International Association Of Certified Practicing Engineers	www.iacpe.com Knowledge, Certification, Networking	Rev: 01 Rev 01 – August 2016
IACPE No 19, Jalan Bilal Mahmood 80100 Johor Bahru Malaysia	**ACCIDENT INCIDENT INVESTIGATION** **CERTIFIED PRACTICING SAFETY PROFESSIONAL TRAINING MODULE**	

The International Association of Certified Practicing Engineers is providing the introduction to the Training Module for your review.

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INTRODUCTION

Scope

In 2014 4,679 full time workers were killed on the job. Which is on average, about 90 workers a week or more 13 people killed every day. The fatal work injuries involving contractors accounted for 17 percent of all fatal work injuries in 2014.

The purpose of the training guide is to give insight and a step by step guide to complete an accident investigation. There are four major steps that will be discussed in this training guide along with details as to why each of the steps is completed and the skills set that is required by the individuals conducting the investigation.

The steps are as follows:

- Gather the Information
- Analyze the Information
- Risk Control Measures
- The Action Plan

General Design Consideration

Every year people are killed or injured at work. An average of greater than 4000 employees and self-employed people are killed each year because of accidents in the workplace. (1) A further 150,000 sustain major injuries or injuries that mean they are absent from work for more than three days. Over 2.3 million cases of ill health are caused or made worse by work. (2) Over 40 million working days are lost annually through work-related accidents and illnesses. Over the past century, safety professionals have tried to more effectively explain how and why accidents occur

Accidents are unexpected events or occurrences that result in unwanted or undesirable outcomes. The unwanted outcomes can include harm or loss to personnel, property, production, or nearly anything that has some inherent value. These losses increase an organization's operating cost through higher production costs, decreased efficiency, and the long-term effects of decreased employee morale and unfavorable public opinion. The same accidents happen again and again, causing suffering and distress to an ever-widening circle of workers and their families. Incident includes all undesired circumstances and near misses which have the potential to cause accidents, or have a potentially significant environmental impact.

In most accidents, human performance is likely to be a significant causal factor. In another situation, an accident may occur because of an equipment malfunction, which upon further investigation is found to result from a poorly constructed control device. The human factors framework consists of five key areas that should be addressed in any accident investigation (DOE, 2000):

1. Human-machine interface

In every accident, there is a human consideration, or a human-made object, or both. Generally, any accident can be attributed to a human activity or response

2. Human capabilities

Determining whether worker capabilities match work requirements is another human factor consideration. Persons in this occupation who lack high levels of these capabilities have a greater propensity to cause accidents. Many other capabilities can affect performance, depending on specific task requirements:

- Experience, knowledge, and training: For any task or work activity, human performance is generally enhanced if the person has previous experience in

performing the task, has knowledge of the input, and understands the meaning of various indicators and the implications of various actions. This knowledge and experience can be gained through formal training, education, and on-the-job training.

- Physical aptitude, fitness, and behavior: A worker's capability to perform effectively may be reduced by: (a) recent injuries or surgery or temporary physical limitations; (b) seasonal allergies or other temporary disorders; (c) changes in visual capacity (e.g., decreased visual acuity due to aging, color vision, and night adaptation) or changes in work that demand greater visual abilities; (d) hearing loss due to noise exposure; and (e) physical and neurological effects due, for example, to exposure to toxic materials.
- Stress: Workers may experience stress because of work-related or personal events. Sources of stress may stem from: (a) drug use—which can impair motor and cognitive functions—including taking prescription or over-the-counter medications to alleviate a condition or injury (e.g., taking antihistamines for allergies); (b) alcohol consumption, which can reduce sensory perception resulting in loss of physical coordination; and (c) smoking, which can cause muscular deterioration and weakness among other things.
- Fatigue: A worker may become fatigued due to disruptions in sleep patterns resulting from social, familial, or work factors such as an excessive workload for an extended period.
- Work or shift changes: Changes in working hours (from day to evening) can alter a worker's effectiveness until he/she has adjusted to the change in schedule.

3. Equipment/design considerations

Equipment can also contribute to an accident in two main ways. One way is for an equipment malfunction to directly cause the accident. A second way is for the equipment to contribute to a human error that then causes the accident. There are two main sources of human error: design flaws and improper maintenance. When an accident involves some type of equipment, it is useful to examine the equipment to determine whether the design is compatible with human capabilities and consistent with commonly accepted operating practices and norms.

Table 1: Equipment design can affect human performance

Features	Interaction Characteristics
Large Equipment	• Equipment to carry or house humans should be designed with specified size, stature, and sitting height limitations. • A proper field of view should be provided.
Control Placement and Operations	• Control knobs and dials should be positioned so that an operator can easily reach and operate them. • Controls should be placed in an arrangement that logically reflects the normal sequence of operations. • Control operation should be compatible with widely accepted standards or norms (e.g., knobs turn clockwise to increase power and counterclockwise to decrease power).
Visual Displays	• Information presented in visual displays should be easy to perceive, process, and interpret. • Coded information should be compatible with widely accepted standards or norms (e.g., color-coded indicators, such as red for danger, yellow for caution).
Audio Indicators	• Audio alarms should be easily interpreted and distinguishable from other audio indicators. • Audio alarms should be compatible with widely accepted standards or norms, so that high frequency and rates indicate urgency.

4. Physical work environment

Environmental factors can influence human-machine performance and thereby contribute to an accident. The physical work environment is the setting in which the accident occurred. Environmental factors that may influence the effective performance of both humans and equipment include:

- Illumination: The level of lighting must be sufficient for workers to have a good view of their work environment, the equipment, and the materials they are working with.
- Noise: High levels of noise can distract workers from concentrating on the task they are performing. In addition, high levels of extraneous noise can interfere with audio indicators that workers rely on to signal actions or activities.
- Vibration and motion: High levels of vibration and motion can interfere with human task performance, especially tasks that require fine motor movement. Vibration can also interfere with equipment performance, causing unexpected performance decrements in equipment that is normally considered highly reliable.
- Thermal conditions: Worker performance is influenced by temperature extremes, which can often influence worker concentration (information processing and decision-making). Extreme temperatures may also affect human control responses by requiring additional clothing or gear for protection. In addition, equipment may have limited operating conditions under extreme temperatures. It is important to identify the limits of equipment and machines under extreme temperatures.
- Altitude and depth: Humans can experience physical functioning problems when performing at high altitudes and extreme depths; in general, humans also experience cognitive functioning decrements under both these conditions.

5. Organizational work environment.

Effective safety management systems are critical to establish a work environment in which safe operations are assured.

There are two causes of accident; immediate causes and basic causes.

1. Immediate Causes

The “immediate causes” of accidents are the circumstances that immediately precede the event. They usually can be seen or sensed. Frequently they are called “unsafe acts” (behaviors which could permit the occurrence of an accident) and “unsafe conditions” (circumstances which could permit the occurrence of an accident). Table 2 give the examples of unsafe acts and unsafe conditions.

Table 2: The examples of unsafe acts and unsafe conditions.

Unsafe Acts	Unsafe Conditions
• Operating equipment without authority • Failure to warn • Failure to secure • Operating at improper speed • Making safety device inoperable • Removing safety devices • Using defective equipment • Using equipment improperly • Failing to use personal protective equipment properly • Improper loading • Improper placement • Improper lifting • Improper position for task • Servicing equipment in operation • Horseplay • Under influence of alcohol and/or other drugs	• Inadequate guards or barriers • Inadequate or improper protective equipment • Defective tools, equipment or materials • Congestion or restricted action • Inadequate warning systems • Fire and explosion hazards • Poor housekeeping; disorderly workplace • Hazardous environmental conditions; gases, dusts, smokes, fumes, vapors • Noise exposures • Radiation exposures • High or low temperature exposures • Inadequate or excessive illumination • Inadequate ventilation

2. Basic causes

Basic causes are the real causes behind the symptoms; the reasons why the unsafe acts and conditions occurred; the factors that, when identified, permit meaningful management control. Often, these are referred to as root causes, real causes, indirect causes, underlying or contributing causes. Basic causes have two major categories; Personal factors and job factor. Table 3 give the examples of these categories.

Table 3: Examples of Basic Causes

Personal Factors	Job Factors
• Inadequate capability (Physical/ Physiological & Mental/Psychological) • Lack of knowledge • Lack of skill • Stress (Physical/Physiological & Mental/ Psychological) • Improper motivation	• Inadequate leadership and/or supervision • Inadequate engineering • Inadequate purchasing • Inadequate maintenance • Inadequate tools, equipment, materials • Inadequate work standards • Wear and tear • Abuse or misuse

There are two fundamental types of accidents should be avoid; individual and system accidents.

1. Individual Accidents

Individual accidents is an accident occurs wherein the worker is not protected from the hazards of an operation and is injured (e.g., radiation exposure, trips, slips, falls, industrial accident, etc.). The inherent challenges in investigating an individual accident are due to the source of the human error and the victim or target of the accident can often be the same individual. This can lead to a limited or contained analysis that fails to consider the larger organizational or systemic contributors to the accident. These types of accidents

involving individual injuries can overly focus on the mitigating barriers or personnel protection equipment (PPE) that avoid injuries and not consider the appropriate preventative barriers to prevent the actual accident.

The focus of preventing individual accidents is to protect the worker from hazards inherent in mission operation. To prevent recurrence of individual injury accidents, corrective actions from accident investigations must identify what barriers failed and why [i.e., stop the source and the flow of energy from the hazards to the target (the worker)]. The mitigating barriers are important to reducing or eliminating the harm or consequences of the accident, but emphasis must be on barriers to prevent the accident from occurring.

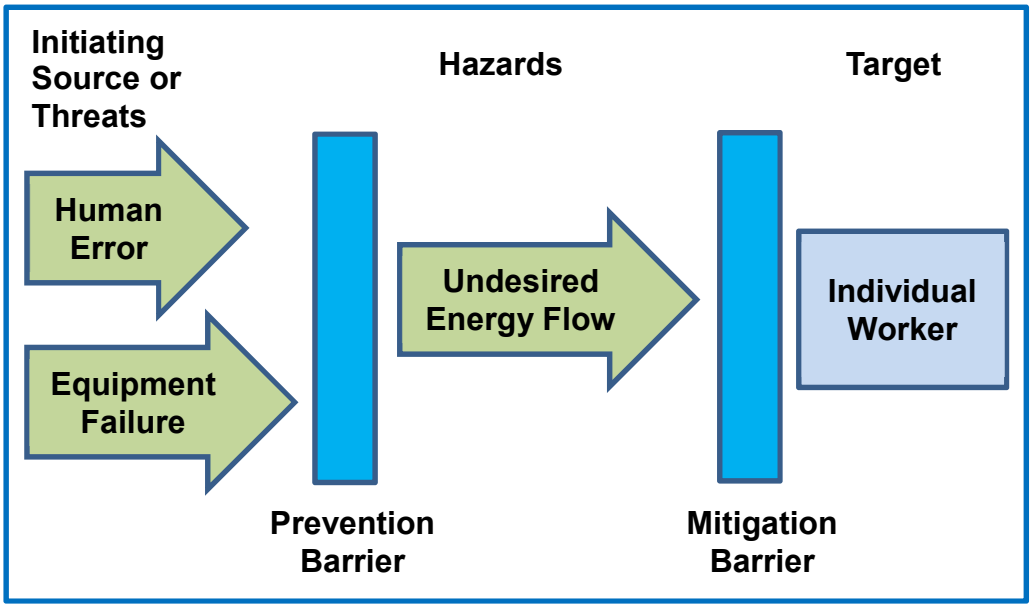

Figure 1: Individual Accident

2. System Accident

A system accident is an accident wherein the protective and mitigating systems collectively fail allowing release of the hazard and adversely affecting many people, the community and potentially the environment. System hazards are typically managed from cradle to grave through risk management. Risk management processes identify the potential threats, weaknesses, and failures as risks to the design, construction, operations, maintenance, and disposition of the system. Risk management establishes

and records the risk parameters (or basis) and the investment decisions, the control systems, and policies to mitigate these risks.

System accidents occur from four sources:

- Human error such as someone dropping high explosives resulting in detonation.
- Failure of a piece of equipment, tooling or facility. For example, a piece of tooling with faulty bolts causes high explosive to drop on the floor resulting in detonation.
- From a natural disaster, such as an earthquake resulting in falling debris that could detonation high explosives.
- “Other” as of yet undiscovered to accommodate future discoveries

The most likely differentiation of the type of accident investigation is from experience that individual accidents are likely to be influenced by work practices, plans and oversight, while system failures will most likely be influenced by risk management process for design, operations, or maintenance. System accidents require a more in-depth investigation into the policies and management culture that drives risk management decision-making.

The focus of preventing system accidents is to maintain the physical integrity of operational barriers such that they prevent threats that may result from human error, malfunctions in equipment or operational processes, facility malfunctions or from natural disasters or such that they mitigate the consequences of the event in case prevention fails. The idea is that one wants to isolate these hazards from those things that would threaten to release the unwanted energy or material, such as human errors, faulty equipment, sabotage, or natural disasters such as wind and lightning through the use of preventive barriers. If this is done, work can proceed safely (accidents are avoided).

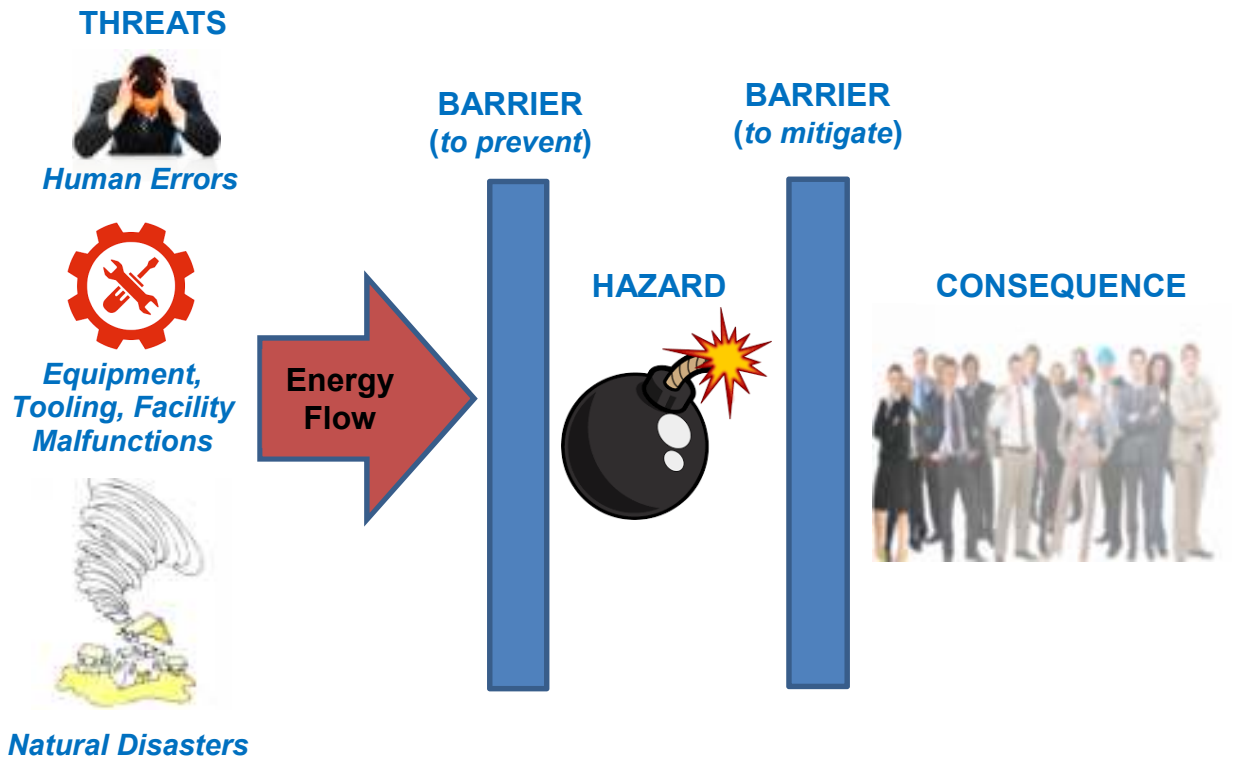

Figure 2: Prevent a system accident (DOE, 2012)

An accident model is the frame of reference, or stereotypical way of thinking about an accident, that are used in trying to understand how an accident happened. The frame of reference is often an unspoken, but commonly held understanding, of how accidents occur. The advantage is that communication and understanding become more efficient because some things (e.g., common terminology, common experiences, common points-of-reference, or typical sequences) can be taken for granted. The disadvantage is that it favors a single point of view and does not consider alternate explanations.

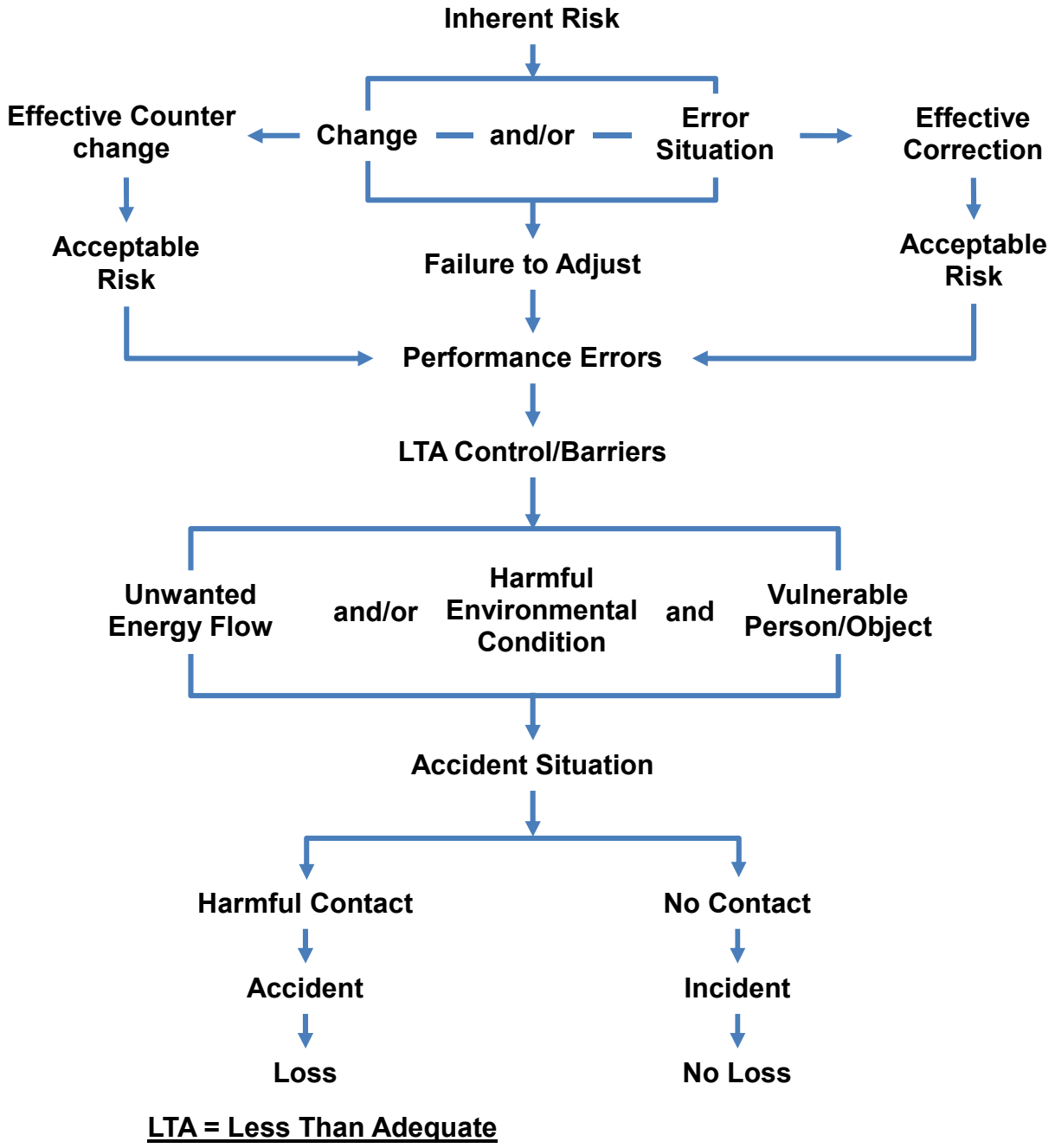

Figure 3: Accident Model

Accident models have evolved over time and can be characterized by the three models below (Hollnage, 2004)

1. Single Event Model

An accident is thought to be the result of a single, one-time easily identifiable, unusual, unexpected occurrence that results in injury or illness. Some still believe this explanation to be adequate. It's convenient to simply blame the victim when an accident occurs. For instance, if a worker cuts her hand on a sharp edge of a work surface, her lack of attentiveness may be explained as the cause of the accident. All responsibility for the accident is placed squarely on the shoulders of the employee. An accident investigator who has adopted this explanation for accidents will never look beyond perceived personal employee flaws to discover the underlying system weaknesses that may have contributed to the accident.

2. Sequence of Events Model

This is a simple, linear cause and effect model where accidents are seen thee natural culmination of a series of events or circumstances, which occur in a specific and recognizable order. The model is often represented by a chain with a weak link or a series of falling dominos, stacked in a row, the first domino falling sets off a chain reaction of related events that result in an injury or illness. This explanation describes an accident as a series of related occurrences which lead to a final event which results in injury or illness. In this model, accidents are prevented by fixing or eliminating the weak link, by removing a domino, or placing a barrier between two dominos to interrupt the series of events.

In this model, an unexpected event initiates a sequence of consequences culminating in the unwanted outcome. The unexpected event is typically taken to be an unsafe act, with human error as the predominant cause. The accident investigator will assume that by eliminating any one of those actions or events, the chain will be broken and the future accident prevented. In the example above, the investigator may recommend removing the sharp edge of the work surface (an engineering control) to prevent any future injuries.

The sequential model is not limited to a simple series and may utilize multiple sequences or hierarchies such as event trees, fault trees, or critical path models. Sequential models are attractive because they encourage thinking in causal series, which is easier to represent graphically and easier to understand. In this model, an unexpected event initiates a sequence of consequences culminating in the unwanted outcome. The unexpected event is typically taken to be an unsafe act, with human error as the predominant cause.

The sequential model is also limited because it requires strong cause and effect relationships that typically do not exist outside the technical or mechanistic aspect of the accident. In other words, true cause and effect relationships can be found when analyzing the equipment failures, but causal relationships are extremely weak when addressing the human or organizational aspect of the accident.

Figure 4: Sequence of Events Model

3. Epidemiological or Latent Failure Model (Multiple Cause Theory)

This is a complex, linear cause and effect model where accidents are seen as the result of a combination of active failures (unsafe acts) and latent conditions (unsafe conditions). These are often referred to as epidemiological models, using a medical metaphor that likens the latent conditions to pathogens in the human body that lay dormant until triggered by the unsafe act. In this model, accidents are prevented by strengthening barriers and defenses.

This model views the accident to be the result of long standing deficiencies that are triggered by the active failures. The focus is on the organizational contributions to the failure and views the human error as an effect, instead of a cause. Eliminating one of the events does not assure prevention of future accidents.

The epidemiological models differ from the sequential models on four main points:

- Performance Deviation – The concept of unsafe acts shifted from being synonymous with human error to the notion of deviation from the expected performance.

- Conditions – The model also considers the contributing factors that could lead to the performance deviation, which directs analysis upstream from the worker and process deviations.
- Barriers – The consideration of barriers or defenses at all stages of the accident development.
- Latent Conditions – The introduction of latent or dormant conditions that are present within the system well before there is any recognizable accident sequence.

The epidemiological model allows the investigator to think in terms other than causal series, offers the possibility of seeing some complex interaction, and focuses attention on the organizational issues. The model is still sequential, however, with a clear trajectory through the ordered defenses. Because it is linear, it tends to oversimplify the complex interactions between the multitude of active failures and latent conditions. The limitation of epidemiological models is that they rely on “failures” up and down the organizational hierarchy, but does nothing to explain why these conditions or decisions were seen as normal or rational before the accident.

The investigator realizes that eliminating one of the events does not assure prevention of future accidents. Removing the sharp edge of a work surface does not guarantee a similar injury will be prevented at the same or other workstation. Many other factors may have contributed to an injury. An accident investigation will not only recommend corrective actions to remove the sharp surface, it will also address the underlying system weaknesses that caused it.

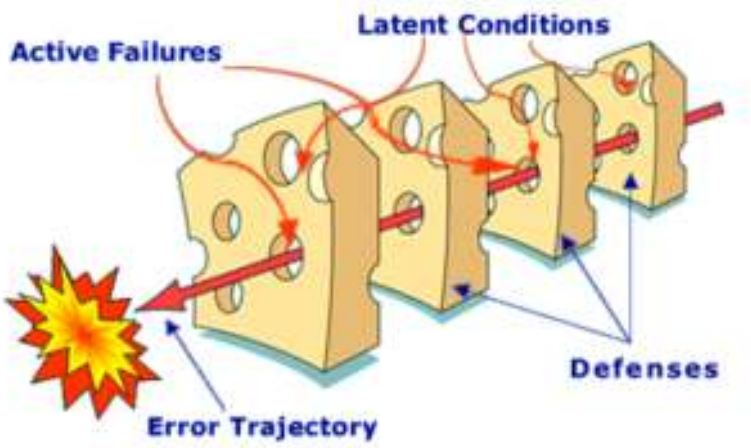

Figure 5: Epidemiological or Latent Failure Model

4. Systemic Model

This is a complex, non-linear model where both accidents (and success) are seen to emerge from unexpected combinations of normal variability in the system. In this model, accidents are triggered by unexpected combinations of normal actions, rather than action failures, which combine, or resonate, with other normal variability in the process to produce the necessary and jointly sufficient conditions for failure to succeed. Because of the complex, non-linear nature of this model, it is difficult to represent graphically.

A major benefit of the systemic model is that it provides a more complete understanding of the subtle interactions that contributed to the event. Because the model views accidents as resulting from unexpected combinations of normal variability, it seeks an understanding of how normal variability combined to create the accident. From this understanding of contributing interactions, latent conditions or organizational weaknesses can be identified.

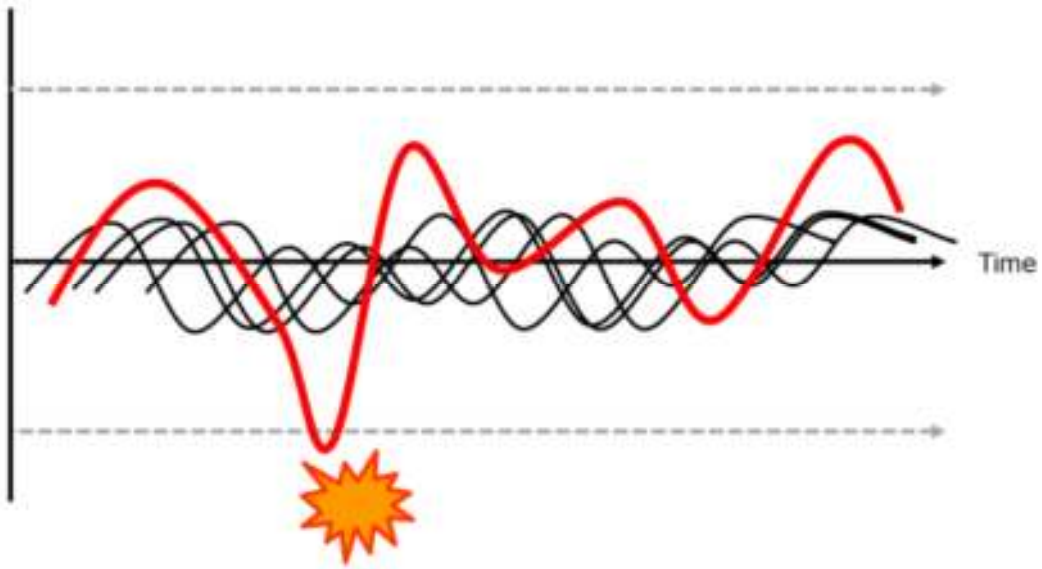

Figure 6: Systemic Model

It is important to note that a serious injury accident can easily be the result of 20 or more events. Events can occur anytime, anywhere, any place, and to anyone. It is possible that pertinent events may have occurred many weeks or months before the accident.

There are four categories of events:

1. Actual Events. These are events that able to determine actually occurred i.e., an event that is witnessed by one or more persons (two or more is best) and they can verify it actually happened. You would want to interview all witnesses to the event.
2. Assumed Events. These are events that must have happened but have not yet been verified. Flag these somehow to remind you that more investigation is needed. Assumed events are harder to establish.
3. Non-Events. If an event was supposed to happen, but did not, that is a non-event. Although non-events describe an event that did not occur, they should be captured because they may help discover conditions and behaviors relevant to the investigation.
4. Simultaneous Events. In some accidents scenarios two or more events occur at precisely the same time resulting in a hazardous condition or set of unsafe behaviors that cause an injury.

Accidents occur during work activities and must be evaluated within the context of the work situation. The work site ingredients, and the upstream processes which shaped them and contributed to the accident causation sequence. The work situation is composed of people, plant and hardware, procedures and management controls, and the interfaces which ideally tie them together into a well-coordinated, smooth functioning, effective production of beneficial work.

If there are significant deficiencies, errors, or unwanted changes in any of the major people-plant-procedures work ingredients, or in their interfaces or relationships, the stage is set for an accident. Some deficiencies, errors, and unwanted changes which contribute to work accidents develop during normal work activities; others are built into the system or arc set in motion during the upstream processes which establish the work situation.

The work process schematic, Figure 7, depicts the elements of the upstream processes which prepare the work situation and work activity, as well as the feedback loops which provide the performance data necessary to correct and refine those processes.

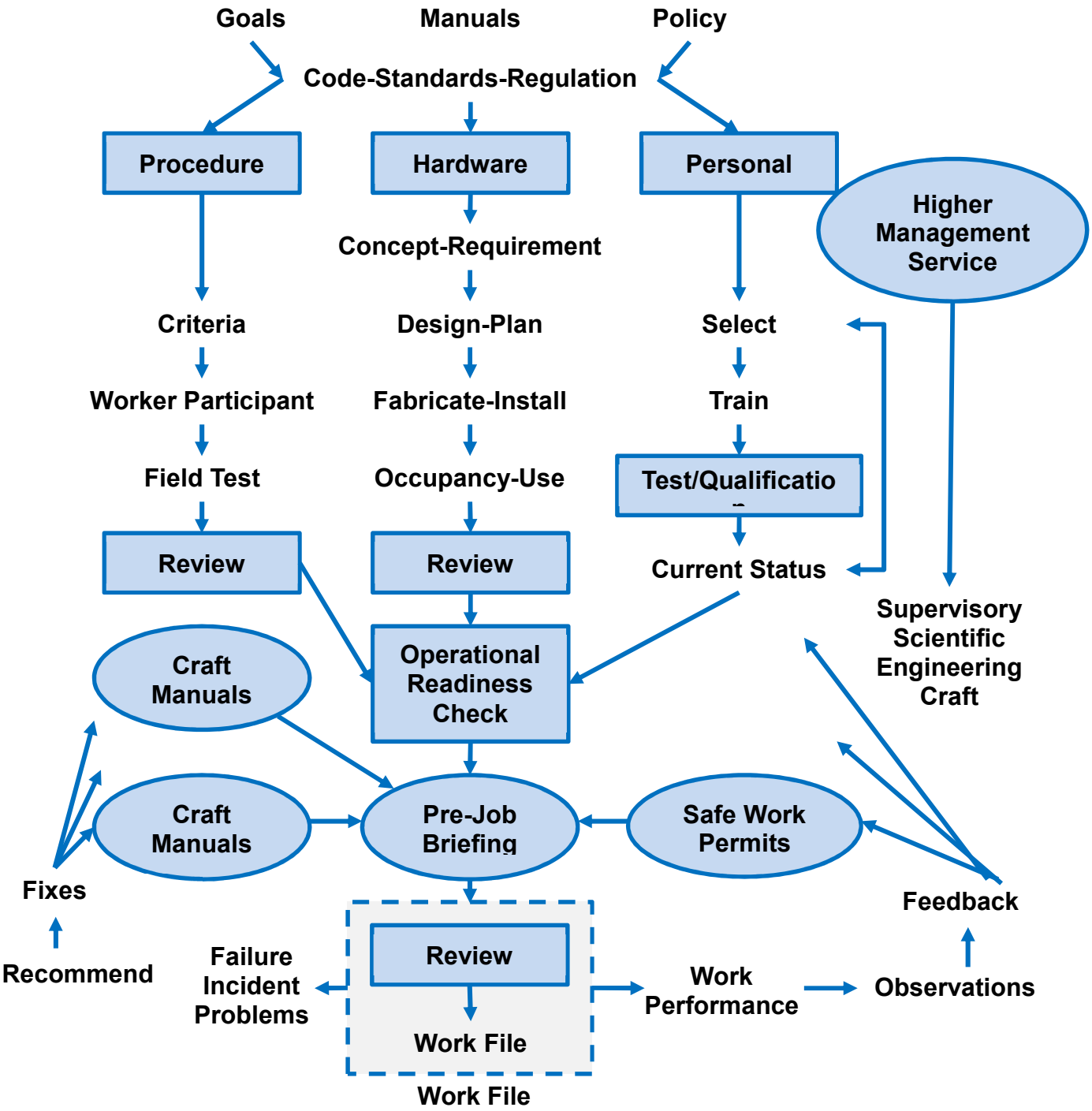

Figure 7: The work process

The investigation and analysis of work-related accidents and incidents forms an essential part of managing health and safety. Well thought-out risk control measures, combined with adequate supervision, monitoring and effective management will ensure that your work activities are safe. The purpose of an accident investigation is to determine the causes and recommend corrective action(s) to eliminate or minimize such events.

An accident investigation is an appropriately detailed, systematic search to uncover the "who, what. when, where, why, and how" of a loss-producing event and to determine what recommendations and corrective actions are needed in order to prevent a recurrence. An accident investigation should be thorough and attempt to identify underlying/basic causes.

The thoroughness, depth, scope, and focus of the investigation are influenced by the magnitude of loss; the objectivity and independence of the investigators, appointing official, and reviewers; and by the basic concepts of accident causation held by these people and the organizations they represent. Loss level, participant independence, and particularly, concepts held affect the facts that are sought, the observations made, the perceptions believed, the conclusions drawn, and the corrective actions recommended.

Sound concepts and principles of accident causation and development, therefore, form the essential foundation upon which effective accident investigations are built.

Incident investigation is a process for reporting, tracking, and investigating incidents that includes

1. a formal process for investigating incidents, including staffing, performing, documenting, and tracking investigations of process safety incidents and
2. the trending of incident and incident investigation data to identify recurring incidents.

This process also manages the resolution and documentation of recommendations generated by the investigations. The accident investigation is a complex project that involves a significant workload, time constraints, sensitive issues, cooperation between team members, and dependence on others.

An accident investigation may have different purposes:

- Identify and describe the true course of events (what, where, when)
- Identify the direct and root causes / contributing factors of the accident (why)
- Identify risk reducing measures to prevent future, comparable accidents (learning)
- Investigate and evaluate the basis for potential criminal prosecution (blame)
- Evaluate the question of guilt in order to assess the liability for compensation (pay)

An effective investigation requires a methodical, structured approach to information gathering, collation and analysis. The findings of the investigation will form the basis of an action plan to prevent the accident or incident from happening again and for improving your overall management of risk. The investigation process should begin after arranging for first aid or medical treatment for the injured person(s). In getting started, remind everyone involved—especially workers— the investigation is to learn and prevent, not find fault. Steps of the investigation process include:

1. Call or gather the necessary person(s) to conduct the investigation and obtain the investigation kit.
2. Secure the area where the injury occurred and preserve the work area as it is.
3. Identify and gather witnesses to the injury event.
4. Interview the involved worker.
5. Interview all witnesses.
6. Document the scene of the injury through photos or videos.
7. Complete the investigation report, including determination of what caused the incident and what corrective actions will prevent recurrences.
8. Use results to improve the injury and illness prevention program to better identify and control hazards before they result in incidents.
9. Ensure follow-up on completion of corrective actions.

Figure 9 and 10 shows an overview of the incidents element activities but different flow chart formats. At some facilities, the incidents element is used to assign blame to personnel involved in an incident. This approach results in ineffective recommendations

being implemented. A more effective approach is to develop recommendations that address the systemic causes of the incidents. The incidents element is not a process to assign blame, but a process to develop effective recommendations to address the underlying, system related causes of incidents.

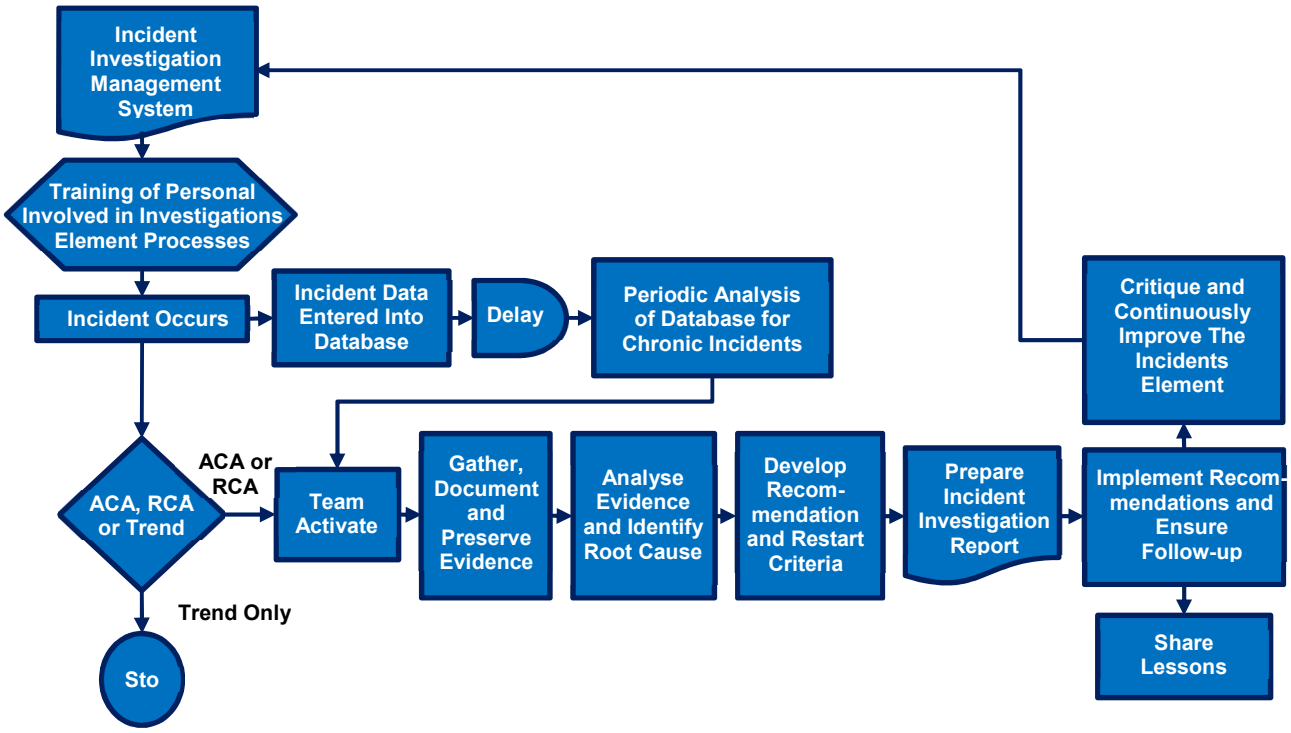

Figure 8: Incident investigation flowchart

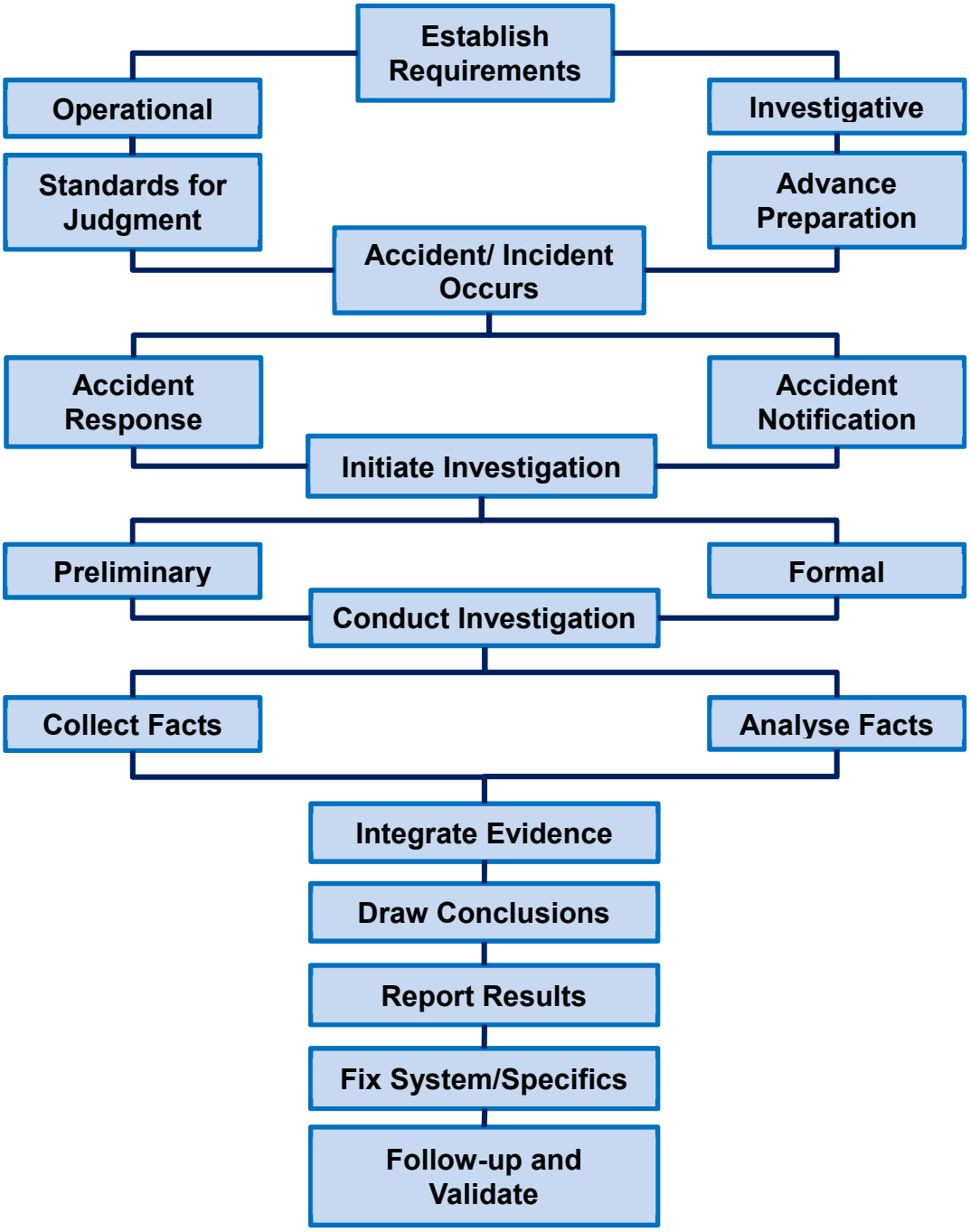

Figure 9: The investigation process

Incident investigations are conducted whenever and wherever incidents occur; because performing investigations remotely is rarely effective. The investigation team is usually based near the incident scene to allow them to more efficiently collect data by conducting interviews, gathering physical evidence, and so forth. Analysis of the root causes of incidents may occur anywhere, but being near the personnel involved in the management of the facility is preferable, as it helps foster discussions with facility personnel.
Figure 10 shows the relationship of these different levels of analysis

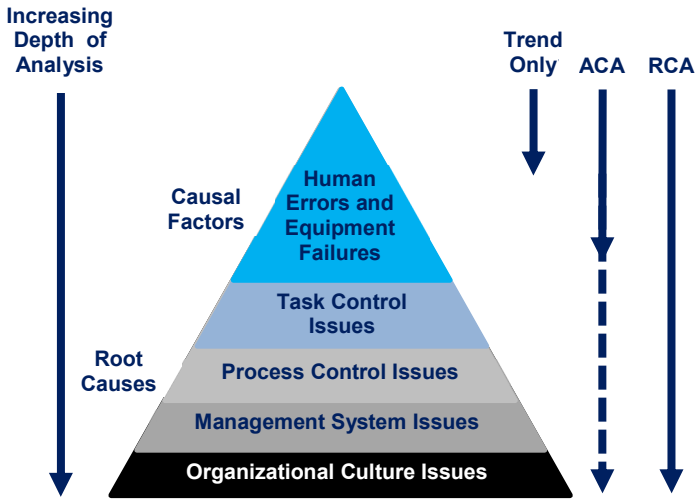

Figure 10: The relationship of these different levels of analysis

An effective accident investigation can be accomplished either by Independent investigators or by monitored self-investigators. In fact, preliminary investigation is almost always performed by in-house line managers/supervisors and/or safety personnel, who generally work to criteria established by an independent group (see figure 11). In addition, almost without exception, minor accidents are investigated only by the cognizant manager, supervisor, with follow-up by the local safety person or group. When a more objective investigation is required, it is usually accomplished by experienced investigators who are free from control, undue influence, and other dependence upon the organization and activities under investigation. When investigators have no vested interest in the outcome, they often weigh information and analytical results in a more open, evaluative manner and arrive at more rational, reasonable, and accurate conclusions and recommendations.

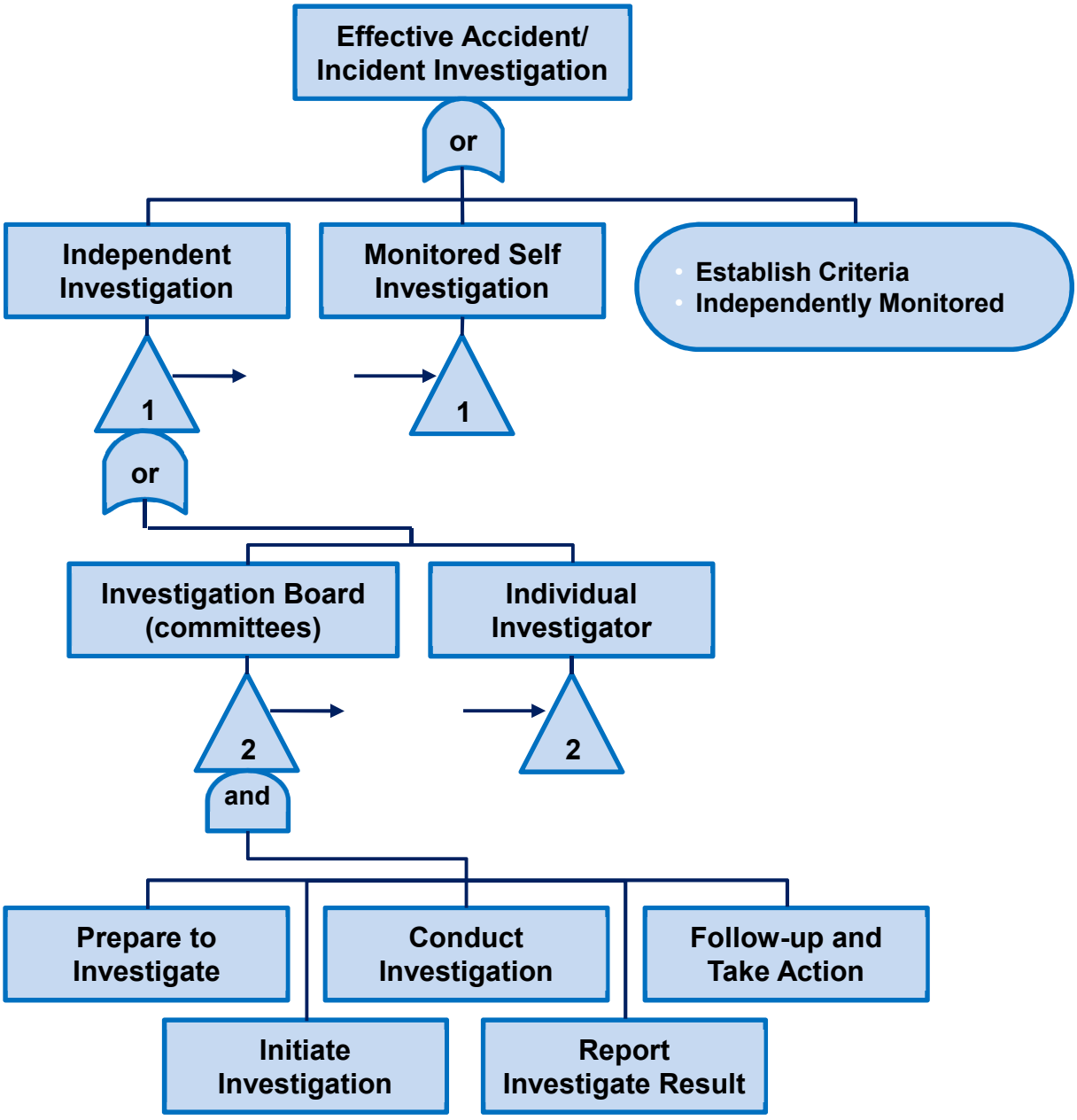

Figure 11: Effective accident/incident investigation

All staff and others working with the company are required to report all incidents and close calls, including ergonomic issues, soft tissue damage and any signs or symptoms of musculoskeletal (MSI) injury to their supervisor or company contact. All incidents will be reported and investigated following company and regulatory requirements. Incident reports will be reviewed by a supervisor and other management as appropriate to the severity or potential severity of the incident. Each element in company have their own responsibilities to help incident investigation.

1. Management.

A manager will investigate an incident reported by a direct report. A manager will participate in an investigation of an incident if the severity or potential severity requires action appropriate to the manager's authority. All investigations requiring immediate notification to the company and will be attended by the appropriate management personnel. Copies of investigations required by the company will be provided by the appropriate management personnel.

2. Supervisor

A supervisor must advise new and returning workers of the requirement to report all incidents including close calls. An annual reminder to all employees to report incidents is recommended. A supervisor must investigate incidents in a manner that is timely and appropriate to the circumstances and severity of the incident. A supervisor's incident review and signoff are a requirement.

3. Worker

A worker will report to the supervisor all incidents including close calls. A worker will attend the incident investigation unless unable to do so as a result of injury. Workers may choose to report a close call using the company's form Incident Close Call Reporting, or verbally to their supervisor, who will be responsible for completing the document.

4. Safety Committee Members (SCM)

A SCM member should be included in an incident investigation. If not available, another employee knowledgeable in the investigation process may be included in the investigation.

Incident Reporting and Investigation Procedure:

- The incident is reported by a person to the company. (An incident involving an employee may be reported by others to the company.) The incident may be reported verbally or in writing.
- The incident site must be visited if possible and the site preserved until the investigation is complete, if safe to do so. Photographs, sketches and other evidence collection should be undertaken promptly.
- The direct supervisor of the employee involved or the person who reported the incident will organize and lead the investigation. The investigation must be carried out by those knowledgeable about the type of work involved and, if reasonably available, with the participation of a SCM member.
- The investigation team will include those appropriate to the severity or potential severity and type of incident. The team may include people not under the scope of this policy.
- The investigation will follow the Incident Investigation Template format, which includes root cause analysis.
- The investigation must be held in a timely manner. A preliminary investigation may be necessary if required attendees are not able to attend due to injury or other reasons.
- SCM will evaluate any future risks that recommendations or corrective actions could create.
- SCM will monitor the effectiveness of any changes or implementations.
- SCM will communicate the recommendations and corrective actions to all relevant parties.
- All investigation reports will be forwarded to the SCMs. The SCM will review the reports for completeness and determine if additional investigation or distribution is required.
- An industry safety alert will be issued through the company if findings from the investigation could help others prevent injury.

DEFINITIONS

Accident– a sudden undesirable event that is unplanned and causes damage, which could or could not be prevented.

Creativity – being able to adapt in overcoming constraints and under specification.

Dangerous occurrence– is an unplanned occurrence event which has the potential to cause injury; which may or may not cause damage to surroundings.

Effectiveness – how well it meets its intended purpose.

Experience – are actions based on the past experience in an effort to repeat success and avoid failure.

Hazard – the chance to cause danger or risk, including ill health or injury; can cause damage to property, plant, or the environment.

ill health – is a condition of lesser health in which disease or impairment of function is present.

Immediate cause – is the most obvious reason why an adverse incident happens. There may be several immediate causes identified in any event.

Incident– is an event or occurrence that is likely to happen because of certain event or the result of certain events.

Improvement Based – The concept of continuous improvement is applied to safety.

Fatal – results in work-related death

Goal Based – Safety becomes an organizational goal.

Guidelines–The general way that the work is to be carried out.

Management – are the supervisors and higher management that oversees the personnel and the accident investigations.

Major injury – is defined as fractures, amputations, loss of sight, a burn, acute illness resulting in unconsciousness requiring admittance to hospital for more than 24 hours.

Material – the equipment or materials that were being used when the accident occurred.

Minor injury – is defined as a sprain, strain, contusion, abrasion as a result of an accident, where a person is unfit for work for three days.

Personnel – is the people that are employed by the company that may have been involved in the accident or the ones that is conducting the investigation.

Physical Evidence – is the evidence that was collected at the location of the accident. Eg. Pictures, witness statements, environmental appearance.

Risk – is a situation that involves exposure to danger.

Risk Control Measures – is precautions put in place by the workplace to reduce the risk to a tolerable level.

Root Cause – is an initiation cause of either a condition or a causal chain that leads to an outcome or effect of interest.

Rule Based – Safety is based on rules and regulations.

Serious Injury – is when the person that is injured cannot carry out their normal work duties for more than three consecutive days.

Task – is the actual work procedure being used at the time of the accident happened.

Underlying cause– the less obvious reason for an event to happen.

Witness – is a person or group of people that seen the accident or heard the accident and can give an account of the details that took place.

Likelihood that an event will happen again:

- **Certain** – it will happen again possible soon.
- **Likely**–it will reoccur often.
- **Possible**–it will occasionally occur.
- **Rare**–it is very unlikely to happen again.
- **Unlikely**–it is not expected to happen again in the near future.

Causal factor is an event or condition in the accident sequence that contributes to the unwanted result. There are three types of causal factors: direct cause(s), which is the immediate event(s) or condition(s) that caused the accident; root causes(s), which is the causal factor that, if corrected, would prevent recurrence of the accident; and the contributing causal factors, which are the causal factors that collectively with the other causes increase the likelihood of an accident, but which did not cause the accident.

Event and causal factors analysis includes charting, which depicts the logical sequence of events and conditions (causal factors that allowed the accident to occur), and the use of deductive reasoning to determine the events or conditions that contributed to the accident.

Direct cause of an accident is the immediate event(s) or condition(s) that caused the accident.

Root causes are the causal factors that, if corrected, would prevent recurrence of the same or similar accidents. Root causes may be derived from or encompass several contributing causes. They are higher-order, fundamental causal factors that address classes of deficiencies, rather than single problems or faults.

Contributing causes are events or conditions that collectively with other causes increased the likelihood of an accident but that individually did not cause the accident. Contributing causes may be longstanding conditions or a series of prior events that, alone, were not sufficient to cause the accident, but were necessary for it to occur. Contributing causes are the events and conditions that “set the stage” for the event and, if allowed to persist or re-occur, increase the probability of future events or accidents.

Barrier analysis review the hazards, the targets (people or objects) of the hazards, and the controls or barriers that management systems put in place to separate the hazards from the targets. Barriers may be physical or administrative.

Change analysis is a systematic approach that examines planned or unplanned changes in a system that caused the undesirable results related to the accident.