FAULT TREE ANALYSIS

Fault tree analysis (FTA) is a top down, deductive failure analysis in which an undesired state of a system is analyzed using boolean logic to combine a series of lower-level events. This analysis method is mainly used in the field of safety engineering and Reliability engineering to determine the probability of a safety accident or a particular system level (functional) failure.

- Understand the logic leading to the top event / undesired state.
- Show compliance with the (input) system safety / reliability requirements.
- Prioritize the contributors leading to the top event - Creating the Critical
- Equipment/Parts/Events lists for different importance measures.

STEPS INVOLVED IN FTA

1. Define the undesired event to study

Definition of the undesired event can be very hard to catch, although some of the events are very easy and obvious to observe. An engineer with a wide knowledge of the design of the system or a system analyst with an engineering background is the best person who can help define and number the undesired events. Undesired events are used then to make the FTA, one event for one FTA; no two events will be used to make one FTA.

2. Obtain an understanding of the system

Once the undesired event is selected, all causes with probabilities of affecting the undesired event of 0 or more are studied and analyzed. Getting exact numbers for the probabilities leading to the event is usually impossible for the reason that it may be very costly and time consuming to do so. Computer software is used to study probabilities; this may lead to less costly system analysis.

System analysts can help with understanding the overall system. System designers have full knowledge of the system and this knowledge is very important for not missing any cause affecting the undesired event. For the selected event all causes are then numbered and sequenced in the order of occurrence and then are used for the next step which is drawing or constructing the fault tree.

3. Construct the fault tree

After selecting the undesired event and having analyzed the system so that we know all the causing effects (and if possible their probabilities) we can now construct the fault tree. Fault tree is based on AND and OR gates which define the major characteristics of the fault tree.

4. Evaluate the fault tree

After the fault tree has been assembled for a specific undesired event, it is evaluated and analyzed for any possible improvement or in other words study the risk management and find ways for system improvement. This step is as an introduction for the final step which will be to control the hazards identified. In short, in this step we identify all possible hazards affecting in a direct or indirect way the system.

5. Control the hazards identified

This step is very specific and differs largely from one system to another, but the main point will always be that after identifying the hazards all possible methods are pursued to decrease the probability of occurrence.

.FAILURE MODE AND EFFECT ANALYSIS

Failure Modes and Effects Analysis (**FMEA**) is a systematic, proactive method for evaluating a process to identify where and how it might fail and to assess the relative impact of different failures, in order to identify the parts of the process that are most in need of change.

FMEA is an analytical methodology used to ensure that potential problems have been considered and addressed throughout the product and process development cycle.

FMEA helps to:

- Discover the potential failures, their potential cause mechanisms and the risks designed into a product or process
- Develop actions that reduce the risk of failure
- Follow-up and evaluate the results of actions on the risks that were discovered

FMEAs are conducted by a core team of three or four people with supporting Subject Matter Experts (SME). This group creates the Cross Functional Team (CFT). Ideally, the CFT should be selected from disciplines that have a slightly different view of the product or process under investigation. The synergy created by the CFT is what makes FMEA so powerful.

APPRAISAL

EFFECTIVE STEPS TO IMPLEMENT SAFETY PROCEDURES

A safe and healthy workplace is one of the keys to the success of any industry. By establishing good health and safety practices in the workplace, an industry is likely to have more motivated and productive employees.

1.1 The following goals have to be established by any industry

(1) Provide workers with a safe work environment.

(2) Conduct routine/regular workplace inspections.

(3) Provide Personal Protective Equipment.

(4) Develop and implement safe work procedures and rules.

(5) Provide on-going safety training

(6) Enforce safety rules and appropriate discipline.

(7) Provide on-going property conservation practices.

1.2 Employee orientation program

All new employees must attend the Safety Orientation Session prior to starting work within their assigned area. This session will be conducted under the direction of the Safety Director and in coordination with Human Resources. Upon completion of the Safety Orientation Session, each new employee will be required to acknowledge that they have received, understand, and will abide by the industry's Safety Program. All participants must sign a statement verifying that they have completed the session. This report will be filed in the employee's personnel file.

The following topics are covered in the Safety Orientation Session:

1. Company History
2. Safety Program/Policy & Work rules
3. Responsibilities
4. Safety Education/Training
5. Safety Audit/Inspections
6. Accident Reporting/Investigation Requirements
7. First Aid & Blood borne Pathogens
8. Personal Protective Equipment
9. Tool & Equipment Use
10. Material Handling
11. Machine Guarding
12. Hazard Communication
13. Emergency Action

1.3 Safety Rules

All safety rules must be obeyed. Failure to do so will result in strict disciplinary action.

1. All injuries must be reported as soon as possible.
2. No horseplay, alcohol, or drugs allowed on premises. No alcohol usage allowed during
   a. Lunch break.
3. PPE must be worn as prescribed by management.
4. All tools/equipment must be maintained in good condition.
5. Only appropriate tools shall be used for specific jobs.
6. All guards must be kept in place.
7. No spliced electrical cords/wiring allowed.

Safety committee

General functions of the Safety Committee can include:

(1) Identifying workplace hazards

(2) Enforcement of Safety Rules

(3) Measuring safety performance

(4) Reducing frequency/severity of injuries

(5) Creating safety policies

(6) Developing and monitoring safety programs

Specific tasks of the Safety Committee can include:

(1) Conducting self-inspections of the workplace

(2) Review employee reports of hazards

(3) Assist in safety training

(4) Creating safety incentive programs

(5) Publish/distribute safety newsletter

(6) Inspect PPE

(7) Post safety posters/slogans on bulletin board

(8) Identify Light Duty Jobs

Emergency action plan

The Emergency Action Plan (EAP) is in place to ensure employee safety from fire and other emergency. At the time of an emergency, all employees should know what type of evacuation is necessary and what their role is in carrying out the plan.

In some emergencies total and immediate evacuation will be necessary. In other emergencies only partial evacuation may be necessary.

When a fire is detected it is necessary that the fire alarm pull station be activated as soon as possible. The fire alarm will notify the emergency response team who will perform assigned duties. The activation of the alarm will also notify the local fire department.

In the event of bomb threat, toxic chemical release, hazardous weather, or other emergencies - notification will be made over the public address system. In the event of fire, bomb threat, or toxic chemical release; employees are to proceed to the nearest available and safe exit and leave the building as soon as possible. Floor plans (maps) and exits have to be posted in each department.

SAFETY EDUCATION AND PERIODIC TRAINING

Safety Education

It deals primarily in the development of mind, broadening one's knowledge in the field of safety by understanding the concept or principle of any hazardous material on the job activity. The cause for the hazard or the hazardous property of the material one handles can be ascertained easily through education and then it could be explained even to the uneducated employees through any kind of communication technique. This develops the consciousness, awareness and a state of mental alertness among the workers to identify and prevent the hazardous

Safety Training

Safety training is an extension of safety education which lies effectively in the use of safety work practices and techniques. The general benefits from the safety training are

1. Training activities indirectly demonstrate company's interest in employees which leads to good human relations at work.
2. Understanding the importance of safety and hence following safe work procedures in the operation of machines, equipments and handling materials
3. Training saves the time spent by the supervisor to instruct and correct
4. Knowing the techniques of fire fighting, first aid, lifting, stacking etc helps a lot in the accident prevention and in emergencies.

Level - Training Needs

Helper - Need for safety at work, hazards connected with his work, ways to safeguard

Operator - Need for Safety, safety requirements of his job,his responsibilities

Supervisor - Hazards in the operations supervised and the technical skills to

identify and prevent them, a
broad knowledge of company's policy, techniques of supervision, human relations and communication
skills.

Manager - Responsibility for safety, companys policy and direction, techniques to identify and control hazards, safety engineering and management, human relations and communication.

Training programmes on specific areas like fire extinguishing, first aid , noise, industrial hygiene, major
hazards control during emergencies, uses of personal protective equipments must be covered. Training
can be given by

1. On-Job training
2. Lecture Method
3. Group Discussions
4. Case Studies
5. Learning by doing
6. Demonstration and visit