varying sizes, complexities, and ages may use different methodologies and team members for each operation. Then the conclusions can be integrated into one final study and evaluation.

A more specific example is the use of a PHA checklist for a standard boiler or heat exchanger and the use of a Hazard and Operability PHA for the overall process. Also, for batch-type processes like custom batch operations, a generic PHA of a representative batch may be used where there are only small changes of monomer or other ingredient ratio and the chemistry is documented for the full range and ratio of batch ingredients. Another process where the employer might consider using a generic type of PHA is a gas plant. Often these plants are simply moved from site to site, and therefore, a generic PHA may be used for these movable plants. Also, when an employer has several similar size gas plants and no sour gas is being processed at the site, a generic PHA is feasible as long as the variations of the individual sites are accounted for in the PHA.

Finally, when an employer has a large continuous process with several control rooms for different portions of the process, such as for a distillation tower and a blending operation, the employer may wish to do each segment separately and then integrate the final results.

Small businesses covered by this rule often will have processes that have less storage volume and less capacity and may be less complicated than processes at a large facility. Therefore, OSHA would anticipate that the less complex methodologies would be used to meet the process hazard analysis criteria in the standard. These process hazard analyses can be done in less time and with fewer people being involved. A less complex process generally means that less data, P&IDs, and process information are needed to perform a process hazard analysis.

Many small businesses have processes that are not unique, such as refrigerated warehouses or cold storage lockers or water treatment facilities. Where employer associations have a number of members with such facilities, a generic PHA, evolved from a checklist or what-if questions, could be developed and effectively used by employers to reflect their particular process; this would simplify compliance for them.

When the employer has a number of processes that require a PHA, the employer must set up a priority system to determine which PHAs to conduct first. A preliminary hazard analysis may be useful in setting priorities for the processes that the employer has determined are subject to coverage by the process safety management standard. Consideration should be given first to those processes with the potential of adversely affecting the largest number of employees. This priority setting also should consider the potential severity of a chemical release, the number of potentially affected employees, the operating history of the process, such as the frequency of chemical releases, the age of the process, and any other relevant factors. Together, these factors would suggest a ranking order using either a weighting factor system or a systematic ranking method. The use of a preliminary hazard analysis will assist an employer in determining which process should be of the highest priority for hazard analysis resulting in the greatest improvement in safety at the facility occurring first.

Process Safety Information

Process safety information (PSI) might be considered the keystone of a PSM Program in that it tells you what you are dealing with from both the equipment and the process standpoint. In order to be in compliance with the OSHA PSM regulations the process safety information should include information pertaining to the hazards of the highly hazardous chemicals used or produced by the process, information pertaining to the technology of the process and information pertaining to the equipment in the process (American Institute of Chemical Engineers, Center for Chemical Process Safety, 1995).

Information pertaining to the hazards of the highly hazardous chemicals in the process should consist of at least the following:

- Toxicity information
- Permissible exposure limit
- Physical data
- Reactivity data
- Corrosivity data
- Thermal and chemical stability data
- Hazardous effects of inadvertent mixing of different materials that could foreseeably occur

Operating Procedures

Operating procedures describe tasks to be performed, data to be recorded, operating conditions to be maintained, samples to be collected, and safety and health precautions to be taken. The procedures need to be technically accurate, understandable to employees, and revised periodically to ensure that they reflect current operations. The process safety information package helps to ensure that the operating procedures and practices are consistent with the known hazards of the chemicals in the process and that the operating parameters are correct. Operating procedures should be reviewed by engineering staff and operating personnel to ensure their accuracy and that they provide practical instructions on how to actually carry out job duties safely. Also the employer must certify annually that the operating procedures are current and accurate.

Operating procedures provide specific instructions or details on what steps are to be taken or followed in carrying out the stated procedures. The specific instructions should include the applicable safety precautions and appropriate information on safety implications. For example, the operating procedures addressing operating parameters will contain operating instructions about pressure limits, temperature ranges, flow rates, what to do when an upset condition occurs, what alarms and instruments are pertinent if an upset condition occurs, and other subjects. Another example of using operating instructions to properly implement operating procedures is in starting up or shutting down the process. In these cases, different parameters will be required from those of normal operation. These operating instructions need to clearly indicate the distinctions between startup and normal operations, such as the appropriate allowances for heating up a unit to reach the normal operating parameters. Also, the operating instructions need to describe the proper method for increasing the temperature

of the unit until the normal operating temperatures are reached.

Computerized process control systems add complexity to operating instructions. These operating instructions need to describe the logic of the software as well as the relationship between the equipment and the control system; otherwise, it may not be apparent to the operator.

Operating procedures and instructions are important for training operating personnel. The operating procedures are often viewed as the standard operating practices (SOPs) for operations. Control room personnel and operating staff, in general, need to have a full understanding of operating procedures. If workers are not fluent in English, then procedures and instructions need to be prepared in a second language understood by the workers. In addition, operating procedures need to be changed when there is a change in the process. The consequences of operating procedure changes need to be fully evaluated and the information conveyed to the personnel. For example, mechanical changes to the process made by the maintenance department (like changing a valve from steel to brass or other subtle changes) need to be evaluated to determine whether operating procedures and practices also need to be changed. All management of change actions must be coordinated and integrated with current operating procedures, and operating personnel must be alerted to the changes in procedures before the change is made. When the process is shut down to make a change, then the operating procedures must be updated before re-starting the process.

Training must include instruction on how to handle upset conditions as well as what operating personnel are to do in emergencies such as pump seal failures or pipeline ruptures. Communication among operating personnel and workers within the process area performing non routine tasks also must be maintained. The hazards of the tasks are to be conveyed to operating personnel in accordance with established procedures and to those performing the actual tasks. When the work is completed, operating personnel should be informed to provide closure on the job.

Employee Training

All employees, including maintenance and contractor employees involved with highly hazardous chemicals, need to fully understand the safety and health hazards of the chemicals and processes they work with so they can protect themselves, their fellow employees, and the citizens of nearby communities. Training conducted in compliance with the OSHA Hazard Communication standard (*Title 29 Code of Federal Regulations* (CFR) Part 1910.1200) will inform employees about the chemicals they work with and familiarize them with reading and understanding MSDSs. However, additional training in subjects such as operating procedures and safe work practices, emergency evacuation and response, safety procedures, routine and non routine work authorization activities, and other areas pertinent to process safety and health need to be covered by the employer's training program.

In establishing their training programs, employers must clearly identify the employees to be trained, the subjects to be covered, and the goals and objectives they wish to achieve. The learning goals or objectives should be written in clear measurable terms before the training begins. These goals and objectives need to be tailored to each of the specific training modules or segments. Employers

should describe the important actions and conditions under which the employee will demonstrate competence or knowledge as well as what are acceptable performance.

Hands-on training, where employees actually apply lessons learned in simulated or real situations, will enhance learning. For example, operating personnel, who will work in a control room or at control panels, would benefit by being trained at a simulated control panel. Upset conditions of various types could be displayed on the simulator, and then the employee could go through the proper operating procedures to bring the simulator panel back to the normal operating parameters. A training environment could be created to help the trainee feel the full reality of the situation but under controlled conditions. This type of realistic training can be very effective in teaching employees correct procedures while allowing them also to see the consequences of what might happen if they do not follow established operating procedures. Other training techniques using videos or training also can be very effective for teaching other job tasks, duties, or imparting other important information. An effective training program will allow employees to fully participate in the training process and to practice their skills or knowledge.

Employers need to evaluate periodically their training programs to see if the necessary skills, knowledge, and routines are being properly understood and implemented by their trained employees. The methods for evaluating the training should be developed along with the training program goals and objectives. Training program evaluation will help employers to determine the amount of training their employees understood and whether the desired results were obtained. If, after the evaluation, it appears that the trained employees are not at the level of knowledge and skill that was expected, the employer should revise the training program, provide retraining, or provide more frequent refresher training sessions until the deficiency is resolved. Those who conducted the training and those who received the training also should be consulted as to how best to improve the training process. If there is a language barrier, the language known to the trainees should be used to reinforce the training messages and information.

Careful consideration must be given to ensure that employees, including maintenance and contract employees, receive current and updated training. For example, if changes are made to a process, affected employees must be trained in the changes and understand the effects of the changes on their job tasks. Additionally, the evaluation of the employee's absorption of training will certainly determine the need for further training.

Contractors

Employers who use contractors to perform work in and around processes that involve highly hazardous chemicals have to establish a screening process so that they hire and use only contractors who accomplish the desired job tasks without compromising the safety and health of any employees at a facility. For contractors whose safety performance on the job is not known to the hiring employer, the employer must obtain information on injury and illness rates and experience and should obtain contractor references. In addition, the employer must ensure that the contractor has the appropriate job skills, knowledge, and certifications (e.g., for pressure vessel welders). Contractor work methods and experience should be evaluated.

Maintaining a site injury and illness log for contractors is another method employers must use to track and maintain current knowledge of activities involving contract employees working on or adjacent to processes covered by PSM. Injury and illness logs of both the employer's employees and contract employees allow the employer to have full knowledge of process injury and illness experience. This log contains information useful to those auditing process safety management compliance and those involved in incident investigations.

Contract employees must perform their work safely. Considering that contractors often perform very specialized and potentially hazardous tasks, such as confined space entry activities and non routine repair activities, their work must be controlled while they are on or near a process covered by PSM. A permit system or work authorization system for these activities is helpful for all affected employers. The use of a work authorization system keeps an employer informed of contract employee activities. Thus, the employer has better coordination and more management control over the work being performed in the process area. A well-run and well-maintained process, where employee safety is fully recognized, benefits all of those who work in the facility whether they are employees of the employer or the contractor.

Pre-Start-up Safety Review

For new processes, the employer will find a PHA helpful in improving the design and construction of the process from a reliability and quality point of view. The safe operation of the new process is enhanced by making use of the PHA recommendations before final installations are completed. P&IDs should be completed, the operating procedures put in place, and the operating staff trained to run the process, before start-up. The initial start-up procedures and normal operating procedures must be fully evaluated as part of the pre-start-up review to ensure a safe transfer into the normal operating mode.

For existing processes that have been shut down for turnaround or modification, the employer must ensure that any changes other than "replacement in kind" made to the process during shutdown go through the management of change procedures. P&IDs will need to be updated, as necessary, as well as operating procedures and instructions. If the changes made to the process during shutdown are significant and affect the training program, then operating personnel as well as employees engaged in routine and non routine work in the process area may need some refresher or additional training. Any incident investigation recommendations, compliance audits, or PHA recommendations need to be reviewed to see what affect they may have on the process before beginning the start-up.

Mechanical Integrity of Equipment

Employers must review their maintenance programs and schedules to see if there are areas where "breakdown" is used rather than the more preferable on-going mechanical integrity program. Equipment used to process, store, or handle highly hazardous chemicals has to be designed, constructed, installed, and maintained to minimize the risk of releases of such chemicals. This requires that a mechanical integrity program be in place to ensure the continued integrity of process equipment.

Elements of a mechanical integrity program include identifying and categorizing equipment and instrumentation, inspections and tests and their frequency; maintenance procedures; training of maintenance personnel; criteria for acceptable test results; documentation of test and inspection results; and documentation of manufacturer recommendations for equipment and instrumentation.

Process Defenses

The first line of defense an employer has is to operate and maintain the process as designed and to contain the chemicals. This is backed up by the second line of defense which is to control the released chemicals through venting to scrubbers or flares, or to surge or overflow tanks designed to receive such chemicals. This also would include fixed fire protection systems like sprinklers, water spray, or deluge systems, monitor guns, dikes, designed drainage systems, and other systems to control or mitigate hazardous chemicals once an unwanted release occurs.

Written Procedures

The first step of an effective mechanical integrity program is to compile and categorize a list of process equipment and instrumentation to include in the program. This list includes pressure vessels, storage tanks, process piping, relief and vent systems, fire protection system components, emergency shutdown systems and alarms, and interlocks and pumps. For the categorization of instrumentation and the listed equipment, the employer should set priorities for which pieces of equipment require closer scrutiny than others.

Inspection and Testing

The mean time to failure of various instrumentation and equipment parts would be known from the manufacturer's data or the employer's experience with the parts, which then influence inspection and testing frequency and associated procedures. Also, applicable codes and standards-such as the National Board inspection Code, or those from the American Society for Testing and Materials, American Petroleum Institute, National Fire Protection Association, American National Standards institute, American Society of Mechanical Engineers, and other groups-provide information to help establish an effective testing and inspection frequency, as well as appropriate methodologies.

The applicable codes and standards provide criteria for external inspections for such items as foundation and supports, anchor bolts, concrete or steel supports, guy wires, nozzles and sprinklers, pipe hangers, grounding connections protective coatings and insulation, and external metal surfaces of piping and vessels. These codes and standards also provide information on methodologies for internal inspection and a frequency formula based on the corrosion rate of the materials of construction. Also, internal and external erosion must be considered along with corrosion effects for piping and valves. Where the corrosion rate is not known, a maximum inspection frequency is recommended (methods of developing the corrosion rate are available in the codes). Internal inspections need to cover items such as the vessel shell, bottom and head; metallic linings; non-metallic linings; thickness measurements for vessels and piping; inspection for erosion, corrosion, cracking and bulges; internal equipment like trays, baffles, sensors ad screens for erosion, corrosion or cracking and other deficiencies.

Some of these inspections may be performed by state or local government inspectors under state and local statutes. However, each employer must develop procedures to ensure that tests and inspections are conducted properly and that consistency is maintained even where different employees may be involved. Appropriate training must be provided to maintenance personnel to ensure that they understand the preventive maintenance program procedures, safe practices, and the proper use and application of special equipment or unique tools that may be required. This training is part of the overall training program called for in the standard.

Quality Assurance

A quality assurance system helps ensure the use of proper materials of construction, the proper fabrication and inspection procedures, and appropriate installation procedures that recognize field installation concerns. The quality assurance program is an essential part of the mechanical integrity program and will help maintain the primary and secondary lines of defense designed into the process to prevent unwanted chemical releases or to control or mitigate a release. "As built" drawings, together with certifications of coded vessels and other equipment and of construction, must be verified and retained in the quality assurance documentation.

Equipment installation jobs need to be properly inspected in the field for use of proper materials and procedures and to ensure that qualified craft workers do the job. The use of appropriate gaskets, packing, bolts, valves, lubricants and welding rods needs to be verified in the field. Also, procedures for installing safety devices need to be verified, such as the torque on the bolts on rupture disc installations, uniform torque on flange bolts, and proper installation of pump seals. If the quality of parts is a problem, it may be appropriate for the employer to conduct audits of the equipment supplier's facilities to better ensure proper purchases of required equipment suitable for intended service. Any changes in equipment that may become necessary will need to be reviewed for management of change procedures.

Non routine Work Authorizations

Non routine work conducted in process areas must be controlled by the employer in a consistent manner. The hazards identified involving the work to be accomplished must be communicated to those doing the work and to those operating personnel whose work could affect the safety of the process. A work authorization notice or permit must follow a procedure that describes the steps the maintenance supervisor, contractor representative, or other person needs to follow to obtain the necessary clearance to start the job. The work authorization procedures must reference and coordinate, as applicable, lockout/tagout procedures, line breaking procedures, confined space entry procedures, and hot work authorizations. This procedure also must provide clear steps to follow once the job is completed to provide closure for those that need to know the job is now completed and that equipment can be returned to normal.

Managing Change

To properly manage changes to process chemicals, technology, equipment and facilities, one must define what is meant by change. In the process safety management standard, change includes all modifications to equipment,

procedures, raw materials, and processing conditions other than "replacement in kind." These changes must be properly managed by identifying and reviewing them prior to implementing them. For example, the operating procedures contain the operating paramaters (pressure limits, temperature ranges, flow rates, etc.) and the importance of operating within these limits. While the operator must have the flexibility to maintain safe operation within the established parameters, any operation outside of these parameters requires review and approval by a written management of change procedure. Management of change also covers changes in process technology and changes to equipment and instrumentation. Changes in process technology can result from changes in production rates, raw materials, experimentation, equipment unavailability, new equipment, new product development, change in catalysts, and changes in operating conditions to improve yield or quality. Equipment changes can be in materials of construction, equipment specifications, piping pre-arrangements, experimental equipment, computer program revisions, and alarms and interlocks. Employers must establish means and methods to detect both technical and mechanical changes.

Temporary changes have caused a number of catastrophes over the years, and employers must establish ways to detect both temporary and permanent changes. It is important that a time limit for temporary changes be established and monitored since otherwise, without control, these changes may tend to become permanent. Temporary changes are subject to the management of change provisions. In addition, the management of change procedures are used to ensure that the equipment and procedures are returned to their original or designed conditions at the end of the temporary change. Proper documentation and review of these changes are invaluable in ensuring that safety and health considerations are incorporated into operating procedures and processes. Employers may wish to develop a form or clearance sheet to facilitate the processing of changes through the management of change procedures. A typical change form may include a description and the purpose of the change, the technical basis for the change, safety and health considerations, documentation of changes for the operating procedures, maintenance procedures, inspection and testing, P&IDs, electrical classification, training and communications, pre-start-up inspection, duration (if a temporary change), approvals, and authorization. Where the impact of the change is minor and well understood, a check list reviewed by an authorized person, with proper communication to others who are affected, may suffice.

For a more complex or significant design change, however, a hazard evaluation procedure with approvals by operations, maintenance, and safety departments may be appropriate. Changes in documents such as P&IDs, raw materials, operating procedures, mechanical integrity programs, and electrical classifications should be noted so that these revisions can be made permanent when the drawings and procedure manuals are updated. Copies of process changes must be kept in an accessible location to ensure that design changes are available to operating personnel as well as to PHA team members when a PHA is being prepared or being updated.

Incident Investigation

Incident investigation is the process of identifying the underlying causes of incidents and implementing steps to prevent similar events from occurring. The intent of an incident investigation is for employers to learn from past experiences

and thus avoid repeating past mistakes. The incidents OSHA expects employers to recognize and to investigate are the types of events that resulted in or could reasonably have resulted in a catastrophic release. These events are sometimes referred to as "near misses," meaning that a serious consequence did not occur, but could have.

Employers must develop in-house capability to investigate incidents that occur in their facilities. A team should be assembled by the employer and trained in the techniques of investigation including how to conduct interviews of witnesses, assemble needed documentation, and write reports. A multi-disciplinary team is better able to gather the facts of the event and to analyze them and develop plausible scenarios as to what happened, and why. Team members should be selected on the basis of their training, knowledge and ability to contribute to a team effort to fully investigate the incident.

Employees in the process area where the incident occurred should be consulted, interviewed or made a member of the team. Their knowledge of the events represents a significant set of facts about the incident that occurred. The report, its findings, and recommendations should be shared with those who can benefit from the information. The cooperation of employees is essential to an effective incident investigation. The focus of the investigation should be to obtain facts and not to place blame. The team and the investigative process should clearly deal with all involved individuals in a fair, open, and consistent manner.

Emergency Preparedness

Each employer must address what actions employees are to take when there is an unwanted release of highly hazardous chemicals. Emergency preparedness is the employer's third line of defense that will be relied on along with the second line of defense, which is to control the release of chemical. Control releases and emergency preparedness will take place when the first line of defense to operate and maintain the process and contain the chemicals fails to stop the release. In preparing for an emergency chemical release, employers will need to decide the following:

- Whether they want employees to handle and stop small or minor incidental releases;
- Whether they wish to mobilize the available resources at the plant and have them brought to bear on a more significant release;
- Whether employers want their employees to evacuate the danger area and promptly escape to a preplanned safe zone area, and then allow the local community emergency response organizations to handle the release; or
- Whether the employer wants to use some combination of these actions.

Employers will need to select how many different emergency preparedness or third lines of defense they plan to have, develop the necessary emergency plans and procedures, appropriately train employees in their emergency duties and responsibilities, and then implement these lines of defense.

Employers, at a minimum, must have an emergency action plan that will facilitate the prompt evacuation of employees when there is an unwanted release of a

highly hazardous chemical. This means that the employer's plan will be activated by an alarm system to alert employees when to evacuate, and that employees who are physically impaired will have the necessary support and assistance to get them to a safe zone. The intent of these requirements is to alert and move employees quickly to a safe zone. Delaying alarms or confusing alarms are to be avoided. The use of process control centers or buildings as safe areas is discouraged. Recent catastrophes indicate that lives are lost in these structures because of their location and because they are not necessarily designed to withstand overpressures from shock waves resulting from explosions in the process area.

When there are unwanted incidental releases of highly hazardous chemicals in the process area, the employer must inform employees of the actions/procedures to take. If the employer wants employees to evacuate the area, then the emergency action plan will be activated. For outdoor processes, where wind direction is important for selecting the safe route to a refuge area, the employers should place a wind direction indicator, such as a wind sock or pennant, at the highest point visible throughout the process area. Employees can move upwind of the release to gain safe access to a refuge area by knowing the wind direction.

If the employer wants specific employees in the release area to control or stop the minor emergency or incidental release, these actions must be planned in advance and procedures developed and implemented. Handling incidental releases for minor emergencies in the process area must include pre-planning, providing appropriate equipment for the hazards, and conducting training for those employees who will perform the emergency work before they respond to handle an actual release. The employer's training program, including the Hazard Communication standard training, is to address, identify, and meet the training needs for employees who are expected to handle incidental or minor releases.

Preplanning for more serious releases is an important element in the employer's line of defense. When a serious release of a highly hazardous chemical occurs, the employer, through preplanning, will have determined in advance what actions employees are to take. The evacuation of the immediate release area and other areas, as necessary, would be accomplished under the emergency action plan. If the employer wishes to use plant personnel-such as a fire brigade, spill control team, a hazardous materials team-or employees to render aid to those in the immediate release area and to control or mitigate the incident, refer to OSHA's Hazardous Waste Operations and Emergency Response (HAZWOPER) standard (Title 79CFR Part 1910.1 20). If outside assistance is necessary, such as through mutual aid agreements between employers and local government emergency response organizations, these emergency responders are also covered by HAZWOPER. The safety and health protection required for emergency responders is the responsibility of their employers and of the on-scene incident commander.

Responders may be working under very hazardous conditions; therefore, the objective is to have them competently led by an on-scene incident commander and the commander's staff, properly equipped to do their assigned work safely, and fully trained to carry out their duties safely before they respond to an emergency. Drills, training exercises, or simulations with the local community emergency response planners and organizations are one means to obtain better

preparedness. This close cooperation and coordination between plant and local community emergency preparedness managers also will aid the employer in complying with the Environmental Protection Agency's Risk Management Plan criteria.

An effective way for medium to large facilities to enhance coordination and communication during emergencies within the plant and with local community organizations is by establishing and equipping an emergency control center. The emergency control center should be located in a safe zone so that it could be occupied throughout the duration of an emergency. The center should serve as the major communications link between the on-scene incident commander and plant or corporate management as well as with local community officials. The communications equipment in the emergency control center should include a network to receive and transmit information by telephone, radio, or other means. It is important to have a backup communications network in case of power failure or if one communication means fails. The center also should be equipped with the plant layout; community maps; utility drawings, including water for fire extinguishing; emergency lighting; appropriate reference materials such as a government agency notification list, company personnel phone list, SARA Title III reports and material safety data sheets, emergency plans and procedures manual; a listing the location of emergency response equipment and mutual aid information; and access to meteorological data and any dispersion modeling data.

Compliance Audits

An audit is a technique used to gather sufficient facts and information, including statistical information, to verify compliance with standards. Employers must select a trained individual or assemble a trained team to audit the process safety management system and program. A small process or plant may need only one knowledgeable person to conduct an audit. The audit includes an evaluation of the design and effectiveness of the process safety management system and a field inspection of the safety and health conditions and practices to verify that the employer's systems are effectively implemented. The audit should be conducted or led by a person knowledgeable in audit techniques who is impartial towards the facility or area being audited. The essential elements of an audit program include planning, staffing, conducting the audit, evaluating hazards and deficiencies and taking corrective action, performing follow-up and documenting actions taken.

Planning

Planning is essential to the success of the auditing process. During planning, auditors should select a sufficient number of processes to give a high degree of confidence that the audit reflects the overall level of compliance with the standard. Each employer must establish the format, staffing, scheduling, and verification methods before conducting the audit. The format should be designed to provide the lead auditor with a procedure or checklist that details the requirements of each section of the standard. The names of the audit team members should be listed as part of the format as well. The checklist, if properly designed, could serve as the verification sheet that provides the auditor with the necessary information to expedite the review of the program and ensure that all requirements of the standard are met. This verification sheet format could also identify those

elements that will require an evaluation or a response to correct deficiencies. This sheet also could be used for developing the follow-up and documentation requirements.

Staffing

The selection of effective audit team members is critical to the success of the program. Team members should be chosen for their experience, knowledge, and training and should be familiar with the processes and auditing techniques, practices, and procedures. The size of the team will vary depending on the size and complexity of the process under consideration. For a large, complex, highly instrumented plant, it may be desirable to have team members with expertise in process engineering and design; process chemistry; instrumentation and computer controls; electrical hazards and classifications; safety and health disciplines; .maintenance; emergency preparedness; warehousing or shipping; and process safety auditing. The team may use part-time members to provide the expertise required and to compare what is actually done or followed with the written PSM program.

Conducting the Audit

An effective audit includes a review of the relevant documentation and process safety information, inspection of the physical facilities, and interviews with all levels of plant personnel. Utilizing the audit procedure and checklist developed in the preplanning stage, the audit team can systematically analyze compliance with the provisions of the standard and any other corporate policies that are relevant. For example, the audit team will review all aspects of the training program as part of the overall audit. The team will review the written training program for adequacy of content, frequency of training, effectiveness of training in terms of its goals and objectives as well as to how it fits into meeting the standard's requirements. Through interviews, the team can determine employees' knowledge and awareness of the safety procedures, duties, rules, and emergency response assignments. During the inspection, the team can observe actual practices such as safety and health policies, procedures, and work authorization practices. This approach enables the team to identify deficiencies and determine where corrective actions or improvements are necessary.

Evaluation and Corrective Action

The audit team, through its systematic analysis, should document areas that require corrective action as well as where the process safety management system is effective. This provides a record of the audit procedures and findings and serves as a baseline of operation data for future audits. It will assist in determining changes or trends in future audits.

Corrective action is one of the most important parts of the audit and includes identifying deficiencies, and planning, following-up, and documenting the corrections. The corrective action process normally begins with a management review of the audit findings. The purpose of this review is to determine what actions are appropriate, and to establish priorities, timetables, resource allocations and requirements, and responsibilities. In some cases, corrective action may involve a simple change in procedures or a minor maintenance effort to remedy the problem. Management of change procedures need to be used, as appropriate, even for a seemingly minor change. Many of the deficiencies can be acted on

promptly, while some may require engineering studies or more detailed review of actual procedures and practices. There may be instances where no action is necessary; this is a valid response to an audit finding. All actions taken, including an explanation when no action is taken on a finding, need to be documented.

The employer must assure that each deficiency identified is addressed, the corrective action to be taken is noted, and the responsible audit person or team is properly documented. To control the corrective action process, the employer should consider the use of a tracking system. This tracking system might include periodic status reports shared with affected levels of management, specific reports such as completion of an engineering study, and a final implementation report to provide closure for audit findings that have been through management of change, if appropriate, and then shared with affected employees and management. This type of tracking system provides the employer with the status of the corrective action. It also provides the documentation required to verify that appropriate corrective actions were taken on deficiencies identified in the audit.

OSHA believes that PSM should help small employers to comply more easily with the new requirements the standard imposes. The end result can only be safer more healthful workplace for all employees-a goal we all share.

3.6 EPA STANDARDS

What are data standards?

Data Standards help people use, exchange and understand environmental data. The use of data standards across EPA's many programs provides consistently defined and formatted data elements and sets of data values, which provide the public access to more meaningful data. EPA data standards are a means to promote the efficient sharing of environmental information among US EPA, states, tribes, local governments, the private sector, and other information trading partners.

Who Develops Data Standards?

EPA's Data Standards are developed and approved by the Environmental Data Standards Council (EDSC), a partnership among EPA, States and Tribal partners to develop and agree upon data standards for environmental information collection and exchange. The Council seeks to promote efficient sharing of environmental information between States, EPA and Tribes through the use of data standards to support data exchange and data integration activities. The EDSC has approved the standards for the following subject areas: Date, SIC/NAICS, Latitude/Longitude, Facility Identification, Contact Information, Chemical Identification, Biological Taxonomy, Permits, Tribal Identification, Enforcement and Compliance, and Reporting Water Quality Results for Chemical and Microbiological Analytes.

If EPA establishes a business need for the standard, the Agency proceeds to form an Action Team to develop the Agency business rules for the data standard. The standard will either be interim or final depending on the status of business rules development. The standard and the business rules are submitted to the Chief Information Officer (CIO) and the Quality Information Council (QIC) for approval as an Agency final data standard. The final data standard is posted in the Environmental Data Registry (EDR) and is then available for implementation

into EPA information systems. Although approved by the EDSC, EPA has not yet finalized standards for Contact Information and Reporting Water Quality Results for Chemical and Microbiological Analytes. EPA anticipates approving these standards and finalizing relevant business rules shortly.

Policies and procedures

EPA's Data Standards Policy establishes principles, responsibilities, and requirements for the development, maintenance, and implementation of data standards within the EPA's jurisdiction. This policy and related procedures support EPA's enterprise architecture and Quality System for Environmental Data and Technology by underscoring EPA's commitment to improving data quality and promoting data interoperability, exchanges, sharing, and the ability to use data in diverse situations.

Standards also promote quality; EPA's goal is high-quality information delivered in an efficient way to the people who need it.

How do EPA data standards contribute to quality information?

Data standards are a very important part of improving data quality for better decision making in EPA's environmental management programs and those of its partners:

- The use of data standards enables reusability of data elements and their metadata that can reduce redundancy between systems, thereby improving reliability and often reducing cost
- Data standards ensure consistency in code set use by providing for the maintenance and management of permissible code sets

Benefits of EPA data standards:

The benefits of EPA's data standards are those applicable to any standard:

- They are developed by subject matter experts coming to consensus on how to solve business problems – so it represents the "best" solution
- They are harder to develop than non-standards, but are more economical in the long term because you can use the same code or presentation and publishing mechanisms to provide access to information
- They enable transparency and understanding: use of standards promotes common, clear meanings for data that is often reused
- They enable access: the same well understood terms, codes, and data structures can be used for data retrieval
- They encourage and enable reuse of data and software for multiple purposes
- Mappings to standards allow comparisons even when data isn't standardized
- They provide consistent results during data retrieval

3.7 OHSAS – 18001

OHSAS 18001 is an international standard giving requirements related to Health and Safety Management Systems. OHSAS 18001 enables an organization to have control over, and knowledge of, all relevant hazards resulting from normal operations and abnormal situations, and improve its performance. Full form of OHSAS is Occupational Health and Safety Assessment Series.

World-wide OHSAS is adopted for compliance and certification by the organizations. Organizations worldwide felt the urgent requirement to control and improve work place health and safety performance and do so with occupational health and safety management systems (OHSMS). However, in the previous century, there was glut of national standards proprietary certification schemes to choose from. Such flash flood of schemes and standards, created confusion and fragmentation in the market and undermined the credibility of individual schemes because each standard or scheme was claiming to be superior over the other. Recognizing this shortfall, an international collaboration called the Occupational Health and Safety Assessment Series (OHSAS) Group was formed to create a single unified approach. The Group comprised representatives hailing from national standard bodies, academic bodies, accreditation bodies, certification bodies and occupational safety and health institutions.

Drawing from the best of existing schemes and standards, OHSAS 18001 was published in 1999. OHSAS 18001 provided requirements for an Occupational Health and Safety Management System. As of 2005, around 16,000 organizations in more than 80 countries were using the OHSAS 18001. By 2009 more than 54,000 certificates had been issued in 116 countries to Health and Safety Management Standard. This number is growing everyday by leaps and bounds because of increased safety concerns in the organizations.

Occupational Health and Safety Management system promotes a safe and healthy work environment by providing a framework to:

1) Identify and control workplace health and safety risks
2) Reduce the potential for workplace accidents
3) Aid legal compliance of Health and Safety
4) Improve overall performance of Health and Safety Management

The OSHAS 18001 standard provides organizations with the elements of an effective safety management system which can be integrated with other management systems and help organizations achieve better occupational health and safety performance and economic objectives.

OHSAS 18001 specifies requirements for an organization develop and implement a policy and objectives, which take into account legal compliance obligations and information about workplace health and safety risks. It applies to all categories and sizes of organizations and accommodates diverse geographical, cultural and social conditions.

Occupational Health and Safety Management can be aligned with existing ISO 9001 and ISO 14001 management systems. Historically organizations start with the quality management system ISO 9001, and then add the environment

management requirements from ISO 14001. Many organizations now implement all three standards simultaneously which can minimise costs and disruption.

Certification Steps for OHSAS 18001:

1) **Management Support-** This is most critical. Without the support of the management your implementation of OHSAS 18001 will almost certainly fail. Plan your sale pitch well to convince your management that OSHAS 18001 is a good idea.

2) **Establish OHSAS 18001Certification Project, Project Plan and Resources**- The cut off period is determined by which one needs to have OHSAS 18001 certification in place. This would enable reverse engineering of the project and importance of time lines including the early start-off date. The project leader needs to be identified. The products or services to be included in the scope of OHSAS 18001 certification needs to be identified. The costing needs to be done. It includes implementation learning cost and certification fee.

3) **Conduct OHSAS 18001 Awareness Training-** This is required to gain A to Z of the fundamentals of OHSAS 18001. Need to cover all resources in the scope. This training is imparted in batches by specialist and industry expert. Evidence of training records needs to be maintained for demonstration during OHSAS 18001 certification audit.

4) **Identify the OHSAS 18001 Implementation Team**- OHSAS 18001 implementation can no longer be tasked to single person, or group of few persons in the organization. The OHSAS 18001 standard is premised on Risk Based thinking, and risk management must be done at the hands of respective departments and functions, such that head of the departments are the "Risk- Owners". Therefore the implementation team would include Heads of the departments, deputies or other critical resources in each function, besides the central team.

5) **Conduct OHSAS 18001 Implementation Training**- This training is imparted by 'specialist and industry expert' to the implementation team identified by the organization. The OHSAS 18001 Implementation training is conducted in workshop style covering implementation practical cases of an organization and its processes. This lasts up to 7 days.

6) **Define Context, Scope and Policy-** Defining the context, scope and policy of OSHAS 18001 will help to ensure the limits of what needs to be done, so that one does not include areas of business that might not have an effect on one's system. The key tool to define the scope is the dependency matrix which will be the first document that needs to be created for the OHSAS 18001.

7) **Define RA and RT, Objectives, Processes and Procedures-** Risk assessment and risk treatment is the backbone of OHSAS 18001 implementation. OHSAS 18001 objectives help to conduct dipstick check of the performance levels. The documentation will include the mandatory procedures defined by the OHSAS 18001 standard, but also any additional processes and procedures required by a company to ensure consistent and

adequate results with respect to quality. The key is to define all the processes in a company and look at how they interact within an organization. It is in these interactions that problems can occur. Extent of documentation depends on size of organization, complexity of the processes and competence of the people.

8) **Implement OHSAS 18001 Processes and Procedures**- Often these processes will already be in place at a company and will just need to be adequately documented to ensure consistent results. Not all processes need to be documented procedures, but it is important to decide which ones need to be, in order to ensure compliant products and services.

9) **Conduct OHSAS 18001 Internal Auditor Training**- OHSAS 18001 standard requires the organization to train team of internal auditors who would perform cross audit on one another on regular basis. Internal auditors need to be competent. To evidence the same, the organization shall need a specialist Industry expert to impart OSHAS 18001 Internal Auditor training.

10) **Conduct OHSAS 18001 Internal Audits**- Before the lead auditors of certification body visits to audit a system, OSHAS 18001 mandates to audit each process internally. This will give a chance to make sure that the processes are doing as planned. There will also be a chance to implement the necessary corrective actions to fix any problems that one may find.

11) **Closure activities and Corrective Action Reports**- This is the step where one can find the root cause of any problems found during the measurements, internal audits and management review, deviations from the established processes, customer concerns and take action to correct the root cause. This is the key step towards continual improvement, which is a main focus of having an OSHAS 18001.

12) **Conduct OHSAS 18001 Management Reviews**- Just as it is important that management supports the implementation of OHSAS 18001, it is also important that they are fully involved in the maintenance of the OSHAS. Top Management needs to review specific data from the activities of the OSHAS in order to ensure that the processes have adequate resources to be effective and improve.

OSHAS Gap Analysis

This is done by Specialist Industry expert, to help organization in gap analysis, so that gaps identified during pre-assessment/gap analysis are plugged before the organization proceeds for certification audit. This is very important step to raise the confidence level of the auditees.

Choose a certification body

This can be a very important step in determining how effective an implementation is. The certification body is the company that will ultimately come in to audit the OSHAS and decide if it is compliant with OSHAS 18001 requirements, as well as whether it is effective and improving.

Operate and measure the OSHAS

This is when one will collect the records that will be required in audits to show

that the processes meet the requirements set out for them, that, they are effective, and that, improvements are being made in the OSHAS as needed. Certification bodies need this to happen over a certain length of time (generally not less than three months), which they will identify, in order to ensure that the system is mature enough to show compliance.

OHSAS 18001 Certification audit-Stage 1

This is a review of the documentation by the certification body auditors to verify that, on paper, one has addressed all the necessary requirements of the OSHAS 18001 standard. The auditors will issue a report outlining where one complies and where, there are problems, and one will have a chance to implement any corrective actions to address the problems. This may take place during the timeframe defined for the initial operation of the OSHAS.

OHSAS 18001 Certification audit-Stage 2

This is the main audit when the certification body auditors will review the records one has accumulated by operating their OSHAS processes, including the records of internal audits, management review and corrective actions. From this review, which will take several days, they will issue a report detailing their findings and whether they have found your OHSAS to be effective and in compliance with the OHSAS 18001 requirements. The auditors will also make a recommendation for certification if you meet all the requirements. If you have any major non-conformances, then one will need to take corrective action for these problems before certification can be recommended.

Time to plan:

A good plan will help a lot when one implements OHSAS 18001 and work towards certification, so proper time should be taken to plan and know the resources one needs. This will save time and resources later on.

Value Added OHSAS 18001 Certification Training and Consultancy:

Accelerate learning with the expert faculty lead auditors and principal trainers from the Industry.

Learning from the **"specialist expert"** will have many advantages:

1) It will drastically change the way of thinking and basic approach towards the Management System Standard.
2) One would cherish and benchmark the training.
3) No fictitious case studies that one cannot connect with.
4) Real time examples and scenarios that one can quickly relate to.
5) Complete focus on one's system and processes.
6) 100% involvement and engagement of the participants.

Thus **OHSAS 18001** should be adopted and encouraged due to the following advantages:

1) Improve the profits.
2) Reduce rework, defects, customer rejections, wastage, and cost of operation.

3) Enhance customer delight.
4) Reduce attrition of customers and employees
5) Enhance confidence of all stakeholders.

Check Your Progress 1

Note: a) Write your answer in about 50 words.

b) Check your progress with answers given at the end of the unit.

1) What are the Certification Steps for OHSAS 18001?

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3.8 LET US SUM UP

Industrial standards are extremely important for the smooth functioning and carrying out of operations for productivity. This unit discussed the Bureau of Indian standards on safety and health and EPA standards. The unit also explained the certification steps for OHSAS 18001.

3.9 KEY WORDS

OHSAS 18001 is an international standard giving requirements related to Health and Safety Management Systems.

3.10 REFERENCES & SUGGESTED FURTHER READINGS

https://www.bureauveritas.com/services+sheet/ohsas-18001-certification_1143

Indian Standard Code of Practice on Occupational Safety and Health Audit. IS 14489:1998 (Reaffirmed 2002) ICS 13.100 © BIS 1998 Bureau of Indian Standards.

3.11 ANSWERS TO CHECK YOUR PROGRESS

Answers to Check Your Progress 1

Your answer should include the following points:

- Management Support
- Establish OHSAS 18001Certification Project, Project Plan and Resources
- Conduct OHSAS 18001 Awareness Training

- Identify the OHSAS 18001 Implementation Team
- Conduct OHSAS 18001 Implementation Training
- Define Context, Scope and Policy
- Define RA and RT, Objectives, Processes and Procedures
- Implement OHSAS 18001 Processes and Procedures
- Conduct OHSAS 18001 Internal Auditor Training
- Conduct OHSAS 18001 Internal Audits
- Closure activities and Corrective Action Reports
- Conduct OHSAS 18001 Management Reviews