Figure1.1. Research Framework

CHAPTER 2
LITERATURE STUDY

2.1. Accident

2.1.1. Accident

An "accident" may be defined as something that is unplanned, uncontrolled, and in some way undesirable; it disrupts the normal functions of a person or persons and causes injury or near-injury. During an accident a person's body comes into contact with or is exposed to some object. Other person, or substance, which is injurious**;** or the movement of a person causes injury or creates the probability of injury (Anton, 1989).

Farmer and Chambers (1926) asserted that, 'from a psychological point of view an accident is merely a failure to act correctly in given situation'.

Some professional groups have different interesting part in describing accident, psychologist are interested in human error and behavior, while engineers are interested in technological malfunctioning and accident pattern. However, those professional groups have the same purpose for analyzing accident even in different parts. The main purpose is prevention or reduction action for next accident.

2.1.2. The structure of an accident

There are **four distinct parts** in the structure of an accident. Namely as written below:

1. **Contributing cause condition of worker**
    a. Supervisory safety performance rules
    b. Mental condition of worker
    c. Physical condition of worker

2. Immediate cause including Unsafe act and unsafe condition

a. Unsafe act

An unsafe act is any act on the part of a person which will increase his or her chances of having an accident (Anton, 1989).

In other definition, **unsafe act** is an element of unsatisfactory behavior immediately prior to an accident event which is significant in initiating the event,a hazard i.e. risk taking, short cuts, carelessness, lack of attention, horseplay etc(John Gilbertson, 2006).

According to Reason (1997),unsafe acts or failure to act is mistakes, slips, lapses and violations are active failures, and they are the immediate cause(s) of the accident. Human errors can be immediate causes either singly or in combination: a violation paired with a mistake is a common immediate cause. It should be noted that some immediate causes may be technical; not all are human failure. However, improvements in engineering reliability mean that simple technical failures are rarely found in the primary cause of accidents. Conversely, the proportion of accident because of human failure has correspondingly increased (Tyler, 2007).

Unsafe act is part of human error that should be handled for reducing and preventing accident by design some systems that help workers to understand more or obtain deeper information about safety. It has been consistently found that unsafe acts occur because workers were not properly trained or motivated by their supervisors. Some workers have not learned that certain actions in some situations will increase their chances of accidental injury or some workers know about safety equipment and procedures but they do not following the instruction (Anton, 1989).

b. Unsafe condition

An unsafe condition is a condition within the working environment which increases the worker's chance of having an accident. However, among the greatest contributors of unsafe condition at the workplace are the actions of the employees themselves (Anton, 1989).

In other definition, **an unsafe condition is** an unsatisfactory physical condition existing in the workplace environment immediately prior to an accident event which is significant in initiating the event. A hazard e.g. slippery floor,

broken glass, unguarded machine, trailing cable, low lighting levels etc (John Gilbertson, 2006).

Attention from safety-minded management team is needed for eliminating and reducing unsafe condition and also controlling contributed factors that cause of accident in workplace.

3. Accidents that usually occurs :

Sometimes accident occurs in different ways between industries, i.e. accident that usually occurs in manufacturing industry is different with accident that usually occurs in electrical industry. Types of accidents in manufacturing industry are: Collision, Crashed, reaction or result improper actions, cuts or abrasions, caught or compressed by equipment. Types of accident in construction industry are: falls from elevation, struck-by construction equipment, vehicle or objects, excavation and trenching. However some accident usually occurs in both industries: electrical accident, struck-by, falling to same level, and others (http://EzineArticles.com/?expert=Kirk_Bernard).

Some accident above cause the victim injured or died. Mostly it happens in industry that does not have good safety standard in the workplace during the working time.

4. **The results of the accident** (Anton, 1989):
   a. Annoyance
   b. Production delays
   c. Spoilage
   d. Minor injury
   e. Disabling injury
   f. Fatality/died

Result of the accident not only about human lives, but also human life, because when the accident occurs during the working hours and make production delays, company will lose some money and pay some money as compensation for their injured or died worker.

2.1.3. Cause of Accidents

Many factors have contribution in cause of accident either environment or human behavior and combination of environment and human behavior.

Environment factors, based on weather categories: hard rain, sweltering, gale and snow are the factors that have contribution in cause of accident. While environment factors based on workplace categories (Anton, 1989): poorly maintained equipment, unguarded moving machine parts, poor design of machine or job process, defective floors and aisles and toxic fumes are contributors to accidental injuries at the workplace.

2.1.4. Contributing Cause of Accident

The contributing causes of accidents are those acts or condition which led you to the cause of an accident. However it not the determining cause of the accident (Anton, 1989).

Some typical examples of contributing cause of accidents are:

1. Inadequate codes or standards
2. Failure by management to enforce safety rules
3. Faulty design or lack of maintenance (Anton, 1989).
4. Mechanical failure of construction machinery/equipment.
5. Physical and emotional stress (Lubega et al., 2000).

Table 2.1 below is explaining about type of industry and person died during 2007-2009 (Jan-Sept) in Taiwan.

Table2.1. Fatal Accident Happened In Taiwan (2007-2009)

Type of Industry	Years		
	2007 (Person)	2008 (Person)	2009(Jan- Sept) (Person)
Manufacturing	95	138	58
Commerce (Trade)	34	35	22
Construction	86	131	66
Transport, Storage, Communication	28	40	17
Farming and fishing	18	44	23
Mining and Quarrying	1	-	-
Utility Service(Electricity)	2	4	2
Real Estate	4	3	2
Health Care & Social welfare Service	1	-	-
Other Service	9	32	13
Accommodation & eating-drinking place	2	5	2
Finance & Insurance	1	-	1
Professional, scientific & technical services	6	5	4
Educational service	1	1	3
Cultural, sporting &recreational service	-	1	-
Public administration	5	11	5
Total	293	450	218

(Source: Taiwan Council of Labor Affair)

Based on Table 2.1 above, researcher wants to explain more detail about accident in electrical (including manufacturing and utility service) and construction industries, because accident in those industries are quite often and fatal.

2.1.5. Fatal Fall Accident

Mostly Fatal fall is fatal accident on construction industry. In Taiwan, accident in construction during 2007-2009 has a big number of victims. Many factors have contribution in this accident, there are:

1. Environment :
    a. Improper or inadequate illumination, ventilation, vibration, confined space.

b. The condition of the walking and working surface (floors and working platforms).
c. Environmental hazard and housekeeping hazard.
d. Extreme weather (hard rain, sweltering, gale and snow), etc (Anton, 1989).

2. Unsafe human activity:
   a. Remove equipment or machine safety device.
   b. Talking with other workers while working.
   c. Protective equipment or safety equipment provided but not used.
   d. Poor housekeeping practices on the part of the worker around the work area.
   e. Hazardous movement (running, jumping, stepping, or climbing over, throwing, etc.).
   f. Improper use of tools or equipment although proper tools were available (Anton, 1989).
3. Unsafe equipment (machine and vehicle):
   a. Defective equipment, tools, machines, and electrical systems.
   b. Ineffective safety device.
   c. The mechanical and physical condition of the equipment .
   d. Faulty design or lack of maintenance (Anton, 1989).
   e. Mechanical failure of construction machinery/equipment (Lubega et al., 2000).
4. Accident event (Chi et al., 2005):
   a. Fall from scaffold, staging.
   b. Fall through existing floor opening.
   c. Fall from building girders or other structural steel.
   d. Fall to lower level.
   e. Jump to lower level, etc.
5. Cause of fall (Chi et al. 2005):
   a. Bodily action.
   b. Poor work practices.
   c. Improper use of personal safety equipment.

d. Overexertion and unusual control, etc.

There are significant relationships between causes of falls and accident events, i.e. falls form scaffold staging were associated with a lack of complying scaffolds and bodily action (Chi et al., 2005).

Factors that mention above will become a resource for construction accident investigation. After analyzing accident scenario, inspectors or management can decide what kind of countermeasure that can prevent fall or other accident that usually happen in construction industry. Some **countermeasures** are mention in Chi et al. (2005), i.e. fixed barrier (handrails, guardrails, surface opening protection), travel restraint systems (safety belt), fall arrest system (safety harness), and fall containment systems (safety nets).

2.1.6. An Electrical shock Accident

An Electrical shock accident occurs when a person comes into contact with an electrical energy source. Electrical energy flows through a portion of the body causing a shock. Exposure to electrical energy may result in no injury at all or may result in devastating damage or death (http://www.emedicinehealth.com/electric_shock/article_em.htm). Cause of electrical shock is when electrical systems are not properly wired to remove dangerous voltage (Holt, 2002). People become injured and death occurs when voltage pushes electrons through the human body, particularly through the heart. Table 2.1 above mention about how many workers in Taiwan died during 2007-2009.

Some factors that have contribution in this accident are:

1. Environment:
   a. Improper or inadequate illumination, ventilation.
   b. The condition of the walking and working surface (floors and working platforms).
   c. Environmental hazard and housekeeping hazard.

2. Unsafe human activity:
    a. Protective equipment or safety equipment provided but not used.
    b. Improper use of tools or equipment although proper tools were available.
    c. Poor housekeeping practices on the part of the worker around the work area (Anton, 1989).
    d. Operating machine or equipment without authority.
    e. Remove equipment or machine safety device.
    f. Talking with other workers while working.
3. Unsafe equipment:
    a. Ineffective safety device.
    b. Defective equipment, tools, machines, and electrical systems.
4. Accident event:
    a. Electrical contact or electrocuted (Anton, 1989).
    b. Exposed to/contact with extreme temperature.
    c. Exposed to/contact with harmful materials (Hamid, 2008).
    d. Burn.
5. Cause of electrical shock:
        a. Failure to maintain safe device.
        b. Lack of safety device.
        c. Improper grounding.
        d. Failure to de-energize electrical systems (Chi et al., 2009).
6. Source of injury:
        a. Power hand tools.
        b. Energized objects.
        c. Power lines.
        d. Electrical equipment.
        e. Electrical wires, etc (Chi et al., 2009).
7. Electrical Task:
    a. Installing, moving, or repairing power lines.
    b. Working on electrical equipment.
    c. Working on hot machinery/equipment, etc (Chi et al., 2009).

An electrical shock from as little as 50V alternating current for a second can disrupt the hearts rhythm resulting in death in a matter of minutes from ventricular fibrillation. According to the American Heart Association, ventricular fibrillation (VF) is a life threatening condition in which the heart no longer beats but "quivers" or *fibrillates* very rapidly, 350 times per minute or more. In order to avoid sudden cardiac death, the person must be treated with a defibrillator immediately. Cardiopulmonary resuscitation (CPR) provides some extra time, but defibrillation is essential for surviving ventricular fibrillation (Holt, 2002).

Countermeasure for eliminating and reducing electrical shock accidents are: safe work practices, insulation, guarding, grounding, power source and electrical protective device, i.e. gloves, sleeves, mats, blankets, etc. (Chi et al., 2009). Example of complete countermeasure is to protect against electric shock from dangerous voltages on metal parts of electrical equipment from a ground-fault must be quickly removed by opening the circuit's over current protection device (Holt, 2002).

Other common factors that have contribution in general accident are:

1. **Supervisory safety performance rules:**
   a. Safety instructions inadequate.
   b. Safety rules not enforce.
   c. Safety not planed into the job.
   d. Infrequent employee safety contacts.
   e. Hazards left uncorrected.
   f. Safety device and equipment not provided (Anton, 1989).
2. **Mental condition of worker:**
   a. Lack of safety awareness and training.
   b. Lack of coordination.
   c. Improper attitude.
   d. Slow mental reaction.
   e. Inattention.
   f. Lack of emotional stability (Anton, 1989).

3. **Physical condition of worker:**
    a. Extreme fatigue.
    b. Deafness.
    c. Poor eyesight.
    d. Heart condition.
    e. High blood pressure.
    f. Lack of physical qualifications for the job (Anton, 1989).
    g. Illness.
    h. Alcohol and drug consumption (Hamid, 2008).

Point 2.2 and 2.3 above explain about factors that have contribution in fatal fall accident and fatal electrical accident. Most of accidents are because of human factor and error.

2.2. Human Error

An error is an out of tolerance action, where the limits of tolerable performance are defined by the system. (Swain and Guttman, 1983). Human error can be understood in different ways. **First,** it can refer to the cause of an event, so that after an accident occurs, it is often reported that it was due to human error. **Second**, Human error can also be a failure of thinking processes of the action or a failure to carry out the action at all. Erroneous action defines what happened without saying anything about why it happened (Whittingham, 2004).

Human error is human decisions, behaviors or actions that should not occur or deviate from the normal state or system. Or it can be described as fault to do right command. Results of human error are decreasing normal system performance, productivity, and assurance.

If human error involves inappropriate or undesirable behavior and could decreased human performance and productivity, then it is important to make someone knows behavior is appropriate or desirable. Rasmussen (1979) points out that such determination are often set by someone conducting a rational, careful evaluation of the behavior after the fact or the error was identified. Occasionally standard of performance in one system is different from other system, i.e. construction activity with electrical activity.

Rasmusssen (1982) makes a proactive point that an action might become an error because the action is performed in unkind environment that does not permit detection and reversal of the behavior before unacceptable consequence occurs.

Based on references above, factors that have contribution to an accident are: environment, human error, and company (including company management).

Company management should have some data about accident that happened in their company for analyzing why accident happened and how the countermeasure to eliminate the accident.

The accident data should be made in easy and consistent system, thus inspector or person that has responsibilities for make accident report are easy to fill up and process. Good database and information system should be created for those reasons.

2.3. Accident Database and information system

Accident Database is a collection of accident information that is organized so that it can easily be accessed, managed, and updated. These are such things as:

a. Who is the victim?
b. What is cause the accident?
c. What is source of accident?
d. What day of the week did it occur?
e. What is cause of injury?
f. What kind of task when the injury occurred? (Brown, 1976).
g. How the state of the victim after the accident?
h. And blank area for describing more detail how accident occurs?

The main purpose of accident database is for accident Information systems that provide information, recording and storing accident information. (Brown, 1976). Accident information must be stored because it should be processed for further analysis (prevention and countermeasure).

Accident information system has two outputs from measurement function. The **first** are construction and maintenance of the database. The **second** are providing a direct influence upon the correction element of control (Brown, 1976).

For designing of the accident information system, specific and selective data have to be collected and stored (Brown, 1976). Data for accident database is coming from previous accident investigation that frequently happened in the past and contributed to the overall control effort.

Based on Brown (1976), there are basically two types of investigation: pre-accident and post-accident. The post accident investigation tends to be more detailed, and because a specific chain of events has occurred, it can generally isolate the cause of the accident for potential elimination. However, both types obtain the same general information and both have the same purpose, namely to eliminate future accidents.

For designing of the accident information system, specific and selective data have to be collected and stored (Brown, 1976). Data for accident database is coming from previous accident investigation that frequently happened in the past and contributed to the overall control effort.

As mentioned in Brown (1976), the designer of accident information system has to understand the function and boundaries of the information system for giving information and evaluating when recording and storing the new information. The designer should ask the following questions when deciding whether to incorporate a given bit of information into the data base:

1. What is the source of the information?
2. How will the presence of this information hinder the retrieval and processing capabilities of other, more useful information?
3. How will this information be processed, and what result will it bring in terms of increase control?
4. How to store and retrieve the information so that it can be useful for decision making?
5. Can this information be reduced, coded, or in some way incorporated into another more important bit of information? (Brown, 1976).
6. Can this information be added with new accident information that did not exist in the current data base?

The decision to incorporate additional bits of information in the data base will depend largely upon the application and the facilities available to process the information (Brown, 1976).

2.4. Accident Template

Template is a standardized file type used by computer software as a pre-formatted example on which to base other files, especially documents. (www.wikipedia.com)

Accident database template is pre-developed page layout that contains accident database information and its basic explanation. The table 2.2 is an example of database template.

The elements in the table 2.2 are the most valuable data elements to develop the capacity to reconstruct the injury event using a standardized template. The elements included the primary or underlying mechanism (‘precipitating mechanism”) and object (“secondary source”) that initiate the injury producing event as well as the direct mechanism (“injury event/exposure”) or object (“primary source”) that resulted in injury (Lincoln, 2004) **.**

The elements also have interrelationships among the various categories to permit cross tabulation of the summarized data for detail interpretation, but these interrelationship maintain their meaning only if variables are coded in proper order, i.e., nature, body part, source, type, secondary source (Lincoln, 2004).

Table 2.2 Key data elements or accident template used to reconstruct an injury event

Data Element	Definition
Activity	The type of broad activity the injured person was engaged in when the injury occurred (for the example, maintenance).
Task	The specific activity engaged in when injury occurred providing additional detail (for example, inspecting engine).
Contributing factor	The key element that increase the risk such that what is normally completed without incident resulted in injury.
Precipitating mechanism	The cause that initiate the chain of events leading to injury; those mechanisms involved at the start of the injury event.
Primary source	The object, substance bodily motion, or exposure that directly produced or inflicted the previously indentified injury or illness.
Secondary Source	The object, substance or person that generated the source of injury or illness or that contributed to the event or exposure.
Injury event/exposure	The manner in which the injury or illness was produced or inflicted by the source of injury or illness.
Nature of Injury	The principal physical characteristic(s) of the injury or illness.
Outcome	The medical, functional, and / or financial results of the injury.

(Lincoln, 2004)

Some of The element in the table 2.2 above is valuable information for accident report. However some information should be added with other information to create accident report obviously enough for future analyzing, i.e. gender, age, working experience, occupation, type of industry, and etc. To be a structural data, Information in Accident template report is classified into some groups, there are: individual data, company profile, environment factors, accident information. Table 2.3 below is modification of database template for accident report.

Table2.3. Modification of data base template for accident report

Information	Detail Information
Individual data	Gender
	Age
	Working Experience
	Occupation
Company	Type of Industry
	Company Size (workers)
Environment factors	Month & Year
	Days (workdays and weekend)
Accident Information	Accident Classification
	Performing Task
	Cause of Accident
	Source of Accident
	Nature of Injury
	Outcome

Every of basic information has detail and consistent description about the basic information content, i.e. for describing task on electrical accident, data base have to provide information about installing, moving, or repairing utility pole and power lines or other task that related to electrical task and accident.

A consistent database will help inspector to **make a report and translate** qualitative data into analyzable data. If the report is complete then accident pattern can be generated more easily.

2.5. Accident Reporting and Analysis

Most accidents are the result of a sequence of events. This sequence of events, which may have been established after accident investigation, will indicate in most cases one series of events that could have resulted in the accident. An accidental chain of events is a complex relationship between human, machine and environment (Stranks, 2007).

Purposes of accident report are for describing who is the victim, how accident happened, and why it happened in detail information. Afterward the reader can conclude what kinds of prevention or countermeasure that effective for preventing another accident.

In practice, the design of accident reporting systems will be compromised by the resource available within an organization to collect data, analyze and

interpret them, and translate any important findings into viable accident countermeasures (Wilson, 1990).

Accident reports are divided into five categories. Each category has its own way in explaining the occupational accident.

2.5.1. Purposeful reporting

Collecting comprehensive accident data needs time and effort. It will lead to the accident analysis which becomes a resource for implementing accident countermeasure. Safety measures are divided into two types (Wilson, 1990):

1. Primary safety measure. The reduction or prevention of accident occurrence.
2. Secondary safety measure. The prevention or reduction in severity of injury.

Purposes of primary safety measure are safety improvements and identify the particular types of countermeasure for preventing and reducing accident occurrence. Comprehensive and detail accident data that relevant to the personnel behavior and its relation to concurrent task demand are needed to accident analysis.

Purposes of secondary safety measure are introducing Personal Protective Equipment or safety device such as interlock system, machine guards, automatics sprinkler system for minimizing cause of accidental injury.

2.5.2. Adequate Reporting

Truncate accident reporting may appear to meet the principal needs of secondary safety. These claims have certain face validity; however, they ignore the potential value of ’control’ data on the behavioral antecedents of damage-only accidents, or ‘near accidents which resulted in neither injury nor damage. Injury, damage and ‘near-misses’ may all result from apparently identical human-technology interactions.

The clue to the different consequences may be discernible only by detailed comparisons of the antecedent behaviors in question. A concentration on injury limits the total number of data available for safety work and makes it difficult, if

not impossible, to estimate the objective risk associated with specific behavior patterns (Brown, 1991). A useful accident reporting system will be one which collects data on all accident, to the same level of detail, regardless of their consequences (Wilson, 1990).

2.5.3. Factual Reporting

In order to meet the first of these objectives, the 'first line' of any accident reporting system should avoid subjectivity and particularly the apportioning of 'blame' and instead, concentrate on the factual reporting of task demands and operator behavior in the relevant period prior to and surrounding the accident.

A comprehensive factual description of technological system demands and human antecedence behavior must be attempted initially, before there is any attempt to classify technical faults or human errors. Faults and/or errors should be identifiable from study of any obvious mismatches between task demand and operator response. The causes will be clear by further detailed analysis of the mismatches and the context in which they occurred (Wilson, 1990).

2.5.4. Task-specific Reporting

Accident data are become more meaningful and contribute usefully to safety improvements, if it recorded in a task specific form and not aggregate across dissimilar tasks until an initial data analysis has been completed on the different behavioral contributions to accident involving those tasks (Wilson, 1990).

2.5.5. Verbal Reporting

Verbal reports will often be the only method of reconstructing the behavioral sequences antecedent and of supporting these reconstructions with information on participants' covert reasons, intentions, perception, decisions, judgments, etc. within task, such reconstructed sequences may be aggregated or compared in order to highlight may mismatches between actual system demands,

perceived system demands and operator behavior which may have contributed to accident causation (Wilson, 1990).

An ideal technique for accident analysis should focus on the possibility of occurrence of one critical event at the time and indicate the complex relationship that can cause it. Sometimes Fault tree analysis is used to predict that combination of events and circumstances which could cause the critical event (Wilson, 1990).

Once data from coded and narrative source had been organized, they needed to be presented in scientific and useful way. The combination of coded and narrative elements of the safety report contributed information to enable a thorough reconstruction of the injury events using the reconstruction template(Lincoln, 2004)**.**

Narratives source contributed six elements: broad activity, task, injury event/exposure, contributing factor, precipitating mechanism, and primary source. Unique information will appear in first three elements (broad activity, task, injury event/exposure). The existing narrative text should provide the causal information without the need to renew investigations into each case. This kind of narrative data is increasingly integrated with large studies, i.e. National Health Interview Survey or Council of Labor Affairs (Lincoln, 2004).

2.6. Safety Program

Safety program management is the control of the working environment, the equipment and processes and the workers for the purpose of reducing accidental injury and losses in the workplace. For reducing injury and losses in the workplace, company management should have some ways such as design on engineering concept and training for workers (Anton, 1989).

Management's acceptance of its responsibilities for safety can best expressed by setting a policy to provide a safe and healthful workplace for its employees. This is a commitment and it should be designed to lay down step by step the company's plan for making a safe workplace, directing a training program for employees and supervisors. Specific goals should be established and maintained to ensure that all personnel responsible for safety matters are kept

abreast of new standards or procedures as they are published by the corporation and by the Department of Labor (Anton, 1989).

A safety program must always start at the top management level. Thus, their employee will respect and follow the rules. Management's interest must be audible, visible and continuous with their safety rules (Anton, 1989).

Anton (1989) mentioned about the specific functions or responsibility for safety managers and half of top management as written below:

1. Establishing programs for detecting, correcting, or controlling hazardous condition, toxic environments, and health hazards. Ensuring that proper safeguards and personal protective equipment are available, properly maintained and properly used.
2. Establishing safety procedures for: employee, plant design, plant layout, vendors, outside contractors and visitors.
3. Establishing or approving the establishment of safety procedures for purchase and installation of new equipment and for the purchase and safe storage of hazardous materials.
4. Maintaining an accident recording system to measure the organization's safety performance.
5. Staying abreast of, and advising management on, the current federal, state, and local laws, codes, and standards related to safety and health in workplace.
6. Carrying out the company's safety obligations as required by law and/or by union.
7. Conducting safety training for all levels of management and newly hired and current employees. Emphasizing the importance of continuous safety training for all management.
8. Allocating the necessary resources, such as time, environment, and money (equipment and product), to safety matters. (http://www.tc.gc.ca/civilAviation)
9. Conducting investigation of accidents, near-misses, and property damage and preparing reports with recommended corrective action.

10. Setting personal examples in day-to-day work. (http://www.tc.gc.ca/civilAviation)
11. Putting safety matters on the agenda of meetings, from broad level downwards. (http://www.tc.gc.ca/civilAviation)
12. Keep informed on the latest developments in the field of safety such as personal protective equipment, new safety standards, workers' compensation legislation, and new literature pertaining to safety, as well as attending safety seminars and conventions.
13. Maintaining liaison with national, state, and local safety organizations and taking an active role in the activities of such groups.
14. Accompanying OSHA Compliance Officers during plant surveys. The safety engineer further reviews reports related to these activities and with management-initiates action for necessary corrections.
15. Distributing the organization's statement of policy as outlined in its organizational manual.
16. Promoting safety topics in company publications. (http://www.tc.gc.ca/civilAviation)

The pre-accident situation (Stranks, 2007)

In any situation prior to an accident taking place, two important factors must be considered, namely:

1. The objective danger. This is the danger that associated with a particular practice, system of work, item of equipment or part of workplace, i.e. dangerous stairs, defective lifting appliance, etc., at particular point in time.
2. The subjective perception of risk on the part of the individual. People perceive risk differently according to a number of behavioral factors, such as attitude, motivation, training, visual perception, personality, level of arousal and memory.

Objective of pre- accident prevention (Stranks, 2007)

The principal objectives of any accident prevention program should be:

- Reduced the objective danger by ensuring good standards of structural safety , and
- Increased people's perception of risk, by instruction and training, supervision, and the operation of safe systems of work.

Pre-accident Strategies

Stranks (2007) classified Pre-accident strategies as **'safe place'** and **'safe person'** strategies.

The principal objective of **a 'safe place'** strategy is to ensure a reduction in the objective danger to people at work. These strategies feature in much of the occupational health and safety legislation and the health and Safety at Work Act 1974. The strategies are classified as follows:

- **Safe premise**. This related to the general structural requirements of buildings, such as the soundness of floors and staircase, and the specific safety features of windows, glazed doors and partition, roof, and environmental working conditions, such as the levels of lighting, ventilation, noise, temperature and humidity, feature in this classification (Stranks, 2007).

- **Safe work equipment**. It is procedures for checking and testing new appliances and equipment together with systems for their maintenance and cleaning must be considered (Stranks, 2007).

- **Safe working practices.** All factors contributing to the operation of specific working practice must be considered, e.g. the safety of electrical appliances, control of hazardous chemical substances used at work, and the operation of chairs with lifting and tilting mechanisms (Stranks, 2007).

- **Safe materials**. Adequate and suitable information in their correct use, storage and disposal must be provided by manufacturers and suppliers. Where substances are classed as toxic, corrosive, harmful or irritant, there may be a need to assess health risk for particular circumstances of use in accordance with the Control of Substances Hazardous to Health (COSSHH) regulation (Stranks, 2007).

- **Safe system of work**. A safe system of works defined as 'the integration of people, machinery and materials in a correct working environment to provide the safest possible working conditions (Stranks, 2007).

- **Safe access to and egress from work**. This refers to access to, and egress from, both the workplace from the road outside and to and from the working area. Consideration must be given, therefore, to the state of approach roads, yards, operations at high level, such as window cleaning, and the use of portable and fixed access equipment, e.g. ladders and lift (Stranks, 2007).

- **Adequate supervision.** The health and safety at work Act requires that in all organizations there must be adequate safety supervision directed by senior management through supervisory management to staff (Stranks, 2007).

-**Competent and trained staff**. The general duty to train staff and others in also laid down in the health and safety at work act and, more specifically, in the Management of Health and Safety at work regulations. All employees need some form of health and safety training and certain people may need to be competent in high risk situation, e.g. electricians, and chemical engineers. Managers must appreciate that well-trained staff are essential and in organizations which regularly provide health and safety training and supervision, accident and ill-health cost tent to be lower (Stranks, 2007).

Generally, **'safe place'** strategies provide better protection than **'safe person'** strategies. However, where it may not be possible to operate a 'safe place' strategy, then a 'safe person' strategy must be used. In certain cases, a combination of 'safe place' and 'safe person' strategies may be appropriate.

The main aim of a 'safe person' strategy is to increase people's perception of risk. One of the principal problems with such strategies is they that depend upon the individual conforming to certain prescribed standards and practices, such as the use of certain items of personal protective equipment (Stranks, 2007).

'Safe person' strategies may be classified as follows (Stranks, 2007):

- **Care of the vulnerable.** Typical examples of 'vulnerable' groups are young persons who, through their lack of experience, may be unaware of hazards, pregnant female staff, where there may be a specific risk to the unborn child and physically and mentally disable clients whose capacity to undertake certain tasks may be limited. In a number of cases there may be e need for continuing medical and/ or health surveillance of such people (Stranks, 2007).

- **Personal hygiene**. Personal hygiene is very much a matter of individual upbringing. In order to promote good standards of personal hygiene, therefore, it is vital that the organization provides adequate washing facilities for use by staff, particularly prior to the consumption of food and drink on returning home at the end of the work period (Stranks, 2007).

- **Personal protective equipment**. Generally, the provision and use of any item of personal protective equipment (PPE) must be seen either as a last resort when all other methods of protection have failed or an interim method of protection until some form of 'safe place' strategy can be put into operation. It is by no means a perfect form or protection in that it requires the person at risk to use or wear the equipment all the time they are exposed to a particular hazard (Stranks, 2007).

- **Safe behavior.** Staff must not be allowed to indulge in unsafe behavior. Example of unsafe behavior include smoking in designated 'No smoking' areas, and the failure to wear or use certain items of PPE (Stranks, 2007).

- **Caution towards danger.** All staff and management should appreciate the risk and the precautions required at work and these risks should be clearly identified in the local statement of Health and Safety Policy (Stranks, 2007).

Post-accident (reactive) strategies

Principal efforts is implementation of proactive strategies, it is generally accepted that there will always be a need for reactive or 'post-accident' strategies, particularly as a result of failure of the various 'safe person' strategies (Stranks, 2007).

Post-accident strategies can be classified as follows:

- **Disaster/contingency/emergency planning**. Here, there is a need for managers to ask themselves this question. "What is the very worst possible type of incident or event that could arise in our operations?" it could be escalating fire, an explosion, collapses of a scaffold used by contractors, flood or major traffic accident and other. All of those kinds of accident have to be considered in safety plant design (Stranks, 2007).
- **Feedback strategies**. Accident and ill-health reporting, recording and investigation provide feedback as to the indirect and direct causes of accidents. The study of past accident causes provides information for the development of future proactive strategies (Stranks, 2007).
- **Improvement strategies**. These strategies are concerned with minimizing the effects of injuries as quickly as possible following an accident. There are the training and retraining of first aid personnel and procedures for the rapid hospitalization of seriously injured persons (Stranks, 2007).

2.7. Adobe Dreamweaver

Macromedia Dreamweaver (http://www.macromedia.com/) is one of the most popular "what you see is what you get" editors. Dreamweaver enables you to create a web site with little html knowledge, but allows you to edit the source code.

Benefits of Dreamweaver:

- Templates allow you to easily update the style of the whole site
- Different templates can be applied to different areas of the web site to ensure consistency within sections (color, style etc)
- The templates ensure that some areas (such as the top navigation) which don't need to change can't be edited accidentally
- The templates can contain all the information needed for the page (which style sheet is attached, which side navigation is used etc)

- For large web sites, where several people work on the pages, content owners can edit pages without danger of someone writing over a page they're working on
- Dreamweaver shows everybody which users have which files checked out