

SAFE EXIT

In the study of safety, the 'safe exit' principles are recommended. The conditions referred to as 'safe exit' are:

- 1 The product, when it fails, should fail safely
- 2 The product, when it fails, can be abandoned safely (it does not harm others by explosion or radiation)
- 3 The user can safely escape the product (e.g., ships need sufficient number of life boats for all passengers and crew; multi-storeyed buildings need usable fire escapes)

RISK-BENEFIT ANALYSIS

The major reasons for the analysis of the risk benefit are:

- 1 To know risks and benefits and weigh them each
- 2 To decide on designs, advisability of product/project
- 3 To suggest and modify the design so that the risks are eliminated or reduced

There are some limitations that exist in the risk-benefit analysis. The economic and ethical limitations are presented as follows:

1. Primarily the benefits may go to one group and risks may go to another group. Is it ethically correct?
2. Is an individual or government empowered to impose a risk on some one else on behalf of supposed benefit to some body else? Sometimes, people who are exposed to maximum risks may get only the minimum benefits. In such cases, there is even violation of rights.
3. The units for comparison are not the same, e.g., commissioning the express highways may add a few highway deaths versus faster and comfortable travel for several commuters. The benefits may be in terms of fuel, money and time saved, but lives of human being sacrificed. How do we then compare properly?
4. Both risks and benefits lie in the future. The quantitative estimation of the future benefits, using the discounted present value (which may fluctuate), may not be correct and sometime misleading.

Voluntary Risk

Voluntary risk is the involvement of people in risky actions, although they know that these actions are unsafe. The people take these actions for thrill, amusement or fun. They also believe that they have full control over their actions (including the outcomes!) and equipments or animals handled, e.g., people participate in car racing and risky stunts.

Testing becomes inappropriate when the products are

- 1 Tested destructively
- 2 When the test duration is long, and
- 3 When the components failing by tests are very costly. Alternate methods such as design of experiments, accelerated testing and computer-simulated tests are adopted in these circumstances.

SAFETY LESSONS FROM 'THE CHALLENGER'

The safety lessons one can learn in the Challenger case are as follows:

1. Negligence in design efforts. The booster rocket casing recovered from earlier flights indicated the failure of filed-joint seals. No design changes were incorporated. Instead of two O-rings, three rings should have been fixed. But there was no time for testing with three rings. At least three rings could have been tried while launching.
2. Tests on O-rings should have been conducted down to the expected ambient temperature i.e., to 20 oF. No normalization of deviances should have been allowed.
3. NASA was not willing to wait for the weather to improve. The weather was not favorable on the day of launch. A strong wind shear might have caused the rupture of the weakened O- rings.
4. The final decision making of launch or no-launch should have been with the engineers and not on the managers. Engineers insisted on 'safety' but the managers went ahead with the 'schedule'.
5. Informed consent: The mission was full of dangers. The astronauts should have been informed of the probable failure of the O-rings (field joints). No informed consent was obtained, when the engineers had expressed that the specific launch was unsafe.
6. Conflict of interest (Risk Vs. Cost): There were 700 criticality-1 items, which included the field joints. A failure in any one of them would have cause the tragedy. No back-up or stand- bye had been provided for these criticality-1 components.
7. Escape mechanism or 'safe exit' should have been incorporated in the craft. **McDonnell**

HUMAN RIGHTS

Human rights are defined as moral entitlements that place obligations on other people to treat one with dignity and respect. Organisations and engineers are to be familiar with the minimum provisions under the human rights, so that the engineers and organizations for a firm base for understanding and productivity. Provisions under 'human rights' are as follows:

1. Right to pursue legitimate personal interest
2. Right to make a living
3. Right to privacy
4. Right to property
5. Right of non-discrimination
6. No sexual harassment

Under professional rights, the following provisions are protected:

1. *Right to form and express professional judgment*: It is also called the *right of professional conscience*. In pursuing professional responsibilities, this empowers one to form and exercise the professional judgment. Both technical and moral judgments are included. This right is bound by the responsibilities to employers and colleagues.
2. *Right to refuse to participate in unethical activities*: It is also called the *right of conscientious refusal*. It is the right to refuse to engage in unethical actions and to refuse to do so solely because one views that as unethical. The employer can not force or threaten the employee to do something that is considered by that employee as unethical or unacceptable. For example, unethical and illegal

activities that can be refused are: falsifying data, forging documents, altering test results, lying, giving or taking bribe etc. There may be situations, when there is a disagreement or no shared agreement among reasonable people over whether an act is unethical. Medical practitioners have a right not to participate in abortions. Similarly, the engineers must have a right to refuse assignments that violate their personal conscience, such as when there exists a threat to human life or moral disagreement among reasonable people.

Aspects

There are four aspects of whistle blowing, namely:

1. *Basis of disclosure*: The basis for disclosure may be intentional, or under pressure from superiors or others not to disclose.
2. *Relevance of topic*: The whistle blower believes that the information is about a significant problem for the organization or its business ally. It can be a threat to the public or employees' health, safety and welfare or a criminal activity, or unethical policies or practices, or an injustice to the workers within the organization.
3. *Agent*: The person disclosing the information may be a current or former employee or a person having a close link to the organization.
4. *Recipient*: The person or organization, who receives the information, is in a position to remedy the problem or alert the affected parties. Usually, the recipients are not aware of the information fully or even partially.

Types

Based on the *destination (recipient)*, whistle blowing is classified into types, as:

- (a) *Internal*: In this case, the information is conveyed to a person within the organization, but beyond the approved channels.
- (b) *External*: This happens when the information is transmitted outside the organization. The recipient may be a municipal chairman or member of legislature or minister. It becomes severe if the information reaches the press and through them the public. The damage is maximum and sometimes poses difficulty in remedying the situation.

Based on the origin or source (agent), this can be divided into three types, as follows:

- (a) *Open*: The originator reveals his identity as he conveys the information. This information is reliable and true, but sometimes partially true.
- (b) *Anonymous*: The identity is concealed. The information may or may not be true. But the agent anticipates perhaps some repression or threat, if identity is revealed.

Partly anonymous (or partly open): Such a situation exists when the individual reveals his identity to the journalist, but insists that the name be withheld .