CHAPTER 2
RESEARCH METHODOLOGY

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2.1 Introduction

This chapter is designed for the exploration of ideas from which research has been originated. This chapter reveals the theoretical underpinning of whole research process. The research method in this chapter is designed to explore level of health and safety management practices in India’s public service. It is aimed at:

- To assess whether the IOC has more effective employee health and safety initiatives than the ONGC.
- To assess whether the ONGC has more occupational health and safety hazards than the IOC.
- To understand whether employees in both the companies have positive attitudes toward employee health and safety practices than their management.
- To understand whether age, gender and levels of education of employees have any significant effect on employee health and safety attitudes.
- To know the level of dedication regarding health and safety management of both the companies.

2.2 The research methodology framework

Research methodology framework is whole warp weft of the research by which researcher starts his research and fulfill the requirements of objective of research. Very first step of research methodology framework is problem genesis. Problem genesis of this research is developed by the valuation financial losses due to accidents and hazards from last few years of giant accidents. These accidents coerced to management practitioners to re-think about the effectiveness of traditional management system.
A Framework for Research Methodology*

* Adapted from Buckley, Buckley & Chiang Exhibit 1, p. 15.
The research method in this chapter is designed to explore health and safety management practices for in sampled companies. It is aimed at:

- What is the attitude of workers towards health and safety management in their employer company?
- Is there any role of education, experience and age towards knowledge and awareness regarding health and safety management?

The chapter focuses the main hypothetical positions that establish the designs of this study. It requires describing the hypothetical basis that drives the methodology directed towards achieving the aim and objectives of the research.

Many arguments, criticism and debates are important in the progress of philosophy and therefore it is important to understand both sides of an argument because research problems require eclectic design, which draws from more than one tradition (Adelopo, 2010). In answering the main questions of this study, the research methodology framework, as depicted in the ‘Research Onion’ (Figure 4.1) is used.
Above research onion is clearly explaining the concept of research methodology. As figure 2.1 depicts that first layer in every research is philosophy execution. Philosophy is the basic idea of any research that should have been developed at early stage of research. After the philosophy execution, researcher has to decide the main research approach whether it is deductive or inductive. After the determination of research approach, researcher has to decide his type of research, whether research will classified in case study, experiment or survey.

Subsequent stage of type of research is method of research. After that researcher should decide the scope of the study, if it is comparative study then it should be classified in to cross sectional otherwise longitudinal.
Last stage in research is data collection and analysis from which production of result is started.

Main research methodology frame work may be defined as the process start from the research question and ends with the application of research technique and process. Research methodology frame work of this research can be better explained by following figure:

As above figure explains that very first step is setting up of research objectives. A research objective is a clear, concise, declarative statement, which provides direction to investigate the variables. Generally research objective focus on the ways to measure the variables, such as to identify or describe them. Sometime objectives are directed towards identifying the relationship or difference between two variables. Research objective are the results sought by the researcher at the end of the research process, i.e. what the researcher will be able to achieve at the end of the research study. The objectives of a research project summarize what is to be achieved by the study. Objective should be closely related to the statement of the problem.

Research question is the methodological point of departure of scholarly research in both the natural and social sciences. The research will answer the question posed. The research question must be accurately and clearly defined. Choosing a research question is the central element of both
quantitative and qualitative research and in some cases it may precede construction of the conceptual framework of study. In all cases, it makes the theoretical assumptions in the framework more explicit, most of all it indicates what the researcher wants to know most and first. The research question serves two purposes:

- It determines where and what kind of research the writer will be looking for and
- It identifies the specific objectives the study or paper will address.

1. The hypothesis is directly related to a theory but contains operationally defined variables and is in testable form. Hypotheses allow us to determine, through research, if our theory is correct. In other words, does prior work experience result in better grades? *(Dr. Christopher L. Heffner, 2013).* Characteristics of a good hypothesis are:
   1. It is written in the form of a concise statement.
   2. It reflects a position being taken by the writer.
   3. It is arguable, and a contrary position can be taken.
   4. It requires research to determine whether or not it is true.
   5. It is a significant matter to social scientists.
   6. It is a complex notion, dealing with a number of variables.
   7. It is not written in the first person.
   8. It can be tested.

*(Transitions in Society, Pg. 65-66)*

Research methods are tools by which a researcher fulfills the object of his research. Research methods are based on hypothesis of the study.
2.3 Sampling

In this research mostly two types of sampling have been used namely; Stratified Sampling and Deliberate/Purposive sampling. Technically it can be said that both type of sampling i.e. probability sampling and non-probability sampling have been used in this research.

Total 27 oil and gas refinery companies selected as universe of the study. These companies are further classified in two strata as (1) Public Companies and (2) Private Companies.

Private companies are left as the study was based on the public companies. After that only two companies purposively selected for the research. On subsequent stage, for satisfaction of research questions, total 92 workers and managers have been selected from each sampled company. These 92 respondents are used for the data collection.

2.4 Data Source

There are mainly two type of data source on the basis of collection sources thereof; primary and secondary. Our research is exploratory research which explored the various elements and components of health and safety management in the context of sampled countries. In this research, primary data is mainly used for the data source. However secondary data has also been used to present the financial losses due to health hazards and accidents in Indian economy.

2.5 Data collection Instruments

Structured questionnaires have been used in the study for the data collection. A new technique of questionnaire named as “Google Forms”
used by researcher for data collection. It is an online mailed form of questionnaire which is often used in survey research.

2.6 Scales of Measurements

Mainly there are four types of measurement of scales. The nominal scale of measurement only satisfies the identity property of measurement. Values assigned to variables represent a descriptive category, but have no inherent numerical value with respect to magnitude.

The ordinal scale has the property of both identity and magnitude. Each value on the ordinal scale has a unique meaning, and it has an ordered relationship to every other value on the scale.

The interval scale of measurement has the properties of identity, magnitude, and equal intervals.

The ratio scale of measurement satisfies all four of the properties of measurement: identity, magnitude, equal intervals, and a minimum value of zero.

Ratio as well as nominal scale have used in this study. Most of the responses are recorded in five levels Likert scales. Only nominal questions like “Are you aware from health and safety management?” have been recorded in nominal scales, rest of the questions have been recorded in ratio scale.
2.7 Hypotheses

Keeping into consideration the objectives and research question of the study, the following null and alternate hypotheses were framed and tested:

$H_01$: The Indian Oil Corporation has not more effective employee health and safety initiatives than the ONGC.

$H_1$: The Indian Oil Corporation has more effective employee health and safety initiatives than the ONGC.

$H_02$: Age, experience and levels of education of employees have no significant effect on employee health and safety attitudes.

$H_2$: Age, gender and levels of education of employees have significant effect on employee health and safety attitudes.

2.8 Data analysis

Data analysis has been made through various test and measurement which have proved best fit for particular hypothesis. Following table showing the data analysis test for particular hypothesis:
<table>
<thead>
<tr>
<th>Objective</th>
<th>Research Questions</th>
<th>Hypotheses</th>
<th>Research Methods</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. To investigate the mechanisms of Health and Safety management in sampled companies</td>
<td>1. Whether the IOC has more effective employee health and safety initiatives than the ONGC.</td>
<td>The Indian Oil Corporation has not more effective employee health and safety initiatives than the ONGC.</td>
<td>Students’ t-test</td>
<td>Used to compare the difference in the means between the actual usage of mechanisms of health and safety management.</td>
</tr>
<tr>
<td>2. To identify that is there any relation between demographical attributes of workers and their attitude towards health and safety management.</td>
<td>2. Is there any role of education, experience and age towards knowledge and awareness regarding health and safety management?</td>
<td>Age, gender and levels of education of employees have no significant effect on employee health and safety attitudes.</td>
<td>F test</td>
<td>The F-test is used to find out the overall probability of the relationship between the dependent variable and all the independent variables occurring by chance.</td>
</tr>
</tbody>
</table>

### 2.8.1 t-test

't-test' is a statistical examination of two population means. A two-sample t-test examines whether two samples are different and is commonly used when the variances of two normal distributions are unknown and when an experiment uses a small sample size. The test statistic in the t-test is known as the t-statistic. The t-test looks at the t-statistic, t-distribution
and degrees of freedom to determine a p value (probability) that can be used to determine whether the population means differ. The t-test is one of a number of hypothesis tests.

2.8.2 F test

An F-test is any statistical test in which the test statistic has an F-distribution under the null hypothesis. It is most often used when comparing statistical models that have been fitted to a data set, in order to identify the model that best fits the population from which the data were sampled. If the null hypothesis is true, then the F test-statistic given above can be simplified (dramatically). This ratio of sample variances will be test statistic used. If the null hypothesis is false, then we will reject the null hypothesis that the ratio was equal to 1 and our assumption that they were equal.

2.9 Research approaches: Quantitative Vs. Qualitative

There are two main approaches in conducting a research. These are the deductive and inductive approaches. Researches that follow the positivist strand are generally classified as deductive. Such researches, which are ideal scientific investigations, follow a series of logical, orderly steps to formulate and test hypotheses (Adelope, 2010). This series of logical steps is known as deductive reasoning. This might be thought of as “top-down” reasoning – proceeding from the general knowledge to the specific knowledge. Starting with a general principle, a testable prediction is derived about a specific case. On the other hand, the inductive approach (“bottom-up reasoning), which supports the interpretivism philosophy, studies specific examples and try to discover patterns and derived general explanations from collected observations (Saunders, Lewis and Thornhill,
These two approaches are adopted in this study, as the researcher intends to use the strength of one to complement the weakness of the other with the aim of providing acceptable explanation to the phenomenon under study, which is the application of forensic accounting in fraud prevention and detection in India. Crowther and Lancaster (2009) opined that to achieve effectiveness in management research may require the combination of inductive and deductive methods. However, the deductive methods are given higher preference.

2.10 What is review of literature?

Almost every research study begins with a review of the literature. The purpose of the literature review section of a research is to provide the reader with an overall framework for where this piece of work fits in the “big picture” of what is known about a topic from previous research. Thus, the literature review serves to explain the topic of the research and to build a rationale for the problem that is studied and the need for additional research. Boote and Beile (2005) eloquently explain the purpose of a literature review in planning primary research:

As the foundation of any research project, the literature review should accomplish several important objectives. It sets the broad context of the study, clearly demarcates what is and what is not within the scope of the investigation, and justifies those decisions. It also situates an existing literature in a broader scholarly and historical context. It should not only report the claims made in the existing literature but also examine critically the research methods used to better understand whether the claims are warranted. Such an examination of the literature enables the author to distinguish what has been learned and accomplished in the area
of study and what still needs to be learned and accomplished. Moreover, this type of review allows the author not only to summarize the existing literature but also to synthesize it in a way that permits a new perspective. Thus a good literature review is the basis of both theoretical and methodological sophistication, thereby improving the quality and usefulness of subsequent research.

Shields and Rangarajan (2013) distinguish between the process of reviewing the literature and a finished work or product known as a literature review. According to an informant website the process of reviewing the literature is often ongoing and informs many aspects of the empirical research project. All of the latest literature should inform a research project. Scholars need to be scanning the literature long after a formal literature review product appears to be completed.

2.11 Literature review of various concepts

2.11.1. A: Accident

An accident means a sudden, unpredictable incident caused by an external factor and leading to an injury or illness.

- *Unpredictable* means that the incident is beyond the control of the employee, i.e. unexpected and unlooked for from the perspective of the concerned person. If an employee deliberately injures herself, it is not an accident.
- *Sudden* means that the incident is rapid and immediate (such as a trip, a fall or a crash).
- *An external factor* means a factor independent of the injured person that causes the accident, such as a slippery street, a pothole,
an object falling on top of a person or a sharp object grabbed accidentally.

In another words an accident at work is defined as a discrete occurrence in the course of work which leads to physical or mental harm. This includes cases of acute poisoning and willful acts of other persons, as well as accidents occurring during work but off the company’s premises, even those caused by third parties. It excludes deliberate self-inflicted injuries, accidents on the way to and from work and accidents having only a medical origin and occupational diseases. The phrase "in the course of work" means whilst engaged in an occupational activity or during the time spent at work. This includes cases of road traffic accidents in the course of work.

The Royal Society for the Prevention of Accidents of the United Kingdom defines an accident as any unforeseen, adverse event causing harm or having the potential to cause harm.

According to the Factories Act, 1948 “It is an occurrence in an industrial establishment causing bodily injury to a person who makes him unfit to resume his duties in the next 48 hours”.

An accident at work takes place at work or in circumstances arising from work. The reasons of accident may be:

Only accidents that occur at work– such type of accidents are occurred when one is working – or in circumstances arising from work are accidents at work. Circumstances arising from work mean various situations that do not belong to the actual job. This means that an accident is only compensated if it takes place at work, in an area belonging to the
place of work, on the way to or from work or when the employee has been sent by the employer to perform a certain task.

**Assault**

Similarly, an injury or illness due to an assault or other deliberate action by another person at work or in circumstances arising from work is also compensated as an accident. An accident at work that has occurred at war or armed conflict shall also be compensated.

**Certain injuries and illnesses comparable to work-related injuries**

In addition to the actual accident, injuries and illnesses that have occurred within a short period of time not exceeding 24 hours and are not compensated as occupational diseases are compensated as accidents at work. These include:

- sores or abrasions,
- injuries caused by corrosive substances,
- injuries caused by breathing gases dangerous to health,
- injuries caused by significant variations in air pressure,
- frostbites, sunstrokes or other similar injuries caused by abnormal temperature,
- inflammations of elbow or patella caused by continuous or repeated pressure or compression exceptional to an employee, and
- sore muscles or sinews caused by a working movement and not due to other defect, injury or illness.

**2.11.2 B: Occupational Health**

Mining is the industry with the highest fatal and nonfatal injury rates. Underground work locations exhibited both the highest numbers and rates
of fatalities. The oil and gas industry face many criticism when it comes to health and safety of its employees. This is due to the various activities within the industry that include chemical processes (Cottle and Guidotti, 1990).

The literature on workplace safety and health administration reveals that much of the subject has been covered in different parts of the world. The ground thus covered tends to focus predominately on disease prevention, psychological factors at the workplace, safety concerns at the workplace, workplace policies, workplace spirituality, epileptic medication at the workplace, safety climate at the workplace, safety management, exposures to chemicals and perceptions of risks. A management system is a proactive with an organized set of components which enable an organisation to accomplish a set of goals. Management system usually focuses on continuous improvement using the plan-do-check-act model. Goal could be anything from facilitating the flow of information to improving quality to minimizing losses from accidents and injuries (Pascal, 1997). There are many types of management systems; environmental (Saad, 2003 International organisation for standardization); hazardous waste (Massoomi, Neff, Pick & Danekas, 2008), infectious disease (Tomiczek, Stumpo & Downey, 2006) and many more. When implementing a management system, it is important to note how multiple management systems will work together.

An occupational health and safety management is comprised of four interrelated components. These include management leadership, employee’s involvement, worksite analysis, hazard prevention and health and safety training (OSHA, 2008).
A safe work environment strengthens and supports individual safety behaviors and this further affects behavior due to the influence workers have on one another. Furthermore, safety climate is correlated with employee’s compliance to safe work practices as well as workplace exposure incidents (Gershon 2000). Management is the motivational force and the source of necessary resources of employees. The OHSMS should have a health and safety policy, goals and objectives to demonstrate management’s involvement and lastly management should lead by example (Henk, 2010).

The health hazards evaluation (HHE) program is used by the national institute for Occupational safety and health (NIOSH), however NIOSH only evaluates each hazards and not management system as a whole (National institute of occupational safety and health). The British standard institute (BSI), specifically the Occupational health and safety advisory services (OHSAS) in 1999 wrote an international occupational health and safety management system specification entitled OHSAS 18000 (Occupational health and safety advisory services, 2007). The BSI 18800 is the guide to the OHSMS which was written in 1996 and updated in 2004. The Canadian centre for occupational health and safety (CCOHS) published the first Canadian consensus based workplace standard in 2006 entitled, occupational health and safety management (CSA Z1000). As with the OHSAS 18000, this standard was created to be compatible with ISO system such as ISO 9000 (Quality management) and ISO 14000 (Environmental management standard) (Canadian centre for occupational health and safety, 2006). Similarly, the International labour organisation (ILO) created the OSH 2001 which provides guidelines on OHSMS standard (International labour organisation). Australia and New Zealand have several OHSMS

As of 2007, 30% of businesses have established health and safety system (OSHA, 2007). Proctor and Gamble implemented an OSHMS that was designed to emphasize continuous improvement in healthy and safety. No standard was followed, but the elements used were not uncommon: organisational planning and support, standards and practices, training and accountability and performance feedback (Fulwiler, 1993).

Occupational health is defined as the prevention of illness and the promotion of health at workplace (ABOHN, 2003). Among its activities occupational health includes the detection of work and workplace hazards, evaluation of regulatory compliance and counseling crisis intervention (ABOHN, 2003). Practitioners of occupational health have among its functions the following: (1) Health supervision of employees, (2) Pre placement of health assessment, (3) Routine health assessment, (4) health education, (5) Environment surveillance, (6) Employee counseling, treatment and rehabilitation and, (7) Record keeping of employee health data. It is also expected that occupational health professionals are able to identify hazards at the workplace, such as exposure to infections, chemicals, allergens, irritants and hazardous waste (Dixon, 1984).

2.11.3 C: Industrial safety

The oil and gas industry faces many criticisms when it comes to health and safety of its employees. This is due to the numerous activities within
the industry that include chemical use for various processes (Cottle and Guidotti, 1990). These include: drilling, cementing, completion, stimulation, and production (Cottle and Guidotti, 1990). The occupational hazards of exposure to these agents have received little attention, as well as the types of health and safety strategies that firms implement.

There are various health and safety issues in the oil and gas sector. The Health and Safety Executive even fail to specify every safety and health concerns because of the diversity of the industry. In the HSE website, there are guidance on minor issues such as personnel transfer basket, interaction between utility systems connection, and many others (HSE, 2006); and major issues such as moving helidecks, examination of passenger lifts, examination of offshore cranes etc.

Industrial safety is defined as the prevention of accidents, incidents and injuries that harm people, property and the environment in the workplace (La Dou, 12; CSP, 2002).

According to the board of certified safety professionals, a safety professional is able to anticipate, identify and evaluate hazards, their likelihood of their occurrence, the expected severity of results, the associated risks, and the derived cost for the company (CSP, 2002).

Therefore, they shall design, develop, and implement correspondent hazards controls as part of their work (CSP, 2002).

2.11.4 D: Occupational Health and Safety Management

Occupational Health and Safety Management Systems (OHSMS) have been defined by Gallagher as “...a combination of the planning and review, the management organizational arrangements, the consultative arrangements, and the specific program elements that work together in
an integrated way to improve health and safety performance” (Gallagher, 2000:1). They differ from older methods in several ways. First, like the Robens reforms, they make those in the workplace more responsible for occupational health and safety (OHS). But, unlike the Robens reforms, this responsibility is discharged through an integrated management system rather than ad hoc structures and prescriptions.

The discussion of the definition of OHSMS falls into eight parts. It begins by listing general characteristics of all OHSMS. Second, it distinguishes voluntary and mandatory methods of implementation. Third and related, is a distinction between OHSMS “systems” and “systematic” OHSMS. Expanding on the former, the fourth part compares managerialist and participative types of OHSMS. Fifth, a more comprehensive framework for categorising organisational forms of OHSMS is introduced. It is based on Gallagher’s (2000) cross typology using control strategy and management structure/style as variables. Sixth, OHSMS are scaled according to the degree of implementation on an ascending hierarchy of quality levels. Seventh, a further developmental framework is introduced based on the implementation of continuous improvement projects. Eighth and finally, the Section closes by summarising the dimensions on which OHSMS vary, and pointing out implications for evaluation and measurement.

The growing use of OHSMS shows both a choice of one kind of OHS intervention in preference to others and a significant investment of financial and human resources by both government and business.

Work-related accidents cause a loss to the company as well as the employees. Accordingly, the Accident Prevention Advisory Unit (APAU) of the Health and Safety Executive (HSE) in the United Kingdom (UK), which passed the world's first Occupational Health and Safety Act, surveyed the costs of work-related accidents in 1989. The ratio of the
direct cost to the indirect cost of the work-related accidents is 1:11. The indirect costs are product and material damage, loss of production time, legal costs, overtime and temporary labor, investigation time, supervisor's time, fines, loss of expertise and experience, loss of morale, and bad publicity. *(1)*

According to **UNW agreement section** 40 the employer shall continue to make all reasonable provisions for the occupational safety and health of employees. Such reasonable provisions shall include the provision of personal protection devices, such as alarms or other items which could enhance the safety of employees who are routinely required to work in potentially dangerous situations, where immediate help is not always available. The Employer will entertain suggestions on the subject from the Union and the Employer and the Union undertake to consult with a view to adopting and expeditiously carrying out reasonable procedures and techniques designed or intended to prevent or reduce the risk of employment injury.

According to clause (a) of sub section of this section the Employer and the Union agree to establish Joint Health and Safety Committees. There shall be a Union co-chair and an Employer co-chair. A Committee shall be established for each work place where the Employer and the Union agree such a Committee is appropriate.

Each Committee shall consist of at least two persons, one of whom is an employee or, where the Committee consists of more than two persons, at least half of whom are employees who:

- Do not exercise managerial functions; and
- Have been selected by the union
A safety and health committee:

a) shall receive, consider and expeditiously dispose of complaints relating to the safety and health of the employees represented by the Committee;

b) shall maintain records pertaining to the disposition of complaints relating to the safety and health of the employees represented by the Committee;

c) shall co-operate with any occupational health service established to serve the workplace;

d) may establish and promote safety and health programs for the education of the employees represented by the Committee;

e) shall participate in all inquiries and investigations pertaining to occupational safety and health including such consultations as may be necessary with persons who are professionally or technically qualified to advise the Committee on such matters;

f) may develop, establish and maintain programs, measures and procedures for the protection or improvement of the safety and health of employees;


g) shall monitor on a regular basis programs, measures and procedures related to the safety and health of employees;

h) shall ensure that adequate records are kept on work accidents, injuries and health hazards and shall monitor data relating to such accidents, injuries and hazards on a regular basis;

i) shall co-operate with safety officers appointed pursuant to the Safety Act;
j) may request from an Employer such information as the Committee considers necessary to identify existing or potential hazards with respect to materials, processes or equipment in the work place; and

k) shall have full access to all Government and Employer reports relating to the safety and health of the employees represented by the Committee but shall not have access to the medical records of any person except with the consent of that person.

l) shall in workplaces where employees are required to work alone, develop, establish, and maintain procedures with respect to employees working alone which may include: performing risk assessments on individual worksites; and identifying and outlining reasonable precautions to eliminate or reduce identified risks.

Under this act employees have the right to refuse to work in situations, which can reasonably be considered dangerous:

a) An employee may refuse to do any particular act or series of acts at work which he/she has reasonable grounds to believe are dangerous to his/her health or safety or the health and safety of any other employee at the place of employment until sufficient steps have been taken to satisfy him/her otherwise or until the Chief Safety Officer or his/her representative has investigated the matter and advised him/her otherwise.

b) The Employer shall not assign another employee to do the work assignment until a Union member and an Employer member of the Safety and Health Committee have investigated the situation and deemed it to be safe.
Employees need moral support also in such situations. Slepica has given some suggestions for helping employees to cope with these ordeals:

1. **Put their sense of safety first**
   Ensure that employees are removed from danger or further exposure to distressing circumstances. Reassure them and keep as calm as possible. It is important to react immediately after the incident and ensure that all members of staff receive support as soon as possible.

2. **Acknowledge the seriousness of what has occurred**
   Make sure they understand their distress is normal and to be expected, given the circumstances. Help to put them at ease. Clarify worker’s questions and any concerns they may have, and encourage workers to talk about what has happened.

3. **Understand what support they might need to help them recover**
   Ask them what is going to assist them, for example contacting a family member or friend or seeing a counselor. Assist them in getting this support. Often speaking to someone who is completely objective and understands what you are going through without judgment can be very helpful.

4. **Promote a return to normal routine**
   Emphasise those things which are reliable and stable in their life and where possible, encourage them to maintain usual routines. A sense of safety and security is re-established simultaneously with the sense of routine and normality that is possible under the circumstances.
5. Monitor and follow-up

Reactions can vary between individuals, so be aware of changes in people’s work performance or attendance at work over time. It is possible for responses to develop over time and follow-up support may be required for some workers or groups. It is also critical for managers to look after themselves while supporting others, as they may have also been affected by what has happened. The important thing for managers to understand is that these are normal reactions to an abnormal event.

2.12 Awareness and literacy

With the above legal and moral requirement literacy of employees is essential factor. According to Alison Howard, a research associate at the Conference Board of Canada, it is important for employers to bypass assumptions and recognize that literacy problems may exist, “Literacy skills are the foundation for participating in more advanced training, including health and safety training,” she says.

There may be various kind of literacy. These are:

**Prose literacy:**
A person the knowledge and skills needed to understand and use information from written material, including editorials, news stories, brochures and instruction manuals.

**Document literacy:**
A person has the skills needed to understand information presented in various formats, such as charts, graphs, forms and maps.
Quantitative literacy (numeracy):
A person has the ability to apply mathematical skills to printed materials. Traditionally, literacy has been defined as the ability to read and write. Recent definitions of literacy encompass a more inclusive set of “essential skills”:
  • Reading
  • Writing
  • Document use
  • Numeracy
  • Computer use
  • Thinking
  • Oral communication
  • Working with others
  • Continuous learning

2.13 Provisions of Factories Act, 1948
The factory act 1948 provides the various provisions regarding health and safety of workers. These provisions are:

Health (Sections: 11 TO 20) includes:

Cleanliness (Section 11): Housekeeping is the modern term used for keeping the factory premises clean and tidy. Factories must not only be kept clean but must be maintained with cleanliness in such a way that accumulation of dirt and refuse must be avoided. Constant cleaning of effluvia (disagreeable vapors) arising from any drain is needed. Removal of dirt and refuse alone is not enough, but they have to be disposed of in a suitable manner without, causing detriment to the residents of the locality.
Disposal of wastes and effluents (Section 12): Wastes and effluents are to be disposed off in order to maintain the hygiene inside the factory. However, such wastes cannot be let out without treatment. This is because wastes would pollute the surroundings. Norms laid down by the State Pollution Control Board have to be observed strictly in this regard.

Ventilation and Temperature (Section 13): Ventilation and air circulation ensure normal health to the workmen. In order to maintain ventilation and fresh air circulation, temperature in the working place should be secured. For this purpose, the interior walls and roofs of the factory must be properly designed and provided with heat resisting or heatproof materials by way of insulation. Reasonable care should be taken for color washing interior walls with psychologically pleasing colors such as light green, etc.

Dust and Fumes (Section 14): Effective measures have to be adopted in order to prevent the workers inhaling dusts, fumes and other impurities that are present (which cannot be seen through naked eye) in the air. Control devices or tools have to be used for the purpose of preventing dust and fumes. Use of exhaust fans is highly recommended in such places. No stationary internal combustion engine is allowed to be operated unless proper arrangements are made to prevent accumulation of injurious fume are caused thereon. [Gregeon vs. Hick Hargreavaes (1955) All E.R.860].

Artificial Humidification (Section 15): In factories where artificial humidification is adopted from the point of view of manufacturing a product(e.g., in a textile mill), the norms prescribed by the Government must be strictly followed for increasing or decreasing or maintaining such artificial humidification, Humidifiers for keeping air moisture at even
level shall be provided. Water used in these plants must constantly be changed and it must be pure. Otherwise it will give room for water borne diseases among workers.

**Overcrowding (Section 16):** Every worker requires at least 350 cubic feet (now after the commencement of the Act, 500 cubic feet) for the purpose of enabling him to work with ease and comfort ensuring mobility. However, while calculating the aggregate space, no account shall be taken of any space, which is more than 14 feet above the level of the floor. The Chief Inspector of Factories, by notice may specify the number of persons to be employed in a room.

**Latrines and Urinals (Section 19):** For a human being, two places are very important and both of them have to be kept clean and tidy. They are–

(i) Latrines and urinals;
(ii) Places where people rest and relax. Factories where more than 250 workers are ordinarily employed, the latrine and urinal accommodation shall be of the prescribed sanitary type. The floors and internal walls up to a height of 3 feet and above from the floor level should be laid in glazed tiles. If tiles are not provided for, the latrines cannot be kept clean, as the bad water would pass through the pores of latrine walls. Sweepers shall be employed whose primary duty is to keep the latrines and urinals clean and washing places tidy.

**Spittoons (Section 20):** Spittoons are nothing but pots that are specially provided for, into which, the workers have to spit. Workers cannot spit, as they like, as that would spoil the cleanliness and hygiene of the factory. Sufficient number of spittoons should be
provided, taking into account the number of persons employed. A fine of Rs.5 would be imposed on any one who violated the rule.

Safety (Sections 21 to 40): Safety is prior to security. According to this concept, the present Factories Act ensures several safety measures as sound in Sections 21 to 40, which are enumerated below:

Fencing of Machinery (Section 21): In every factory the following namely,

- Every moving part of a prime mover, and every fly-wheel connected to a prime mover, whether the prime mover or fly-wheelies in the engine house or not;

- The headrace and tailrace of every water wheel and water-turbine;

- Any part of a stock-bar, which projects beyond the headstock of a lathe;

- Every part of an electric generator, a motor or rotary converter;

- Every part of transmission machinery; and

- Every dangerous part of any other machinery

They have to be dealt in proper position when the parts of machinery are in motion (Section 21). The manager of the factory should take particular care to provide safeguard devices to deal the machine intact, so that it cannot come into contact with workers and thereby cause injury.

2.14 The Workplace (Health, Safety and Welfare) Regulations 1992

The Workplace (Health, Safety and Welfare) Regulations 1992 cover a wide range of basic health, safety and welfare issues and apply to most workplaces (with the exception of those workplaces involving
construction work on construction sites, those in or on a ship, or those below ground at a mine). They are amended by the Quarries Regulations 1999, the Health and Safety (Miscellaneous Amendments) Regulations 2002, the Work at Height Regulations 2005, and the Construction (Design and Management) regulations 2007.

This leaflet gives a brief outline of the requirements of the Workplace Regulations.

**Health**

The measures outlined in this section contribute to the general working environment of people in the workplace.

**Ventilation**

Workplaces need to be adequately ventilated. Fresh, clean air should be drawn from a source outside the workplace, uncontaminated by discharges from flues, chimneys or other process outlets, and be circulated through the work rooms. Ventilation should also remove and dilute warm, humid air and provide air movement which gives a sense of freshness without causing a draught. If the workplace contains process or heating equipment or other sources of dust, fumes or vapors, more fresh air will be needed to provide adequate ventilation.

Windows or other openings may provide sufficient ventilation but, where necessary, mechanical ventilation systems should be provided and regularly maintained.

**Temperatures in indoor workplaces**

Environmental factors (such as humidity and sources of heat in the workplace) combine with personal factors (such as the clothing a worker
is wearing and how physically demanding their work is) to influence what is called someone’s ‘thermal comfort’.

Individual personal preference makes it difficult to specify a thermal environment which satisfies everyone. For workplaces where the activity is mainly sedentary, for example offices, the temperature should normally be at least 16 °C. If work involves physical effort it should be at least 13 °C (unless other laws require lower temperatures).

**Work in hot or cold environments**

The risk to the health of workers increases as conditions move further away from those generally accepted as comfortable. Risk of heat stress arises, for example, from working in high air temperatures, exposure to high thermal radiation or high levels of humidity, such as those found in foundries, glass works and laundries.

Cold stress may arise, for example, from working in cold stores, food preparation areas and in the open air during winter.

Assessment of the risk to workers’ health from working in either a hot or cold environment needs to consider both personal and environmental factors. Personal factors include body activity, the amount and type of clothing, and duration of exposure. Environmental factors include ambient temperature and radiant heat; and if the work is outside, sunlight, wind velocity and the presence of rain or snow.

**2.15 Basic principles to reduce the accidents**

There are some basic principles to prevent the accidents and control the occupational health hazards. These measures are at three different points. These are:
1. Source:
   - During planning and designing of plant, newer technology should be adopted.
   - Substitution of hazardous material into non-hazardous material
   - Change of process
   - Enclosure of process
   - Wet methods to prevent dusty environment
   - Local exhaust ventilation
   - Adequate preventive maintenance programme

2. Air path
   - Good house keeping
   - General exhaust ventilation
   - Dilution of ventilation
   - Continues area monitoring
   - Adequate maintenance programme

3. Receiver
   - Training and education
   - Rotation of workers
   - Enclosure of workers
   - Personal monitoring devices
   - Medical checkups for early detection
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