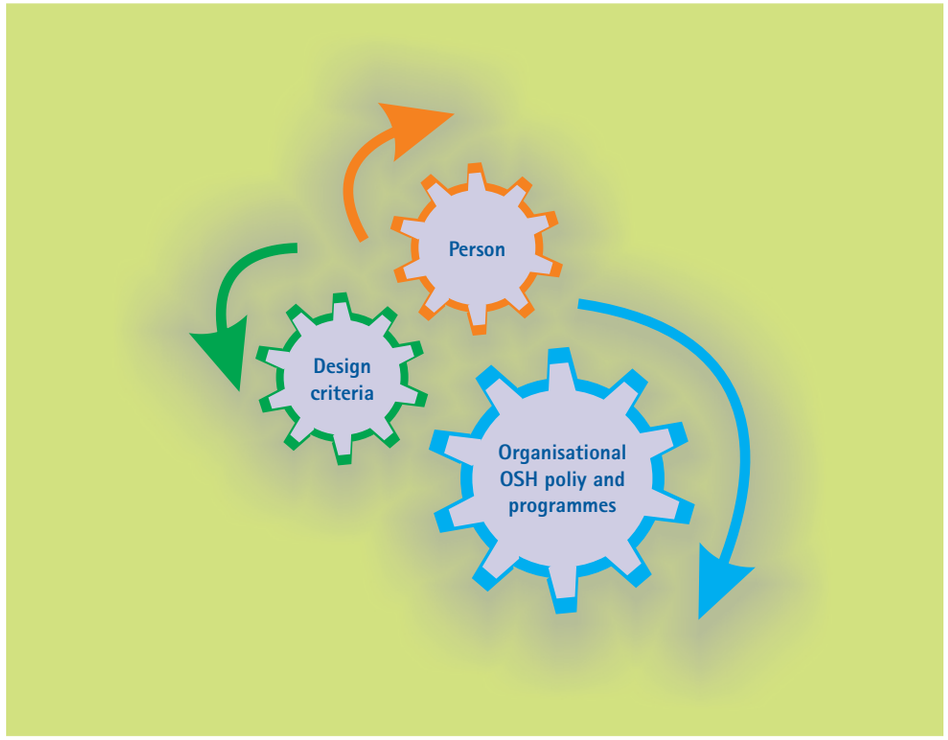
Theme – 8

Organisational Commitments in Reducing Accidents

industrial Disaster Risk Management



InWEnt –
International Weiterbildung und Entwicklung gGmbH
Capacity Building International, Germany
Friedrich-Ebert-Allee 40
53113 Bonn
Fon +49 228 4460-0
Fax +49 228 4460-1766
www.inwent.org

For further information Contact:

Disaster Management Institute
Paryavaran Parisar,
E-5, Arera Colony, PB No. 563,
Bhopal-462 016 MP (India),
Fon +91-755-2466715, 2461538, 2461348,
Fax +91-755-2466653
dmi@dmibhopal.nic.in
www.dmibhopal.nic.in

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DMI Bhopal

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वहाँ है खुशहाली ।।

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Germany

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Chief Editor
Praveen Garg, IAS,
Executive Director, DMI, Bhopal, India

Editors
Dr. Rakesh Dubey, Director, DMI, Bhopal, India
Florian Bemmerlein-Lux, Sr. Advisor, InWEnt, Germany

Support
Sudheer Dwivedi, Dy. Director, DMI, Bhopal, India
Dr. Asit Patra, Asstt. Director, DMI, Bhopal, India
Neeraj Pandey, Content Manager, InWEnt India
Amit Kumar Dadhich, Content Manager, InWEnt India
Huda Khan, Content Manager, InWEnt India

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InWEnt
International Weiterbildung und Entwicklung gGmbH
Capacity Building International, Germany
Friedrich-Ebert-Allee 40
53113 Bonn
Fon +49 228 4460-0
Fax +49 228 4460-1766
www.inwent.org

Disaster Management Institute
Paryavaran Parisar, E-5, Arera Colony, PB No. 563
Bhopal-462 016 MP (India),
Fon +91-755-2466715, 2461538, 2461348,
Fax +91-755-2466653
www.hrdp-iDRM.in

GTZ ASEM
Advisory Service in Environmental Management
A-33, Gulmohar Park,
New Delhi 110049
Fon +91-11-26528840
Fax +91-11-26537673
www.asemindia.com

जहाँ है हरियाली
वहाँ है खुशहाली

MoEF

The Ministry of Environment & Forests (MoEF) is the nodal agency in the administrative structure of the Central Government for the planning, promotion, coordination and overseeing the implementation of India's environmental and forestry policies and programmes.
The Ministry also serves as the nodal agency in the country for the United Nations Environment Programme (UNEP), South Asia Co-operative Environment Programme (SACEP), International Centre for Integrated Mountain Development (ICIMOD) and for the follow-up of the United Nations Conference on Environment and Development (UNCED). The Ministry is also entrusted with issues relating to multilateral bodies such as the Commission on Sustainable Development (CSD), Global Environment Facility (GEF) and of regional bodies like Economic and Social Council for Asia and Pacific (ESCAP) and South Asian Association for Regional Co-operation (SAARC) on matters pertaining to the environment.

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InWEnt - Capacity Building International, Germany, is a non-profit organisation with worldwide operations dedicated to human resource development, advanced training, and dialogue. Our capacity building programmes are directed at experts and executives from politics, administration, the business community, and civil society. We are commissioned by the German federal government to assist with the implementation of the Millennium Development Goals of the United Nations. in addition, we provide the German business sector with support for public private partnership projects. Through exchange programmes, InWEnt also offers young people from Germany the opportunity to gain professional experience abroad.

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Disaster Management Institute (DMI) Bhopal

The Disaster Management Institute (DMI) was set up in 1987 by the Government of Madhya Pradesh (GoMP) as an autonomous organization in the aftermath of the industrial disaster in Bhopal.
Since inception, DMI has built vast experience in preparation of both On-site and Off-site Emergency Management Plans, Safety Audit, Risk Analysis and Risk Assessment, Hazard and Operability Studies (HAZOP), etc.
The National Disaster Management Authority (NDMA) constituted under the chairmanship of the Prime Minister selected DMI as a member of the Core Group for preparation of the National Disaster Management Guidelines- Chemical Disaster. It is a matter of pride that NDMA has selected DMI for conducting Mock Exercises on chemical (industrial) Disaster Management at key industrial locations in the country. The Ministry of Environment and Forests, InWEnt and gtz-ASEM Germany have recognized DMI as a Nodal Training Institutes for capacity building in industrial Disaster Risk Management.

www.HRDP-iDRM.in

Contents

Do you know that?

- 2.2 million deaths per year from occupational accidents and diseases
- 270 million workers suffer non-fatal injuries
- 160 million workers suffer short- or long-term illnesses from work-related causes
- 4% of world's GDP lost due to work-related accidents and diseases

- Annie Rice, ILO Sub-regional Office for Central and Eastern Europe

Who is responsible for accidents and disasters?

- The worker?
- The employer?
- The manager?
- The government?
- The labour inspector?
- The safety and health professional?

From PROTECTION to PREVENTION a systematic action at national and enterprise level is required to address the Occupational Safety and Health (OSH) Policy, which will result in reduction of accidents by involving all the above players.

1. Introduction

Many disasters have occurred because organisations have ignored the warning signs of precursor incidents or have failed to learn from the lessons of the past. Normal accident theory suggests that disasters are the unwanted, but inevitable output of complex socio-technical systems, while high-reliability theory sees disasters as preventable by certain characteristics or response systems of the organisation.

Module 6 has discussed various models of accidents. One of the reasons has highlighted the failure of organisational policies and supervision at higher level for effective implementation of OSH (Occupational Safety and Health) policy. This module will discuss in detail about the flaws at organisational level so that accidents or disasters can be reduced if appropriate actions are ensured for proper monitoring of implementation of organisation's OSH policy and programmes.

Let's have a view of the vital components of a complex process plant. After reviewing the literature we can come to the conclusion that following components make a system or process plant (Figure 1):

- Organisational environment and working culture
- Design criteria from safety considerations
- Grooming of manpower including the workers, supervisors and managers etc.

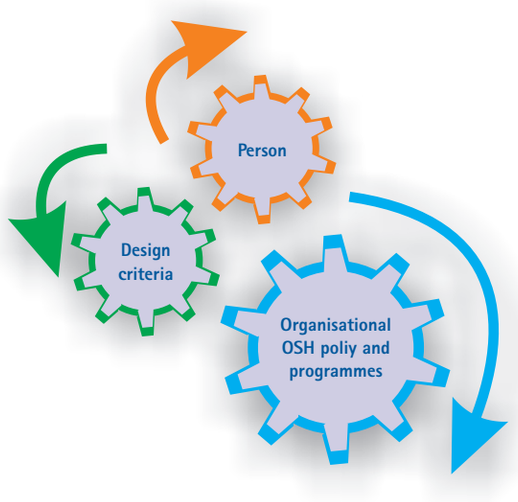


Fig-1

All these three factors are integrated as industrial safety and depend on each other. Every new technology starts out by stressing technical factors like design and construction specifications, then moves on to "discovering" the importance of errors by individual human operators and finally switches to organisational and management aspects as the most important factors.

In this school of thought an integral approach is followed by assuming that all three types of contributing factors must be investigated and acted upon. The most important question then becomes: What is the relative importance of each factor and of the interactions between them?

Fig2. shows a simple model of the main components involved in incident causation, and also defines three basic terms used throughout this module: accident, incident and near miss. Technical and organisational failures can initiate the chain of deviation leading to incident causation events both directly and indirectly. (e.g. By inducing operator failure). Only very seldom is an actually dangerous situation assumed to follow from such failures.

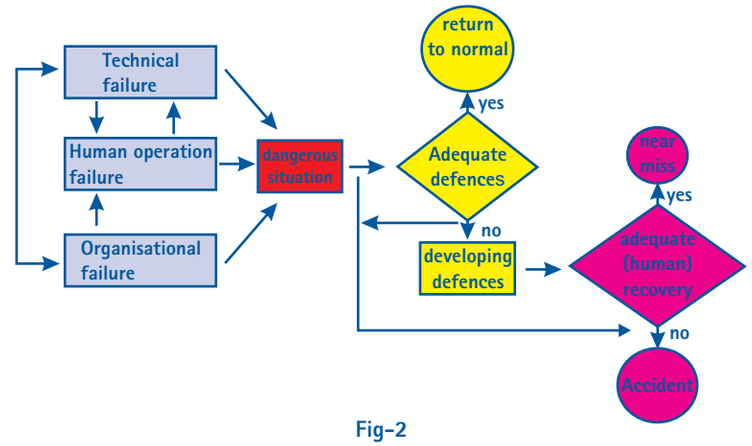


Fig-2

2. Organisational risk model

Risk management of an organisation is crucial and challenging task. Coordination and smooth functioning with least conflicts are amongst all major components that leads towards the accident reduction. The following two models are important to discuss in the present context:

2.1 Model of system migration

The popular framework for modelling risk management is a system framework with two components. The first is a structural hierarchy describing the actors - individuals and organisations in a system. The second considers the dynamics of the system as it migrates towards the boundary of safety. An understanding of both of these components is required to model how and why accidents occur.

(a)Actors
Socio-technical systems are designed to produce a product or service while managing risk. A socio-technical system is shown as Fig 3. and it also tries to throw light on the possible interactions amongst all players. Activities of the individual staff members who interact directly with the process being controlled (e.g. control room operators, SOPs, etc.) are at the Staff level. Factors at the Management level are related to supervision of operational staff and directions received due to adaptation of company policies. Company-level factors include the activities of the company as a whole

including the national and global forces responsible for quality, environmental, and safety issues. The next level represents the activities of the regulators or and professional associations or and ISOs directives that are responsible for constraining the activities of companies in that particular sector. Professional directions in this context are those that exert regulatory authority over the profession, such as the OSHAS 18001 or ISO 14001. Factors at the Government level are related to the activities of Government including, both public servants and elected officials, who are responsible for setting public policies.

When a system functions, decisions at higher levels of the system propagate down the hierarchy. Simultaneously, information about the current state of affairs should percolate up the hierarchy. Two-way flow of information, direction and feedback, are critical to the successful functioning of the system. If instructions from above are not formulated or carried out at the lower levels, system has no coordination and will not be protected.If information from below is not collected or conveyed to decision makers at higher levels, decisions cannot reflect the available capacity and limitations of the system or the constraints facing the system. The result is that the system can become unstable and start to lose control of the hazardous process that it is intended to control. From this perspective, safety can be viewed as an emergent product of a complex socio-technical system.

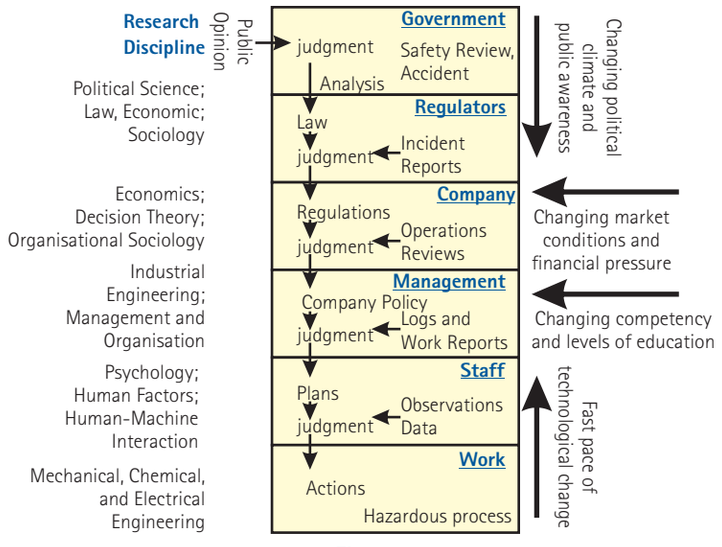


Fig-3

Threats to safety usually result from a loss of control caused by a lack of vertical integration, or mismatches between levels of a complex socio-technical system, not just from deficiencies at any one level alone. All layers play critical, albeit different, roles in maintaining safety. A lack of vertical integration is frequently caused, in part, by a lack of feedback between levels of a complex system. Actors at each level cannot see how their decisions interact with those made by actors at other levels, so the threats to safety are not obvious before an accident occurs because no one has a global view of the entire system.

(b)Dynamics

The second component of the framework, shown in Figure 4a-4b, considers the dynamic forces that can cause a complex socio-technical system to modify its structure and behaviour over time. Financial pressures that result in a cost gradient push the people in the system to reduce costs. Psychological pressures result in an effort gradient pushing people in the system to work in a more mentally or physically efficient manner. When all appears well and there are no accidents, the effort gradient will be viewed as positive, encouraging people to seek out new, better ways of getting the job done. This process of trial and innovation can be particularly important when people are being required to take on more responsibilities with fewer resources.

As a result of cost and effort gradients, work practices will be subjected to an exploratory but systematic change over time. Financial and psychological forces inevitably lead to people finding the most economic ways of performing their job. Moreover, the modification of work practices can occur at several levels of a complex socio-technical system simultaneously. Over time, this migration causes people to cross the official boundary of work practices, shown on the near left in Figure 4a-4b. People are forced to deviate from procedures and cut corners because they are responding to requests or demands to be more cost-effective. As a result, the system's defences-in-depth degrades and erodes gradually over time, not all at once.

One might think that a lack of procedural compliance and the resulting degradation in safety would raise an immediate warning flag, but this does not happen for two reasons. First, the migration in work practices is required to get the job done, given the stresses that the system is undergoing. That is why "work to rule" campaigns can cause complex socio-technical systems to come to a grinding halt. Second, the migration in work practices does not usually have any visible, immediate negative impact. The threats to safety are not obvious before an accident because the violation of procedures does not immediately lead to catastrophe. At each level in the hierarchy, people are working hard, striving to respond to cost-effective measures, but they do not see how their decisions interact with those made by other actors at different levels of the system. Yet, the sum total of these uncoordinated attempts at adapting to environmental stressors is slowly but surely building the conditions for an accident.

As a result, the migration of work practices continues. People try harder and harder to work in more efficient ways, and with each new innovation, they come closer and closer to the real boundary of safety. The boundary, however, is usually invisible; people do not know whether the system as a whole is close to or far away from disaster. Migrations from official work practices can persist and evolve for years without mishaps until the real safety boundary is reached. After an accident, workers may wonder what happened because they did not do anything differently than they had been doing in the recent past. In other words, accidents in complex socio-technical systems do not usually occur because of an unusual action or an entirely new, and it is one-time threat to safety. Instead, they result from a combination of a systematically induced migration in work practices and an odd event that winds up revealing the degradation in safety that had been occurring all the while.

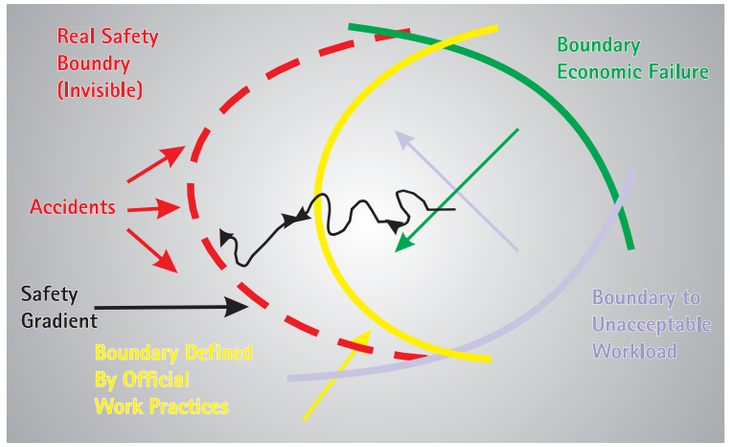


Fig-4a

So it can be concluded that the two pressure gradients, production and effort, that push actors into higher risk levels through gradual shifts in practice. This migration, associated with adapting to circumstances, does not necessarily present actors with negative feedback immediately after each "drift". In fact, the immediate feedback may be very positive, resulting in higher production and rewards but may lead to big disasters.

Socio-technical systems involved in risk management begin to be considered entirety, with all their hierarchical levels, going from "non-shop floor" operators to the legislators and government agencies, responsible for the formulation and implementation of control policies.

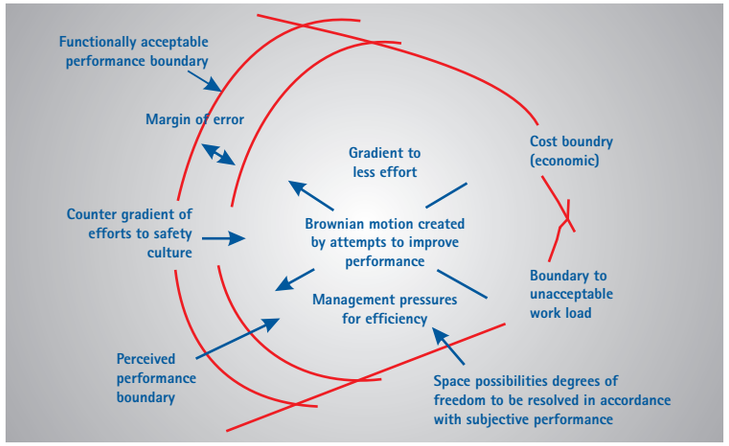


Fig-4b

2.2 Second model

The vertical orientation model (Figure-5)was suggested to "capture the causal process of losses as a boundary condition of working under pressure and to identify sensitive parameters for controlling the behaviour of organisations and individuals". The model describes the interactions between decision-makers situated at all levels in society and their roles as risk managers. The analysis takes up again the notion of control loop discussed previously, by exploring the possibilities of failure:

a) in the design of the constraints necessary for forcing the implementation of control actions;
b) in carrying out these actions;
c) in the feedback provided after carrying out the actions.

The analysis include maps that show the control loops and information prescribed or proposed between the different hierarchical levels of the system and the same maps showing the local adaptations that over the time existed in the system, being carried out in the components, whose purpose was to impose regulatory actions or inform management of the results of the actions carried out.

Table 1, shows the taxonomy of possible failures in the design, execution or feedback of the various loops analysed. The factors need to be analysed and reviewed for all components of a system especially the management policy vs economy without compromising the safety and regulatory compliance.

In behaviour-modelling the mechanisms model in terms of working situation constraints, acceptable performance boundaries and subjective criteria guiding the adaptations to the changes that should be adopted.

Table-1

1) Inadequate nature of the enforcement of constraints for implementing control actions:

1.1) Unidentified hazards.
1.2) Loss, ineffectiveness or inadequacy of the control action for the hazards identified.
1.2.1) Design of the control algorithm (process) does not enforce constraints . Failures in the creation process. Process change without the corresponding change in the control algorithm (asynchrony of evolutions). Modification or incorrect adaptation.
1.2.2) Model of inconsistent, incomplete or incorrect process ("lack of linkup"). Failures in up-dating process (asynchronous evolution). Time lags or measurement inaccuracies not accounted for.
1.2.3) Inadequate coordination between controllers and decision-makers (boundary areas between activities and co-activities).

2) Inadequate execution of control actions :
2.1) Communication break-down.
2.2) Inadequate "actuated" operation (technical device or person responsible for action conformity after auctioning the specific commands).
2.3) Time lags.

3) Loss of or inadequate feedback:
3.1) Not included in the system design.
3.2) Communication break-down.
3.3) Time lags.
3.4) Inadequate sensor operation (incorrect or no information supplied).

Organisational behaviour has influence of:
- Central and state governments policies and programmes
- Regulatory influences
- Technical and working conditions
- Overall review and monitoring of sensitive management

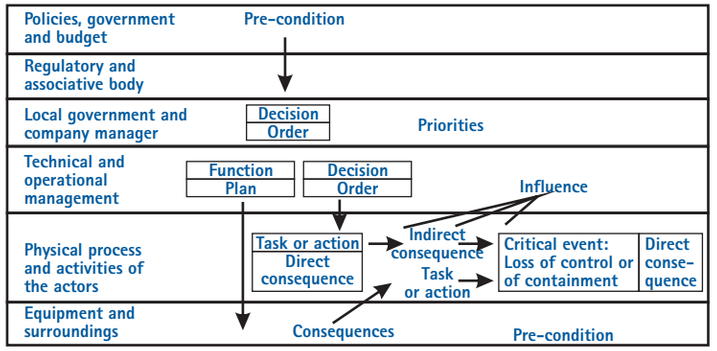


Fig-5

After analysing the factors for a system it is important to review the ILO and national initiatives. In the following paragraphs these initiatives are being described.

3. ILO initiative

ILO has developed the guidelines on Occupational Safety and Health (OSH) management for the employer to show strong leadership and commitment to OSH activities in the organisation, and make appropriate arrangements for the establishment of an OSH management system. As per the guidelines the system should contain the main elements of policy, organising, planning and implementation, evaluation and action for improvement, as shown in figure 6. These all main elements are being reproduced as:-

Fig-6

3.1 Policy

(A) Occupational safety and health policy

- The employer, in consultation with workers and their representatives, should set out in writing an OSH policy, which should be:
  - (a) specific to the organisation and appropriate to its size and the nature of its activities;
  - (b) concise, clearly written, dated and made effective by the signature or endorsement of the employer or the most senior accountable person in the organisation;
  - (c) communicated and readily accessible to all persons at their place of work;
  - (d) reviewed for continuing suitability; and
  - (e) made available to relevant external interested parties, as appropriate.
- The OSH policy should include, as a minimum, the following key principles and objectives to which the organisation is committed:
  - (a) protecting the safety and health of all members of the organisation by preventing work-related injuries, ill health, diseases and incidents;
  - (b) complying with relevant OSH national laws and regulations, voluntary programmes, collective agreements on OSH and other requirements to which the organisation subscribes;
  - (c) ensuring that workers and their representatives are consulted and encouraged to participate actively in all elements of the OSH management system; and
  - (d) continually improving the performance of the OSH management system.
- The OSH management system should be compatible with or integrated in other management systems in the organisation.

(B) Workers participation

- Workers participation is an essential element of the OSH management system in the organisation.
- The employer should ensure that workers and their safety and health representatives are consulted, informed and trained on all aspects of OSH, including emergency arrangements, associated with their work.
- The employer should make arrangements for workers and their safety and health representatives to have the time and resources to participate actively in the processes of organising, planning and implementation, evaluation and action for improvement of the OSH management system.
- The employer should ensure, as appropriate, the establishment and efficient functioning of a safety and health committee and the recognition of workers' safety and health representatives, in accordance with national laws and practice.

3.2 Organising

(A) Responsibility and accountability

- The employer should have overall responsibility for the protection of workers' safety and health, and should provide leadership for OSH activities in the organisation.
- The employer and senior management should allocate responsibility, accountability and authority for the development, implementation and performance of the OSH management system and the achievement of the relevant OSH objectives. Structures and processes should be established which:
  - (a) ensure that OSH is a line-management responsibility which is known and accepted at all levels;
  - (b) define and communicate to the members of the organisation the responsibility, accountability and authority of persons who identify, evaluate or control OSH hazards and risks;
  - (c) provide effective supervision, as necessary, to ensure the protection of workers' safety and health;
  - (d) promote cooperation and communication among members of the organisation, including workers and their representatives, to implement the elements of the organization's OSH management system;
  - (e) fulfill the principles of OSH management system contained in relevant national guidelines, tailored guidelines or voluntary programmes, as appropriate, to which the organisation subscribes;
  - (f) establish and implement a clear OSH policy and measurable objectives;
  - (g) establish effective arrangements to identify and eliminate or control work-related hazards and risks, and promote health at work;
  - (h) establish prevention and health promotion programmes;
  - (i) ensure effective arrangements for the full participation of workers and their representatives in the fulfillment of the OSH policy;
  - (j) provide appropriate resources to ensure that persons responsible for OSH, including the safety and health committee, can perform their functions properly; and
  - (k) ensure effective arrangements for the full participation of workers and their representatives in safety and health committees, where they exist.
- A person or persons at the senior management level should be appointed, where appropriate, with responsibility, accountability and authority for:
  - (a) the development, implementation, periodic review and evaluation of the OSH management system;
  - (b) periodic reporting to the senior management on the performance of the OSH management system; and

(c) promoting the participation of all members of the organsation.

(B) Competence and training

- The necessary OSH competence requirements should be defined by the employer, and arrangements should be established and maintained to ensure that all persons are competent to carry out the safety and health aspects of their duties and responsibilities.
- The employer should have access to sufficient OSH competence to identify and eliminate or control work-related hazards and risks, and to implement the OSH management system.
- Under the arrangements of policy, training programmes should:
  (a) cover all members of the organisation, as appropriate;
  (b) be conducted by competent persons;
  (c) provide effective and timely initial and refresher training at appropriate intervals;
  (d) include participants' evaluation of their comprehension and retention of the training;
  (e) be reviewed periodically. The review should include the safety and health committee, where it exists, and the training programmes, modified as necessary to ensure their relevance and effectiveness; and
  (f) be documented, as appropriate and according to the size and nature of activity of the organisation.
- Training should be provided to all participants at no cost and should take place during working hours, if possible.

(C) Occupational Safety and Health management system documentation

- According to the size and nature of activity of the organisation, OSH management system documentation should be established and maintained, and may cover:
  (a) the OSH policy and objectives of the organisation;
  (b) the allocated key OSH management roles and responsibilities for the implementation of the OSH management system;
  (c) the significant OSH hazards/risks arising from the organisation's activities, and the arrangements for their prevention and control; and
  (d) arrangements, procedures, instructions or other internal documents used within the framework of the OSH management system.
- The OSH management system documentation should be:
  (a) clearly written and presented in a way that is understood by those who have to use it; and
  (b) periodically reviewed, revised as necessary, communicated and readily accessible to all appropriate or affected members of the organisation.
- OSH records should be established, managed and maintained locally and according to the needs of the organisation. They should be identifiable and traceable, and their retention times should be specified.
- Workers should have the right to access records relevant to their working environment and health, while respecting the need for confidentiality.

- OSH records may include:
  (a) records arising from the implementation of the OSH management system;
  (b) records of work-related injuries, ill health, diseases and incidents;
  (c) records arising from national laws or regulations dealing with OSH;
  (d) records of workers' exposures, surveillance of the working environment and workers' health; and
  (e) the results of both active and reactive monitoring.

(D) Communication

- Arrangements and procedures should be established and maintained for:
  (a) receiving, documenting and responding appropriately to internal and external communications related to OSH;
  (b) ensuring the internal communication of OSH information between relevant levels and functions of the organisation; and
  (c) ensuring that the concerns, ideas and inputs of workers and their representatives on OSH matters are received, considered and responded to.

3.3 Planning and implementation

(A) Initial review

- The organisation's existing OSH management system and relevant arrangements should be evaluated by an initial review, as appropriate. In the case where no OSH management system exists, or if the organisation is newly established, the initial review should serve as a basis for establishing an OSH management system.
- The initial review should be carried out by competent persons, in consultation with workers and/or their representatives, as appropriate. It should:
  (a) identify the current applicable national laws and regulations, national guidelines, tailored guidelines, voluntary programmes and other requirements to which the organisation subscribes;
  (b) identify, anticipate and assess hazards and risks to safety and health arising from the existing or proposed working environment and working organisation;
  (c) determine whether planned or existing controls are adequate to eliminate hazards or control risks; and
  (d) analyse the data provided from workers' health surveillance.

  The result of the initial review should:
  (a) be documented;
  (b) become the basis for making decisions regarding the implementation of the OSH management system; and continual improvement of the organisation.

.**(B) System planning, development and implementation**

- The purpose of planning should be to create an OSH management system that supports:
  - (a) as the minimum compliance with national laws and regulations;
  - (b) the elements of the organisation's OSH management system; and
  - (c) continual improvement in OSH performance.
- Arrangements should be made for adequate and appropriate OSH planning, based on the results of the initial review, subsequent reviews or other available data. These planning arrangements should contribute to the protection of safety and health at work, and should include:
  - (a) a clear definition, priority setting and quantification, where appropriate, of the organisation's OSH objectives;
  - (b) preparation of a plan for achieving each objective, with defined responsibility and clear performance criteria indicating what is to be done by whom and when;
  - (c) the selection of measurement criteria for confirming that the objectives are achieved; and
  - (d) the provision of adequate resources, including human and financial resources and technical support, as appropriate.
- The OSH planning arrangements of the organisation should cover the development and implementation of all the OSH management system elements, as described in the ILO guidelines and illustrated in figure 5.

(C) Occupational safety and health objectives

- Consistent with the OSH policy and based on the initial or subsequent reviews, measurable OSH objectives should be established, which are:
  - (a) specific to the organisation, and appropriate to and according to its size and nature of activity;
  - (b) consistent with the relevant and applicable national laws and regulations, and the technical and business obligations of the organisation with regard to OSH;
  - (c) focused towards continually improving workers' OSH protection to achieve the best OSH performance;
  - (d) realistic and achievable;
  - (e) documented, and communicated to all relevant functions and levels of the organisation; and
  - (f) periodically evaluated and if necessary updated.

(D) Hazard prevention

(a) Prevention and control measures

- Hazards and risks to workers' safety and health should be identified and assessed on an ongoing basis. Preventive and protective measures should be implemented in the following order of priority:
  - (a) eliminate the hazard/risk;

  - (b) control the hazard/risk at source, through the use of engineering controls or organisational measures;
  - (c) minimize the hazard/risk by the design of safe work systems, which include administrative control measures; and
  - (d) where residual hazards/risks cannot be controlled by collective measures, the employer should provide for appropriate personal protective equipment, including clothing, at no cost, and should implement measures to ensure its use and maintenance.
- Hazard prevention and control procedures or arrangements should be established and should:
  - (a) be adapted to the hazards and risks encountered by the organisation;
  - (b) be reviewed and modified if necessary on a regular basis;
  - (c) comply with national laws and regulations, and reflect good practice; and
  - (d) consider the current state of knowledge, including information or reports from organisations, such as labour inspectorates, occupational safety and health services, and other services as appropriate.

(b) Management of change

- The impact on OSH of internal changes (such as those in staffing or due to new processes, working procedures, organisational structures or acquisitions) and of external changes (for example, as a result of amendments of national laws and regulations, organisational mergers, and developments in OSH knowledge and technology) should be evaluated and appropriate preventive steps should be taken prior to the introduction of changes.
- A workplace hazard identification and risk assessment should be carried out before any modification or introduction of new work methods, materials, processes or machinery. Such assessment should be done in consultation with and involving workers and their representatives, and the safety and health committee, where appropriate.
- The implementation of a "decision to change" should ensure that all affected members of the organisation are properly informed and trained.

(c) Emergency prevention, preparedness and response

- Emergency prevention, preparedness and response arrangements should be established and maintained. These arrangements should identify the potential for accidents and emergency situations, and address the prevention of OSH risks associated with them. The arrangements should be made according to the size and nature of activity of the organisation. They should:
  - (a) ensure that the necessary information, internal communication and coordination are provided to protect all people in the event of an emergency at the worksite;
  - (b) provide information to, and communication with, the relevant competent authorities, and the neighbourhood and emergency response services;

(c) address first-aid and medical assistance, firefighting and evacuation of all people at the worksite; and
(d) provide relevant information and training to all members of the organisation, at all levels, including regular exercises in emergency prevention, preparedness and response procedures.

- Emergency prevention, preparedness and response arrangements should be established in cooperation with external emergency services and other bodies where applicable.

(d) Procurement

- Procedures should be established and maintained to ensure that:
  (a) compliance with safety and health requirements for the organisation is identified, evaluated and incorporated into purchasing and leasing specifications;
  (b) national laws and regulations and the organisation's own OSH requirements are identified prior to the procurement of goods and services; and
  (c) arrangements are made to achieve conformance to the requirements prior to their use.

(e) Contracting

- Arrangements should be established and maintained for ensuring that the organisation's safety and health requirements, or at least the equivalent, are applied to contractors and their workers.

Arrangements for contractors working on site should:
(a) include OSH criteria in procedures for evaluating and selecting contractors;
(b) establish effective on going communication and coordination between appropriate levels of the organisation and the contractor prior to commencing work. This should include provisions for communicating hazards and the measures to prevent and control them;
(c) include arrangements for reporting of work-related injuries, ill health, diseases and incidents among the contractors' workers while performing work for the organisation;
(d) provide relevant workplace safety and health hazard awareness and training to contractors or their workers prior to commencing work and as work progresses, as necessary;
(e) regularly monitor OSH performance of contractor activities on site; and
(f) ensure that on-site OSH procedures and arrangements are followed by the contractor(s).

Contractors' employees are vulnerable to OSH aspects and generally become victims for risk on one side and on other side these employees/workers are poor in the complianceof OSH policy. Hence proper monitoring and review is required to contractors.

3.4 Evaluation

(A) Performance monitoring and measurement

- Procedures to monitor, measure and record OSH performance on a regular basis should be developed, established and periodically reviewed. Responsibility, accountability and authority for monitoring at different levels in the management structure should be allocated.
- The selection of performance indicators should be according to the size and nature of activity of the organisation and the OSH objectives.
- Both qualitative and quantitative measures appropriate to the needs of the organisation should be considered. These should:
  (a) be based on the organisation's identified hazards and risks, the commitments in the OSH policy and the OSH objectives; and
  (b) support the organisation's evaluation process, including the management review.
- Performance monitoring and measurement should:
  (a) be used as a means of determining the extent to which OSH policy and objectives are being implemented and risks are controlled;
  (b) include both active and reactive monitoring, and not be based only upon workrelated injury, ill health, disease and incident statistics; and
  (c) be recorded.
- Monitoring should provide:
  (a) feedback on OSH performance;
  (b) information to determine whether the day-to-day arrangements for hazard and risk identification, prevention and control are in place and operating effectively; and
  (c) the basis for decisions about improvement in hazard identification and risk control, and the OSH management system.
- Active monitoring should contain the elements necessary to have a proactive system and should include:
  (a) monitoring of the achievement of specific plans, established performance criteria and objectives;
  (b) the systematic inspection of work systems, premises, plant and equipment;
  (c) surveillance of the working environment, including work organisation;
  (d) surveillance of workers' health, where appropriate, through suitable medical monitoring or follow-up of workers for early detection of signs and symptoms of harm to health in order to determine the effectiveness of prevention;
  (e) compliance with applicable national laws and regulations, collective agreements and other commitments on OSH to which the organisation subscribes;

(f) other losses, such as damage to property;
(g) deficient safety and health performance, and OSH management system failures; and
(h) workers' rehabilitation and health-restoration programmes.

(B) Investigation of work-related injuries, ill health, diseases and incidents, and their impact on safety and health performance

- The investigation of the origin and underlying causes of work-related injuries, ill health, diseases and incidents should identify any failures in the OSH management system and should be documented.
- Such investigations should be carried out by competent persons, with the appropriate participation of workers and their representatives.
- The results of such investigations should be communicated to the safety and health committee, where it exists, and the committee should make appropriate recommendations.
- The results of investigations, in addition to any recommendations from the safety and health committee, should be communicated to appropriate persons for corrective action, included in the management review and considered for continual improvement activities.
- The corrective action resulting from such investigations should be implemented in order to avoid repetition of work-related injuries, ill health, diseases and incidents.
- Reports produced by external investigative agencies, such as inspectorates and social insurance institutions, should be acted upon in the same manner as internal investigations, taking into account issues of confidentiality.

(C) Audit

- Arrangements to conduct periodic audits should be established in order to determine whether the OSH management system and its elements are in place, adequate, and effective in protecting the safety and health of workers and preventing incidents.
- An audit policy and programme should be developed, which includes a designation of auditor competency, the audit scope, the frequency of audits, audit methodology and reporting.
- The audit includes an evaluation of the organisation's OSH management system elements or a subset of these, as appropriate. The audit should cover:
  (a) OSH policy;
  (b) workers' participation;
  (c) responsibility and accountability;
  (d) competence and training;
  (e) OSH management system documentation;
  (f) communication;
  (g) system planning, development and implementation;
  (h) prevention and control measures;

(i) management of change;
(j) emergency prevention, preparedness and response;
(k) procurement;
(l) contracting;
(m) performance monitoring and measurement;
(n) investigation of work-related injuries, ill health, diseases and incidents, and their impact on safety and health performance;
(o) compliance of previous audits;
(p) management review;
(q) preventive and corrective action;
(r) continual improvement; and
(s) any other audit criteria or elements that may be appropriate.

- The audit conclusion should determine whether the implemented OSH management system elements or a subset of these:
  (a) are effective in meeting the organisation's OSH policy and objectives;
  (b) are effective in promoting full worker participation;
  (c) respond to the results of OSH performance evaluation and previous audits;
  (d) enable the organisation to achieve compliance with relevant national laws and regulations; and
  (e) fulfill the goals of continual improvement and best OSH practice.
- Audits should be conducted by competent persons internal or external to the organisation who are independent of the activity being audited.
- The audit results and audit conclusions should be communicated to those responsible for corrective action.
- Consultation on selection of the auditor and all stages of the workplace audit, including analysis of results, are subjected to workers' participation, as appropriate.

(D) Management review

- Management reviews should:
  (a) evaluate the overall strategy of the OSH management system to determine whether it meets planned performance objectives;
  (b) evaluate the OSH management system's ability to meet the overall needs of the organisation and its stakeholders, including its workers and the regulatory authorities;
  (c) evaluate the need for changes to the OSH management system, including OSH policy and objectives;
  (d) identify what action is necessary to remedy any deficiencies in a timely manner, including adaptations of other aspects of the organisation's management structure and performance measurement;
  (e) provide the feedback direction, including the determination of priorities, for meaningful planning and continual improvement; and
  (f) evaluate progress towards the organisation's OSH objectives and corrective action activities.

- Reactive monitoring should include the identification, reporting and investigation of:
  - (a) work-related injuries, ill health (including monitoring of aggregate sickness, absence records), diseases and incidents;
  - (g) evaluate the effectiveness of follow-up actions from earlier management reviews.
- The management review should consider:
  - (a) the results of work-related injuries, ill health, diseases and incident investigations; performance monitoring and measurement; and audit activities;
  - (b) additional internal and external inputs as well as changes, including organisational changes, that could affect the OSH management system.
- The findings of the management review should be recorded and formally communicated to:
  - (a) the persons responsible for the relevant element(s) of the OSH management system so that they may take appropriate actions; and
  - (b) the safety and health committee, workers and their representatives.

3.5 Action for improvement

(A) Preventive and corrective actions

Arrangements should be established and maintained for preventive and corrective actions resulting from OSH management system performance monitoring and measurement, OSH management system audits and management reviews. These arrangements should include:

- (a) identifying and analysing the root causes of any non-conformities with relevant OSH regulations and/or OSH management system's arrangements; and
- (b) initiating, planning, implementing, checking the effectiveness of and documenting corrective and preventive action, including changes to the OSH management system itself.

- When the evaluation of the OSH management system or other sources show that preventive and protective measures for hazards and risks are inadequate or likely to become inadequate, the measures should be addressed according to the recognised hierarchy of prevention and control measures, and completed and documented, as appropriate and in a timely manner.

(B) Continual improvement

- These arrangements should take into account:

- (a) the OSH objectives of the organisation;
- (b) the results of hazard and risk identifications and assessments;
- (c) the results of performance monitoring and measurements;
- (d) the investigation of work-related injuries, diseases, ill health and incidents, and the results and recommendations of audits;
- (e) the outcomes of the management review;
- (f) the recommendations for improvement from all members of the organisation, including the safety and health committee, where it exists;
- (g) changes in national laws and regulations, voluntary programmes and collective agreements;
- (h) new relevant information; and
- (i) the results of health protection and promotion programmes.

- The safety and health processes and performance of the organisation should be compared with others in order to improve health and safety performance.

4. Indian initiatives

Health and safety is one of the most important aspects of an organisation's smooth and effective functioning. Good health and safety performance ensures an accident free industrial environment. With the continuous and untiring efforts of various legislative authorities as well as NGOs, the awareness of Occupational Safety and Health (OS and H) has improved in India considerably. Organisations have started attaching the same importance to achieve high OS&H performance as they do to other key aspects of their business activities. This demands adoption of a structured approach for the identification of hazards, their evaluation and control of risks. Considering this fact and a great demand from the industry for a comprehensive framework for OS and H, it was decided to formulate an Indian Standard on OS and H management systems as IS 18001 : 2000. The Indian Standards listed below (Table-2) have been considered in making the standard:

Table-2

Indian Standard (IS) No	Title
3786 : 1983	Method of computation of frequency and severity rates for industrial injuries and classification of industrial accidents (first revision)
14001 : 1996	Environmental management systems specification with guidance for use
14489 : 1998	Code of practice on occupational safety and health audit

The Occupational Safety and Health (OS and H) management into the existing overall management system should be considered within a general management system model that incorporates the following principles (Fig. 7).

Principle 1 Commitment and Policy – An organisation should define its OS&H policy and ensure commitment to its OS and H management systems.

Principle 2 Planning – An organisation should plan to fulfill its OS and H policy, objectives and targets.

Principle 3 Implementation and Operation – For effective implementation, an organisation should develop the capabilities and support mechanism necessary to achieve its OS&H policy, objectives and targets.

Principle 4 Measurement and Evaluation – An organisation should measure, monitor and evaluate its OS&H performance and take preventive and corrective action.

Principle 5 Management Review – An organisation should regularly review and continually improve its OS&H management system, with the objective of improving its OH and S performance.

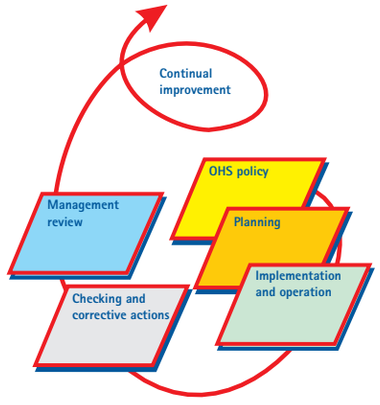


Fig-7

5. OS and H System vs incident learning:

Incident reporting system brings safety problems to the attention of management. Incident reporting is an important and necessary part of the incident learning system and, based on the literature survey a relationship can be established as shown in Figure 8.

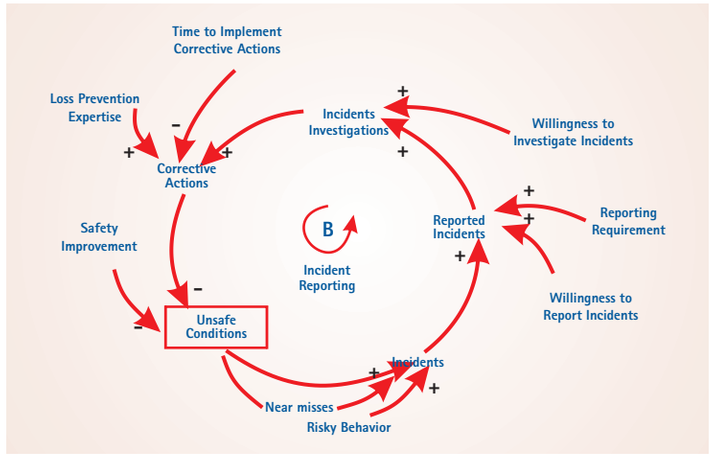


Fig-8

The model shows that risky behaviour with unsafe conditions leads to incidents/ accidents. These incidents will only be reported when there is willingness of reporting incidents and it is governed by either the existing regulatory requirement and or due to management policy. The reported incidents will then be investigated to know the reasons for corrective actions. Corrective actions will improve the unsafe conditions and also the risky behaviour. These in turn will lead to review of the other resources and requirement of OS and H as discussed. Therefore management should promote for incidents/accidents reporting.

If management demonstrates a commitment to safety through their words and deeds then eventually this will translate into a higher Personal Commitment to Safety on the part of employees. As shown in Figure 9, this role-modeling behavior helps to reinforce the balance between productivity and safety that management has struck. To see this, consider what happens when Management Commitment to Safety goes up. After a delay, personal commitment to safety also goes up. Via the outer feedback loop, this leads to a greater willingness to report incidents and higher safety pressure to reinforce management commitment to safety. Via the inner feedback loop, this leads to less risky behavior, causing lower losses and less productivity pressure. Less productivity pressure allows management to maintain its focus on safety. The same type of positive reinforcement occurs if management commitment to safety is falling. However, research shows that incidents are typically not reported. Reasons for not reporting incidents include a fear of punishment, bureaucratic or confusing reporting requirements, or quite simply a desire not to interrupt the work flow.

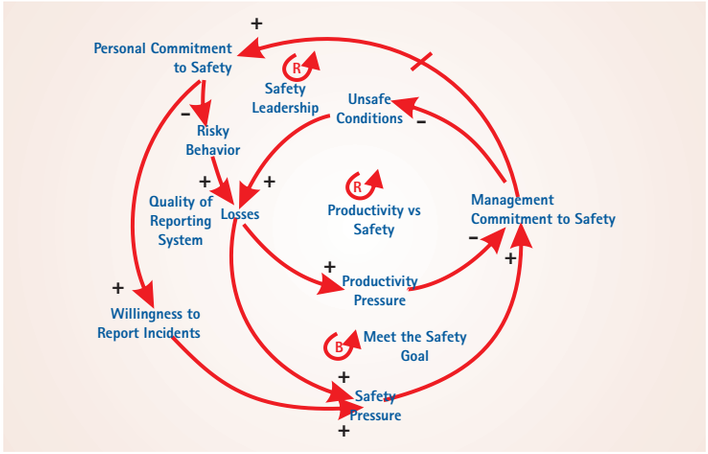


Fig-9

Learning from incidents is not an entirely new concept, but it has not been fully explored as a system for long-term continuous improvement to organisational performance from safety improvement angle. A "disaster dynamics" model that provides insight into the role that a stream of events or frequent interruptions can play in causing disaster by "information overload," but they were not concerned with incident learning. The time period for their dynamic simulation was minutes rather than the months and years involved in incident learning. However, their model does provide a relevant warning that an incident learning system will collapse if it becomes overloaded with incidents. To deal with the incident workload, dedicated resources and processes are required to ensure effective learning. As an example, the commercial airlines have these dedicated resources and, as Haunschild and Sullivan (2002) report, learning from incidents is indeed taking place in this industry. To understand how learning can be facilitated, Figure 10 shows the fundamental components of an incident learning system. We will briefly describe each of these to help clarify how the system works in following points:-

- The importance of identification of accidents and investigation is important learning to reduce the accidents in future and it is only possible when the organisation is sensitised to learning from incidents.
- The next component of incident learning is reporting. As the Center for Chemical Process Safety points out, an incident cannot be investigated unless it is reported. Furthermore, the fraction of incidents reported is dependent on the personal commitment to safety of the workers who observe or are involved in the incidents.

As discussed the management creates the safety climate and so personal commitment to safety of the workers is strongly influenced by management's commitment to safety. Management can show their commitment to safety by creating a climate in which incident reporting is rewarded instead of punished. Incident investigation is the most well-known component of the incident learning system, involving examination of the site, interviewing witnesses, gathering and evaluating all available data to establish the sequence of events and determine exactly what happened. An investigation team will be more effective than a single investigator.

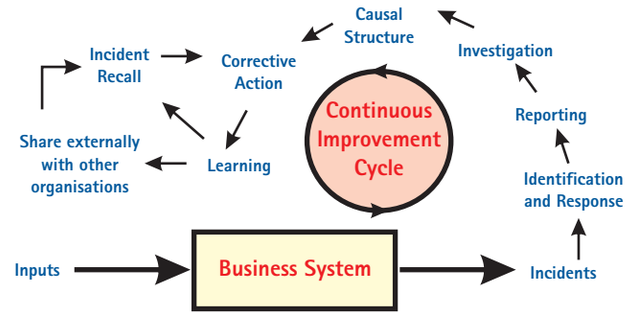


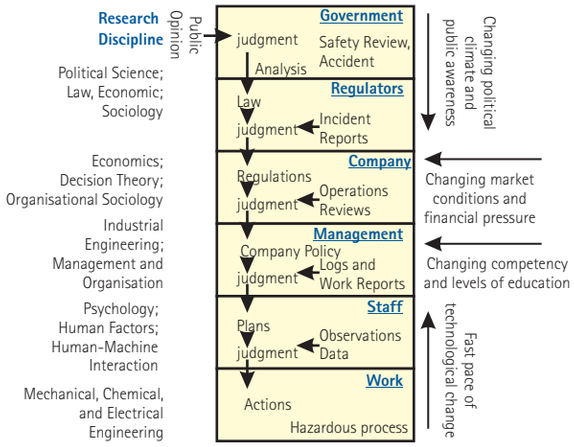
Fig-10

- The literature suggests that the purpose of incident investigation is to determine the basic or root causes of the incident. However, since there may be no single "root cause," efforts are better directed towards identifying causal structure (a system model of the causal relationships).
- Next, it is important to implement corrective actions and follow up on all recommendations made by the investigation team. This is particularly true for actions to eliminate systemic causes of incidents, which may span the organisation and involve many people in different departments and locations. Processes outside of the incident learning system, such as management of change, audits and inspections, are useful in checking that corrective actions have been successfully implemented without introducing new risks.
- Finally, it is important to capture and communicate the learning from the incident, including the relative success or effectiveness of the corrective actions that were taken. This can be done by distributing a summary report by e-mail, website posting, or other means, and should be directed both locally and centrally. In this step organisations should not hesitate in gathering information and lessons learned from other disasters and organisations to translate the best practices into business system to reduce the frequency of incidents.

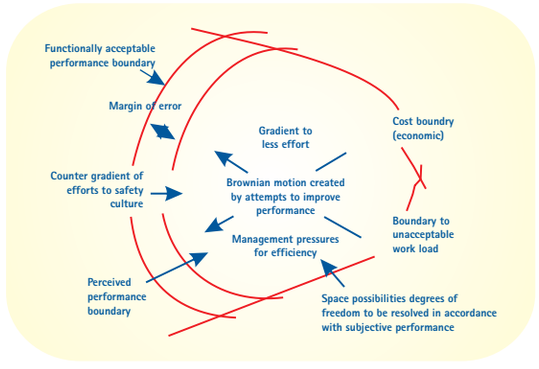
The whole process should be a continual process after each incident.

Exercise-1

Study the following diagram in detail to identify the factors/policies with each of the players, who plays an important role in causing and controlling the accidents and disasters.



Exercise-2



1. Identify how risk in your establishment has increased due to economic drive leading to threat to the organisation.
2. Suggest the coordinated ways where economic drive, target of production and safety can go simultaneously.
3. Think both above in your industry for risk management.

Space for Exercise

Space for Exercise-1

Space for Exercise-2

6. Conclusion

The organisation's top management shall at regular intervals review the OS and H management system to ensure continuing suitability, adequacy and effectiveness. The management review process shall ensure that the necessary information is collected to allow management to carry out this evaluation. This review shall be documented. The management review shall consider:

a) the overall performance of the OS and H management systems;
b) the performance of individual elements of the systems;
c) the finding of audits;
d) internal and external factors, such as changes in organisational structure, legislation pending, introduction of new technology, etc, and shall identify what action is necessary to remedy any deficiencies;
e) adequacy of corrective and preventive action; and
f) compliance of all regulatory provisions.

7. Glossary

- **Audit:** A systematic, independent and documented process for obtaining evidence and evaluating it objectively to determine the extent to which defined criteria are fulfilled. This does not necessarily mean an independent external audit (an auditor or auditors from outside the organisation).
- **Contractor:** A person or an organisation providing services to an employer at the employer's worksite in accordance with agreed specifications, terms and conditions.
- **Employer:** Any physical or legal person that employs one or more workers.
- **Hazard:** The inherent potential to cause injury or damage to life, property and environment.
- **Hazard assessment:** A systematic evaluation of hazards.
- **Incident:** An unsafe occurrence arising out of or in the course of work where no personal injury is caused.
- **Organisation:** A company, operation, firm, undertaking, establishment, enterprise, institution or association, or part of it, whether incorporated or not, public or private, that has its own functions and administration. For organisations with more than one operating unit, a single operating unit may be defined as an organisation.
- **Risk:** A combination of the likelihood of an occurrence of a hazardous event and the severity of injury or damage to the health of people caused by this event.
- **Risk assessment:** The process of evaluating the risks to safety and health arising from hazards at work.
- **Worker:** Any person who performs work, either regularly or temporarily, for an employer.
- **Worksite:** Physical area where workers need to be or to go due to their work which is under the control of an employer.

8. References

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Notes