



NCMT

ACCIDENT AND INCIDENT INVESTIGATION

COURSE MATERIAL

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Training is not a goal, it is part of the solution to a sustained and improved performance

Accident/Incident Investigation/RCA

Course Objectives

- Recognize the need for an investigation
- Investigate the scene of the accident
- Interview victims & witnesses
- Distinguish fact from fiction
- Determine root causes
- Compile data and prepare reports
- Make recommendations

Introduction

The Aim of the Investigation

- The key result should be to prevent a recurrence of the same accident.
- Fact finding:
 - What happened?
 - What was the root cause?
 - What should be done to prevent recurrence?



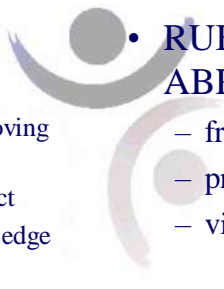
The Aim of the Investigation IS NOT TO:

- Exonerate individuals or management.
- Or, to assign blame.

Types of Accidents

- 
- **FALL TO**
 - same level
 - lower level
 - **CAUGHT**
 - in
 - on
 - between
 - **CONTACT WITH**
 - chemicals
 - electricity
 - heat/cold
 - radiation
 - **BODILY REACTION FROM**
 - voluntary motion
 - involuntary motion

Types of Accidents (continued)

- 
- **STRUCK**
 - Against
 - stationary or moving object
 - protruding object
 - sharp or jagged edge
 - By
 - moving or flying object
 - falling object
 - **RUBBED OR ABRADED BY**
 - friction
 - pressure
 - vibration

Investigation Strategy

- Gather information
- Search for & establish facts
- Isolate essential contributing factors
- Find root causes
- Determine corrective actions
- Implement corrective actions

CONTRIBUTING FACTORS

- ENVIRONMENTAL
- DESIGN
- SYSTEMS & PROCEDURES
- HUMAN BEHAVIOR





Understanding the language of investigation

Adverse event' includes:

- **Accident:** an event that results in injury or ill health;
- **Incident:**
 - **near miss:** an event that, while not causing harm, has the potential to cause injury or ill health.
 - **undesired circumstance:** a set of conditions or circumstances that have the potential to cause injury or ill health, e.g. untrained nurses handling heavy patients.

- **Hazard:** the potential to cause harm, including ill health and injury; damage to property, plant, products or the environment, production losses or increased liabilities.
- **Immediate cause:** the most obvious reason why an adverse event happens, eg the guard is missing; the employee slips etc. There may be several immediate causes identified in any one adverse event.

- **Consequence:**
 - **fatal:** work-related death;
 - **major injury/ill health:** including fractures (other than fingers or toes), amputations, loss of sight, a burn or penetrating injury to the eye, any injury or acute illness resulting in unconsciousness, requiring resuscitation or requiring admittance to hospital for more than 24 hours;
 - **serious injury/ill health:** where the person affected is unfit to carry out his or her normal work for more than three consecutive days;

- **Consequence:**

- **minor injury:** all other injuries, where the injured person is unfit for his or her normal work for less than three days;
- **damage only:** damage to property, equipment, the environment or production losses. (This guidance only deals with events that have the potential to cause harm to people.)

Likelihood that an adverse event will happen again:

- **certain:** it will happen again and soon;
- **likely:** it will reoccur, but not as an everyday event;
- **possible:** it may occur from time to time;
- **unlikely:** it is not expected to happen again in the foreseeable future;
- **rare:** so unlikely that it is not expected to happen again.

- **Risk:** The level of risk is determined from a combination of the likelihood of a specific undesirable event occurring and the severity of the consequences.
- **Risk control measures:** are the workplace precautions put in place to reduce the risk to a tolerable level?
- **Root cause:** an initiating event or failing from which all other causes or failings spring. Root causes are generally management, planning or organizational failings.
- **Underlying cause:** the less obvious 'system' or 'organisational' reason for an adverse event happening, e.g. pre-start-up machinery checks are not carried out by supervisors; the hazard has not been adequately considered via a suitable and sufficient risk assessment; production pressures are too great etc.

The causes of adverse events

These causes can be classified as:

- **Immediate causes:** the agent of injury or ill health (the blade, the substance, the dust etc);
- **Underlying causes:** unsafe acts and unsafe conditions (the guard removed, the ventilation switched off etc);
- **Root causes:** the failure from which all other failings grow, often remote in time and space from the adverse event (eg failure to identify training needs and assess competence, low priority given to risk assessment etc).

Why investigate?

- The fact that an adverse event has occurred suggests that the existing risk control measures were inadequate.
- Learning lessons from near misses can prevent costly accidents.

Legal reasons for investigating:

To ensure you are operating your organisation within the law.

Information and insights gained from an investigation

- An understanding of how and why things went wrong.
- An understanding of the ways people can be exposed to substances or conditions that may affect their health.
- A true snapshot of what really happens and how work is really done. (Workers may find short cuts to make their work easier or quicker and may ignore rules.)
- Identifying deficiencies in your risk control management, which will enable you to improve your management of risk in the future and to learn lessons which will be applicable to other parts of your organisation.

Benefits arising from an investigation

- The prevention of further similar adverse events.
- The prevention of business losses due to disruption, stoppage, lost orders and the costs of criminal and civil legal actions.
- An improvement in employee morale and attitude towards health and safety. Employees will be more cooperative in implementing new safety precautions if they were involved in the decision and they can see that problems are dealt with.
- The development of managerial skills which can be readily applied to other areas of the organisation.

Which events should be investigated?

- It is the potential consequences and the likelihood of the adverse event recurring that should determine the level of investigation, not simply the injury or ill health suffered on this occasion. For example: Is the harm likely to be serious? Is this likely to happen often?
- Similarly, the causes of a near miss can have great potential for causing injury and ill health.
- When making your decision, you must also consider the potential for learning lessons.

Who should carry out the investigation?

- The management and the workforce.
- Supervisors, line managers, health and safety professionals, and senior management/ directors may all be involved, Depending on the level of the investigation.
- Members of the team should be familiar with health and safety good practice, standards and legal requirements, have knowledge of the work activities, time and resources are necessary to carry out the investigation efficiently.
- It is essential that the investigation team is either led by, or reports directly to someone with the authority to make decisions and act on their recommendations.

When should it start?

- The urgency of an investigation will depend on the magnitude and immediacy of the risk involved (e.g. a major accident involving an everyday job will need to be investigated quickly).
- In general, adverse events should be investigated and analysed as soon as possible. This is not simply good practice; it is common sense – memory is best and motivation greatest immediately after an adverse event.

What does it involve?

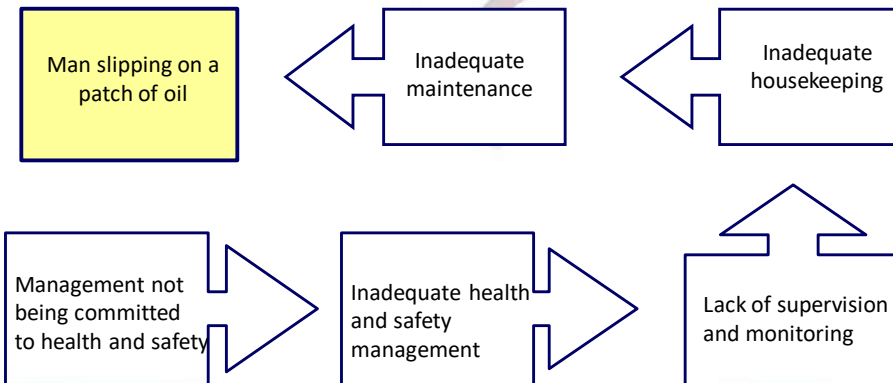
- An investigation will involve an analysis of all the information available, physical (the scene of the incident), verbal (the accounts of witnesses) and written (risk assessments, procedures, instructions, job guides etc), to identify what went wrong and determine what steps must be taken to prevent the adverse event from happening again.
- It is important to be open, honest and objective throughout the investigation process. Pre-conceived ideas about the process, the equipment or the people involved in an adverse event may blind you to the real causes. Question everything. Be wary of blaming individuals.

What makes a good investigation?

- Identifying root causes that organisations can learn from their past failures and prevent future failures.
Dealing with the immediate causes may provide a short-term fix. But, in time, the underlying/root causes that were not addressed will allow conditions to develop where further adverse events are likely to reoccur.
- Investigations should be conducted with accident prevention in mind, not placing blame. Only after the investigation has been completed is it appropriate to consider whether any individuals acted inappropriately.
- Investigations that conclude that operator error was the sole cause are rarely acceptable.

What makes a good investigation?

- The objective is to establish not only how the adverse event happened, but more importantly, what allowed it to happen.
- The root causes of adverse events are almost inevitably management, organisational or planning failures.



Information gathering:

- Explores all reasonable lines of enquiry;
- Is timely;
- Is structured, setting out clearly what is known, what is not known and records the investigative process.

Analysis:

- is objective and unbiased;
- identifies the sequence of events and conditions that led up to the adverse event;
- identifies the immediate causes;
- identifies underlying causes, ie actions in the past that have allowed or caused undetected unsafe conditions/practices;
- identifies root causes, (ie organisational and management health and safety arrangements – supervision, monitoring, training, resources allocated to health and safety etc).

Risk control measures:

- identify the risk control measures which were missing, inadequate or unused;
- compare conditions/practices as they were with that required by current legal requirements, codes of practice and guidance;
- identify additional measures needed to address the immediate, underlying and root causes;
- provide meaningful recommendations which can be implemented.

Action plan and implementation:

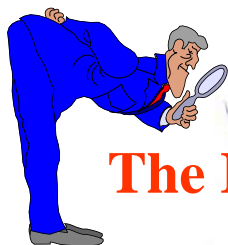
- provide an action plan with SMART objectives (Specific, Measurable, Agreed, Realistic and Timescaled);
- ensure that the action plan deals effectively not only with the immediate and underlying causes but also the root causes;
- include lessons that may be applied to prevent other adverse events, eg assessments of skill and training in competencies may be needed for other areas of the organisation;
- provide feedback to all parties involved to ensure the findings and recommendations are correct, address the issues and are realistic;

Action plan and implementation:

- should be fed back into a review of the risk assessment. The adverse events should be a trigger for reviewing risk assessments);
- communicate the results of the investigation and the action plan to everyone who needs to know;
- include arrangements to ensure the action plan is implemented and progress monitored.

Techniques for analysing adverse events

- There are many tools and techniques for structuring the investigation, analysing adverse events, and identifying root causes. HSE does not endorse any one method – it is for you to choose which techniques suit your company. These techniques are simply tools, not an end in themselves.
- For large, complex or technically demanding investigations, these techniques may be essential in determining not only how the adverse event happened, but also what were the root causes.
- However, provided a methodical approach with full employee participation is adopted, a less complicated approach, such as that set out below, will be appropriate.



The Investigation

Steps to take following an adverse event

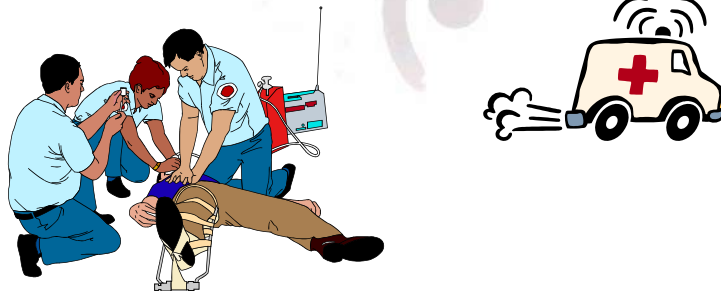
Emergency response:

- take prompt emergency action (eg first aid);
- make the area safe (in some cases this may need to be done first).

Initial report:

Provide Care to the Injured

- Ensure that medical care is provided to the injured people before proceeding with the investigation.



Initial report:

- preserve the scene;
- note the names of the people, equipment involved and the names of the witnesses;
- report the adverse event to the person responsible for health and safety who will decide what further action (if any) is needed.

Secure the Scene

- Eliminate the hazards:
 - Control chemicals
 - De-energize
 - De-pressurize
 - Light it up
 - Shore it up
 - Ventilate



Isolate the Scene

- Barricade the area of the accident, and keep everyone out!
- The only persons allowed inside the barricade should be Rescue, law enforcement, and investigators
- Protect the evidence until investigation is complete

The decision to investigate

The table below will assist you in determining the level of investigation. Remember you must consider the worst potential consequences of the adverse event (eg a scaffold collapse may not have caused any injuries, but had the potential to cause major/ fatal injuries).

Likelihood of recurrence	Potential worst consequence of adverse event			
	Minor	Serious	Major	Fatal
Certain				
Likely				
Possible				
Unlikely				
Rare				

Risk		Minimal		Low		Medium		High
Investigation level		Minimal level		Low level		Medium level		High level

In a **minimal level** investigation, the relevant supervisor will look into the circumstances and try to learn any lessons.

A **low level** investigation will involve a short investigation by the relevant supervisor or line manager to try to prevent a recurrence and to learn any general lessons.

A **medium level** investigation will involve a more detailed investigation by the relevant supervisor or line manager, the health and safety adviser and employee representatives.

A **high level** investigation will involve a team-based investigation, involving supervisors or line managers, health and safety advisers and employee representatives. It will be carried out under the supervision of senior management or directors and will look for the immediate, underlying, and root causes.

The investigation

The four steps include a series of numbered questions. These set out in detail the information that should be entered onto the adverse event investigation form. The question numbers correspond to those on the form.

Step one

Gathering the information

- Find out what happened and what conditions and actions influenced the adverse event. Begin straight away, or as soon as practicable.
- It is important to capture information as soon as possible. This stops it being corrupted, e.g. items moved, guards replaced etc. If necessary, work must stop and unauthorised access be prevented.
- Talk to everyone who was close by when the adverse event happened, especially those who saw what happened or know anything about the conditions that led to it.

Gathering the information

- The amount of time and effort spent on information gathering should be proportionate to the level of investigation.
Collect all available and relevant information. That includes opinions, experiences, observations, sketches, measurements, photographs, check sheets, permits-to-work and details of the environmental conditions at the time etc. This information can be recorded initially in note form, with a formal report being completed later. These notes should be kept at least until the investigation is complete.

Ask “What Happened”

- Get a brief overview of the situation from witnesses and victims.
- Not a detailed report yet, just enough to understand the basics of what happened.



Where, when and who?

- 1 Where and when did the adverse event happen?
- 2 Who was injured/suffered ill health or was otherwise involved with the adverse event?

Gathering detailed information: How and what?

Be precise and establish the facts as best you can. There may be a lack of information and many uncertainties, but you must keep an open mind and consider everything that might have contributed to the adverse event.

Some of the information gathered may appear to have no direct bearing on the event under investigation. However, this information may provide you with a greater insight into the hazards and risks in your workplace. This may enable you to make your workplace safer in ways you may not have previously considered.

3 How did the adverse event happen? Note any equipment involved.

Describe the chain of events leading up to, and immediately after, the adverse event. Very often, a number of chance occurrences and coincidences combine to create the circumstances in which an adverse event can happen. All these factors should be recorded here in chronological order, if possible. Work out the chain of events by talking to the injured person, eye witnesses, line managers, health and safety representatives and fellow workers to find out what happened and who did what. In particular, note the position of those injured, both immediately before and after the adverse event. Be objective and, as far as possible, avoid apportioning guilt, assigning responsibility or making snap judgments on the probable causes.

3 How did the adverse event happen? Note any equipment involved.

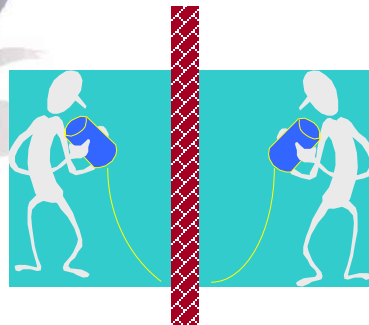
Plant and equipment that had a direct bearing on the adverse event must be identified clearly. This information can usually be obtained from a nameplate attached to the equipment. Note all the details available, the manufacturer, model type, model number, machine number and year of manufacture and any modifications made to the equipment. Note the position of the machinery controls immediately after the adverse event. This information may help you to spot trends and identify risk control measures. You should consider approaching the supplier if the same machine has been implicated in a number of adverse events.

4 What activities were being carried out at the time?

The work that was being done just before the adverse event happened can often cast light on the conditions and circumstances that caused something to go wrong. eg the surroundings, the equipment/materials being used, the number of employees engaged in the various activities, the way they were positioned and any details about the way they were behaving etc.

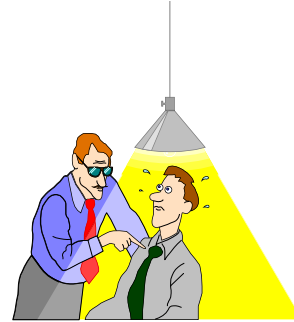
Interview Victims & Witnesses

- Interview as soon as possible after the incident
 - Do not interrupt medical care to interview
- Interview each person separately
- Do not allow witnesses to confer prior to interview



The Interview

- Put the person at ease.
 - People may be reluctant to discuss the incident, particularly if they think someone will get in trouble
- Reassure them that this is a fact-finding process only.
 - Remind them that these facts will be used to prevent a recurrence of the incident



The Interview

- Take Notes!
- Ask open-ended questions
 - “What did you see?”
 - “What happened?”
- Do not make suggestions
 - If the person is stumbling over a word or concept, do not help them out

The Interview

- Use closed-ended questions later to gain more detail.
 - After the person has provided their explanation, these type of questions can be used to clarify
 - “Where were you standing?”
 - “What time did it happen?”

The Interview

- Don't ask leading questions
 - Bad: “Why was the forklift operator driving recklessly?”
 - Good: “How was the forklift operator driving?”
- If the witness begins to offer reasons, excuses, or explanations, politely decline that knowledge and remind them to stick with the facts

The Interview

- Summarize what you have been told.
 - Correct misunderstandings of the events between you and the witness
- Ask the witness/victim for recommendations to prevent recurrence
 - These people will often have the best solutions to the problem

The Interview

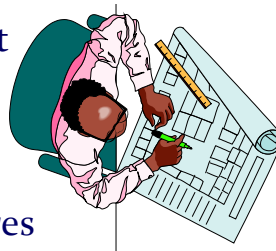
- Get a written, signed statement from the witness
 - It is best if the witness writes their own statement; interview notes signed by the witness may be used if the witness refuses to write a statement

Gathering the information

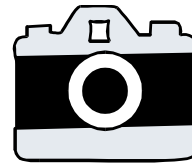
- Examine the accident scene. Look for things that will help you understand what happened:
 - Dents, cracks, scrapes, splits, etc. in equipment
 - Tire tracks, footprints, etc.
 - Spills or leaks
 - Scattered or broken parts
 - Etc.

Gathering the information

- Diagram the scene
 - Use blank paper or graph paper.
Mark the location of all pertinent items; equipment, parts, spills, persons, etc.
 - Note distances and sizes, pressures and temperatures
 - Note direction (mark north on the map)



- Take photographs



- Photograph any items or scenes which may provide an understanding of what happened to anyone who was not there.
- Photograph any items which will not remain, or which will be cleaned up (spills, tire tracks, footprints, etc.)
- 35mm cameras, Polaroids, and video cameras are all acceptable.
 - Digital cameras are not recommended - digital images can be easily altered

5 Was there anything unusual or different about the working conditions?

Adverse events often happen when something is different. When faced with a new situation, employees may find it difficult to adapt, particularly if the sources of danger are unknown to them, or if they have not been adequately prepared to deal with the new situation. If working conditions or processes were significantly different to normal, why was this?

Describe what was new or different in the situation. Was there a safe working method in place for this situation, were operatives aware of it, and was it being followed? If not, why not? Learning how people deal with unfamiliar situations will enable similar situations to be better handled in the future.

Was the way the changes, temporary or otherwise, were introduced a factor? Were the workers and supervisors aware that things were different? Were workers and supervisors sufficiently trained/experienced to recognise and adapt to changing circumstances?

6 Were there adequate safe working procedures and were they followed?

Adverse events often happen when there are no/ inadequate/ not followed safe working procedures. Comments such as ‘...we’ve been doing it that way for years and nothing has ever gone wrong before...’ or ‘...he has been working on that machine for years and knows what to do...’ often lead to the injured person getting the blame. Was a safe working method in place and being followed? If not, why not? Was there adequate supervision and were the supervisors themselves sufficiently trained and experienced? Again, it is important to pose these questions without attempting to apportion blame, assign responsibility or stipulate cause.

7 What injuries or ill health effects, if any, were caused?

It is important to note which parts of the body have been injured and the nature of the injury - ie bruising, crushing, a burn, a cut, a broken bone etc. Be as precise as you are able. If the site of the injury is the right upper arm, midway between the elbow and the shoulder joint, say so. Precise descriptions will enable you to spot trends and take prompt remedial action. For example it could be that what appears to be a safe piece of equipment, due to the standard of its guarding, is actually causing a number of inadvertent cut injuries due to the sharp edges on the guards themselves.

Facts such as whether the injured person was given first aid or taken to hospital (by ambulance, a colleague etc) should also be recorded here.

8 If there was an injury, how did it occur and what caused it?

Where an accident is relatively straightforward, it may seem artificial to differentiate between the accident itself (question 3) and the mode of injury, but when the accident is more complicated the differences between the two aspects become clearer and therefore precise descriptions are vital.

The mode of injury concerns two different aspects:

- the harmful object (known as the 'agent') that inflicted the injury; and
- the way in which the injury was actually sustained.

The object that inflicted the injury may be a hand-held tool like a knife, or a chemical, a machine, or a vehicle etc. The way in which it happened might, eg, be that the employee cut themselves or spilt chemicals on their skin.

9 Was the risk known? If so, why wasn't it controlled? If not, why not?

You need to find out whether the risk was known, and whether was communicated to those who needed to know. You should note what is said and who said it, so that potential gaps in the communication flow may be identified and remedied. The aim is to find out why the sources of danger may have been ignored, not fully appreciated or not understood. Remember you are investigating the processes and systems, not the person.

The existence of a written risk assessment for the process or task that led to the adverse event will help to reveal what was known of the associated risks. A judgement can be made as to whether the risk assessment was 'suitable and sufficient', and whether the risk control measures identified as being necessary were ever adequately put in place.

10 Did the organisation and arrangement of the work influence the adverse event?

The organisational arrangement sets the framework within which the work is done. Here are some examples; there are many more:

- standards of supervision and on-site monitoring of working practices may be less than adequate;
- lack of skills or knowledge may mean that nobody intervenes in the event of procedural errors;
- inappropriate working procedures may mean certain steps in the procedures are omitted, because they are too difficult and time-consuming;
- lack of planning may mean that some tasks are not done, are done too late or are done in the wrong order;
- employees' actions and priorities may be a consequence of the way in which they are paid or otherwise rewarded;
- high production targets and piecework may result in safety measures being degraded and employees working at too fast a pace.

11 Was maintenance and cleaning sufficient? If not, explain why not.

Lack of maintenance and poor housekeeping are common causes of adverse events. Was the state of repair and condition of the workplace, plant and equipment such that they contributed to or caused the adverse event? Were the brakes on the forklift truck in good working order? Were spills dealt with immediately? Was the site so cluttered and untidy that it created a slipping or tripping hazard? Was there a programme of preventative maintenance? What are the instructions concerning good housekeeping in the workplace? You should observe the location of the adverse event as soon as possible and judge whether the general condition or state of repair of the premises, plant or equipment was adequate. Those working in the area, together with witnesses, and any injured parties, should also be asked for their opinion. Working in the area, they will have a good idea of what is acceptable and whether conditions had deteriorated over time.

11 Was maintenance and cleaning sufficient? If not, explain why not.

Consider the role the following factors may play:

- a badly maintained machine or tool may mean an employee is exposed to excessive vibration or noise and has to use increased force, or tamper with the machine to get the work done.
- a noisy environment may prevent employees hearing instructions correctly.
- uneven floors may make movement around the workplace, especially vehicle movements, hazardous.
- badly maintained lighting may make carrying out the task more difficult.
- poorly stored materials on the floor will increase the risk of tripping.
- ice, dirt and other contaminants make it easier to slip and fall.
- tools not in immediate use should be stored appropriately and not left lying around the work area.

12 Were the people involved competent and suitable?

Training should provide workers with the necessary knowledge, skills and hands-on work experience to carry out their work efficiently and safely. The fact that someone has been doing the same job for a long time does not necessarily mean that they have the necessary skills or experience to do it safely. This is particularly the case when the normal routine is changed, when any lack of understanding can become apparent. There is no substitute for adequate health and safety training. Some of the problems that might arise follow:

12 Were the people involved competent and suitable?

- a lack of instruction and training may mean that tasks are not done properly;
- misunderstandings, which arise more easily when employees lack understanding of the usual routines and procedures
- a lack of respect for the risks involved, due to ignorance of the potential consequences;
- problems due to the immaturity, inexperience and lack of awareness of existing or potential risks among young people
- poor handling of dangerous materials or tools, due to employees not being properly informed about how things should be done correctly.

People should also be matched to their work in terms of health, strength, mental ability and physical stature.

13 Did the workplace layout influence the adverse event?

Injuries may be caused by sharp table edges. Hazardous or highly inflammable fumes may be produced in areas where operatives work or where there are naked lights. Or, the workplace may be organised in such a way that there is not enough circulation space. Or, it may be impossible to see or hear warning signals, eg during fork lift truck movements.

Employees should be able to see the whole of their work area and see what their immediate colleagues are doing. The workplace should be organised in such a way that safe practices are encouraged. In other words, workplace arrangements should discourage employees from running risks, eg providing a clear walkway around machinery will discourage people from crawling under or climbing over it.

14 Did the nature or shape of the materials influence the adverse event?

As well as being intrinsically hazardous, materials can pose a hazard simply by their design, weight, quality or packaging, eg heavy and awkward materials, materials with sharp edges, splinters, poisonous chemicals etc.

The choice of materials also influences work processes, eg a particularly hazardous material may be required. Poor quality may also result in materials or equipment failing during normal processing, causing malfunctions and accidents.

15 Did difficulties using the plant and equipment influence the adverse event?

Plant and equipment includes all the machinery, plant and tools used to organise and carry out the work. All of these items should be designed to suit the people using them. This is referred to as ergonomic design, where the focus is on the individual as well as the work task the item is specifically designed to carry out. If the equipment meets the needs of the individual user, it is more likely to be used as it is intended - ie safely. Consider user instructions here. A machine that requires its operator to follow a complicated user manual is a source of risk in itself.

16 Was the safety equipment sufficient?

You should satisfy yourself that any safety equipment and safety procedures are both sufficient and current for all conditions in which work takes place, including the provision and use of any extra equipment needed for employees' safety. For example:

- extra technical safety equipment at machines;
- power supply isolation equipment and procedures;
- personal protective equipment (PPE);
- building safety systems, eg an extract ventilation system.

Make a note of whether the safety equipment was used, whether it was used correctly, whether or not it was in good condition and was working properly etc.

17 Did other conditions influence the adverse event?

'Other conditions' is intended to cover everything else that has not been reported yet, but which might have influenced the adverse event. For example:

- disagreements or misunderstandings between people;
- the weather;
- unauthorised interference in a process or job task;
- defective supplies or equipment;
- deliberate acts, such as trespass or sabotage.

Step two

Analysing the information

- An analysis involves examining all the facts, determining what happened and why. All the detailed information gathered should be assembled and examined to identify what information is relevant and what information is missing.
- To be thorough and free from bias, the analysis must be carried out in a systematic way, so all the possible causes and consequences of the adverse event are fully considered.
- The analysis should be conducted with employee or health and safety representatives and other experts or specialists, as appropriate.

ISOLATE FACT FROM FICTION

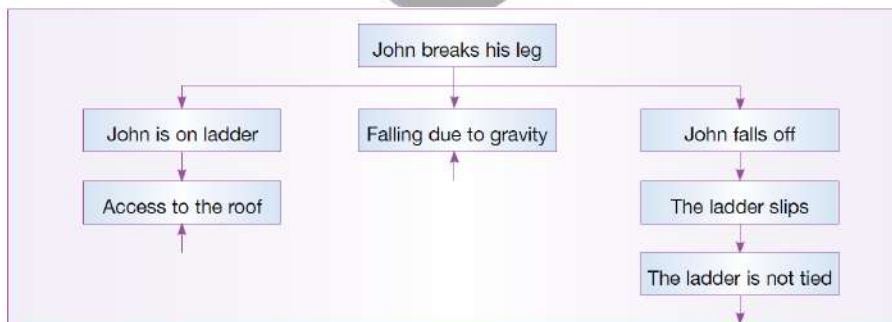
- Use NORMS-based analysis of information
 - Not an interpretation
 - Observable
 - Reliable
 - Measurable
 - Specific
- If an item meets all five of above, it is a fact.

18 What were the immediate, underlying and root causes?

- The causes of adverse events often relate to one another in a complex way, sometimes only influencing events and at other times having an overwhelming impact, due to their timing or the way they interact. The analysis must consider all possible causes. Keep an open mind. Do not reject a possible cause until you have given it serious consideration. The emphasis is on a thorough, systematic and objective look at the evidence

Analysis

- There are many methods of analysing the information gathered in an investigation to find the immediate, underlying and root causes and it is for you to choose whichever method suits you best.



What happened and why?

The first step in understanding what happened and why is to organise the information you have gathered. This guidance uses the simple technique of asking ‘Why’ over and over, until the answer is no longer meaningful. The starting point is the ‘event’, eg John has broken his leg. On the line below, set out the reasons why this happened. This first line should identify:

- the vulnerable person, eg John on a ladder;
- the hazard, eg falling due to gravity;
- the circumstances that brought them together, eg John fell off the ladder.

What happened and why?

For each of the reasons identified ask ‘Why?’ and set down the answers. Continue down the page asking ‘Why’ until the answers are no longer meaningful.

Do not be concerned at the number of times you ask the question, ‘Why?’ because by doing so you will arrive at the real causes of the adverse event. Some lines of enquiry will quickly end, eg ‘Why was the hazard of falling present?’ Answer: ‘Gravity’.

Having collected the relevant information and determined what happened and why, you can now determine the causes of the adverse event systematically.

Checklist/question analysis of the causes

- Using the adverse event analysis work sheets and checklist (in the Adverse Event and Investigation Form), work through the questions about the possible immediate causes of the adverse event (the place, the plant, the people and the process) and identify which are relevant.
- Record all the immediate causes identified and the necessary risk control measures.
- For each immediate cause, the analysis suggests underlying causes which may have allowed the immediate causes to exist.
- Consider the underlying/root cause questions suggested by the immediate causes. Record those that are relevant and note the measures needed to remedy them.

Checklist/question analysis of the causes

- The final step of your analysis is to consider the environment in which the organisation and planning of health and safety was carried out.
- This 'Management' section of the analysis must be carried out by people within the organisation who have both the overall responsibility for health and safety, and the authority to make changes to the management system. Record the underlying failings in the overall management system (ie the root causes of the adverse event) and the remedial action required at management level. The root causes of almost all adverse events are failings at managerial level.

HUMAN BEHAVIOR

- Common to all accidents
- Not limited to the person involved in the accident

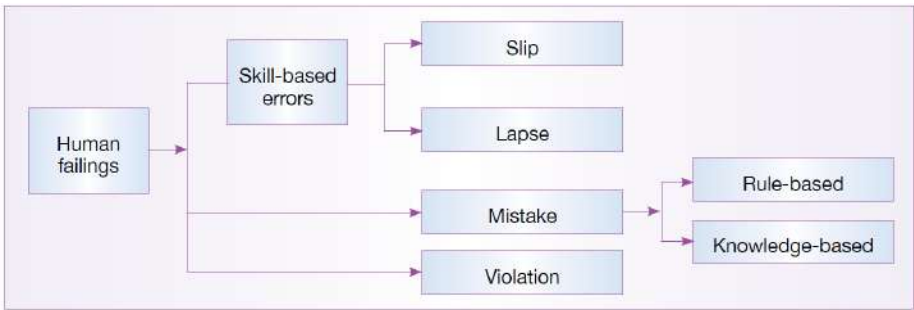


What if ‘human failings (errors and violations)’ are identified as a contributory factor?

- If your investigation concludes that errors or violations contributed to the adverse event, consider carefully how to handle this information.
- The objective of an investigation is to learn the lessons and to act to prevent recurrences, through suitable risk control measures. You will not be able to do that unless your workforce trusts you enough to co-operate with you.
- Speak to those involved and explain how you believe their action(s) contributed to the adverse event. Invite them to explain why they did what they did. This may not only help you better understand the reasons behind the immediate causes of the adverse event, but may offer more pointers to the underlying causes: perhaps the production deadline was short, and removing the guards saved valuable time; maybe the workload is too great for one person etc.

- Laying all the blame on one or more individuals is counter-productive and runs the risk of alienating the workforce and undermining the safety culture, crucial to creating and maintaining a safer working environment.
- Unless you discover a deliberate violation or sabotage of workplace safety precautions, it may be counter-productive to take disciplinary action against those involved. Will anyone be open and honest with you the next time an adverse event occurs? What you should aim for is a fair and just system where people are held to account for their behaviour, without being unduly blamed. In any event, your regime of supervision and monitoring of performance should have detected and corrected these unsafe behaviours.
- Human failings can be divided into three broad types and the action needed to prevent further failings will depend on which type of human failing is involved. See Below:

What if ‘human failings (errors and violations)’ are identified as a contributory factor?



Skill-based errors: a slip or lapse of memory:

Slips happen when a person is carrying out familiar tasks automatically, without thinking, and that person's action is not as planned, eg operating the wrong switch on a control panel;

Lapses happen when an action is performed out of sequence or a step in a sequence is missed, eg a road tanker driver had completed filling his tanker and was about to disconnect the hose when he was called away to answer the phone. On his return he forgot that he hadn't disconnected the hose and drove off.

Mistakes: errors of judgement (rule-based or knowledge-based):

rule-based mistakes happen when a person has a set of rules about what to do in certain situations and applies the wrong rule;

knowledge-based mistakes happen when a person is faced with an unfamiliar situation for which he or she has no rules, uses his or her knowledge and works from first principles, but comes to a wrong conclusion. For example when the warning light comes on indicating that the cooling system pump is overheating, is there a rule for what to do? If not, do you leave the pump on, turn it off, or shut down the whole unit?

Violation (rule breaking):

deliberate failure to follow the rules, cutting corners to save time or effort, based on the belief that the rules are too restrictive and are not enforced anyway, eg operating a circular saw bench with the guard removed.

This type of behaviour can be foreseen. The provision of training, simple practical rules, and routine supervision and monitoring of performance will reduce this type of behaviour.

When considering how to avoid human failings, bear in mind the fact they do not happen in isolation. If human failings are identified as a cause of an adverse event, consider the following factors that can influence human behaviour.

Job factors:

- how much attention is needed for the task (both too little and too much can lead to higher error rates)?
- divided attention or distractions are present;
- inadequate procedures;
- time available.

Human factors:

- physical ability (size and strength);
- competence (knowledge, skill and experience);
- fatigue, stress, morale, alcohol or drugs.

Organisational factors:

- work pressure, long hours;
- availability of sufficient resources;
- quality of supervision;
- management beliefs in health and safety (the safety culture).

Plant and equipment factors:

- how clear and simple to read and understand are the controls?
- is the equipment designed to detect or prevent errors? (For example different-sized connectors are used for oxygen and acetylene bottles to prevent errors in connecting the hoses);
- is the workplace layout user-friendly?

• ENVIRONMENTAL

- Noise
- Vapors, fumes, dust
- Light
- Heat
- Critters



- **DESIGN**

- Workplace layout
- Design of tools & equipment
- Maintenance



- **SYSTEMS & PROCEDURES**

- Lack of systems & procedures
- Inappropriate systems & procedures
- Training in procedures
- Housekeeping



CONTRIBUTING FACTORS INVESTIGATION STRATEGY

INVESTIGATION TEAM

ISOLATES THE KEY FACTOR(S) BY
ASKING THE FOLLOWING QUESTION....

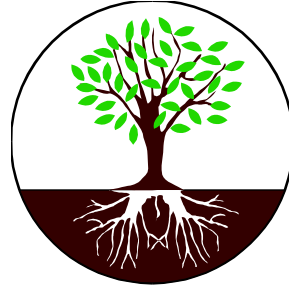
WOULD THE ACCIDENT HAVE
HAPPENED IF THIS PARTICULAR
FACTOR WAS NOT PRESENT?

DETERMINE CAUSES

- Employee actions
 - Safe behavior, at-risk behavior
- Environmental conditions
 - Lighting, heat/cold, moisture/humidity, dust, vapors, etc.
- Equipment condition
 - Defective/operational, guards, leaks, broken parts, etc.
- Procedures
 - Existing (or not), followed (or not), appropriate (or not)
- Training
 - Was employee trained - when, by whom, documentation

FIND ROOT CAUSES

- When you have determined the contributing factors, dig deeper!
 - If employee error, what caused that behavior?
 - If defective machine, why wasn't it fixed?
 - If poor lighting, why not corrected?
 - If no training, why not?



Step Three

Identifying suitable risk control measures

The methodical approach adopted in the analysis stage will enable failings and possible solutions to be identified. These solutions need to be systematically evaluated and only the optimum solution(s) should be considered for implementation. If several risk control measures are identified, they should be carefully prioritised as a risk control action plan, which sets out what needs to be done, when and by whom. Assign responsibility for this to ensure the timetable for implementation is monitored.

19 What risk control measures are needed/recommended?

- Your analysis of the adverse event will have identified a number of risk control measures that either failed or that could have interrupted the chain of events leading to the adverse event, if they had been in place. You should now draw up a list of all the alternative measures to prevent this, or similar, adverse events.
- Some of these measures will be more difficult to implement than others, but this must not influence their listing as possible risk control measures. The time to consider these limitations is later when choosing and prioritising which measures to implement.
- Evaluate each of the possible risk control measures on the basis of their ability to prevent recurrences and whether or not they can be successfully implemented.

19 What risk control measures are needed/recommended?

- In deciding which risk control measures to recommend and their priority, you should choose measures in the following order, where possible:
 - measures which eliminate the risk, eg use ‘inherently safe’ products, such as a water-based product rather than a hydrocarbon-based solvent;
 - measures which combat the risk at source, eg provision of guarding;
 - measures which minimise the risk by relying on human behaviour, eg safe working procedures, the use of personal protective equipment.

In general terms, measures that rely on engineering risk control measures are more reliable than those that rely on people.

20 Do similar risks exist elsewhere? If so, what and where?

- Having concluded your investigation of the adverse event, consider the wider implications:
Could the same thing happen elsewhere in the organisation, on this site or at another location?
What steps can be taken to avoid this?
- Adverse events might not have occurred at other locations yet, but make an evaluation as to whether the risks are the same and the same or similar risk control measures are appropriate.

21 Have similar adverse events happened before? Give details.

- If there have been similar adverse events in the past why have they been allowed to happen again? The fact that such adverse events are still occurring should be a spur to ensure that action is taken quickly. You will be particularly open to criticism if you as an organisation ignore a series of similar accidents.
- Remember that there is value in investigating near-misses and undesired circumstances: it is often only a matter of luck that such incidents do not result in serious injuries or loss of life.

Step four

The action plan and its implementation

22 Which risk control measures should be implemented in the short and long term?

The risk control action plan:

At this stage in the investigation, senior management, who have the authority to make decisions and act on the recommendations of the investigation team, should be involved.

An action plan for the implementation of additional risk control measures is the desired outcome of a thorough investigation. The action plan should have SMART objectives, ie Specific, Measurable, Agreed, and Realistic, with Timescales.

The risk control action plan:

For the risk control measures proposed to be SMART, management, safety professionals, employees and their representatives should all contribute to a constructive discussion on what should be in the action plan.

Not every risk control measure will be implemented, but the ones accorded the highest priority should be implemented immediately.

In deciding your priorities you should be guided by the magnitude of the risk ('risk' is the likelihood and severity of harm). Ask yourself 'What is essential to securing the health and safety of the workforce today?' What cannot be left until another day? How high is the risk to employees if this risk control measure is not implemented immediately? If the risk is high, you should act immediately.

The risk control action plan:

You will, no doubt, be subject to financial constraints, but failing to put in place measures to control serious and imminent risks is totally unacceptable. You must either reduce the risks to an acceptable level, or stop the work.

For those risks that are not high and immediate, the risk control measures should be put into your action plan in order of priority. Each risk control measure should be assigned a timescale and a person made responsible for its implementation.

It is crucial that a specific person, preferably a director, partner or senior manager, is made responsible for ensuring that the action plan as a whole is put into effect.

Progress on the action plan should be regularly reviewed. Any significant departures from the plan should be explained and risk control measure rescheduled, if appropriate.

23 Which risk assessments and safe working procedures need to be reviewed and updated?

All relevant risk assessments and safe working procedures should be reviewed after an adverse event. The findings of your investigation should indicate areas of your risk assessments that need improving. It is important that you take a step back and ask what the findings of the investigation tell you about your risk assessments in general. Are they really suitable and sufficient?

PREPARE A REPORT

- Accident Reports should contain the following:
 - Description of incident and injuries
 - Sequence of events
 - Pertinent facts discovered during investigation
 - Conclusions of the investigator(s)
 - Recommendations for correcting problems



PREPARE A REPORT, CONT.

- Be objective!
 - State facts.
 - Assign cause(s), not blame.
 - If referring to an individuals actions, don't use names in the recommendation.
 - Good: All employees should.....
 - Bad: George should.....

MAKE RECOMMENDATIONS

- DETERMINE CORRECTIVE ACTIONS
 - INVESTIGATION TEAM
 - INTERPRETS & DRAWS CONCLUSION
 - DISTINCTION BETWEEN INTERMEDIATE & UNDERLYING CAUSES

MAKE RECOMMENDATIONS

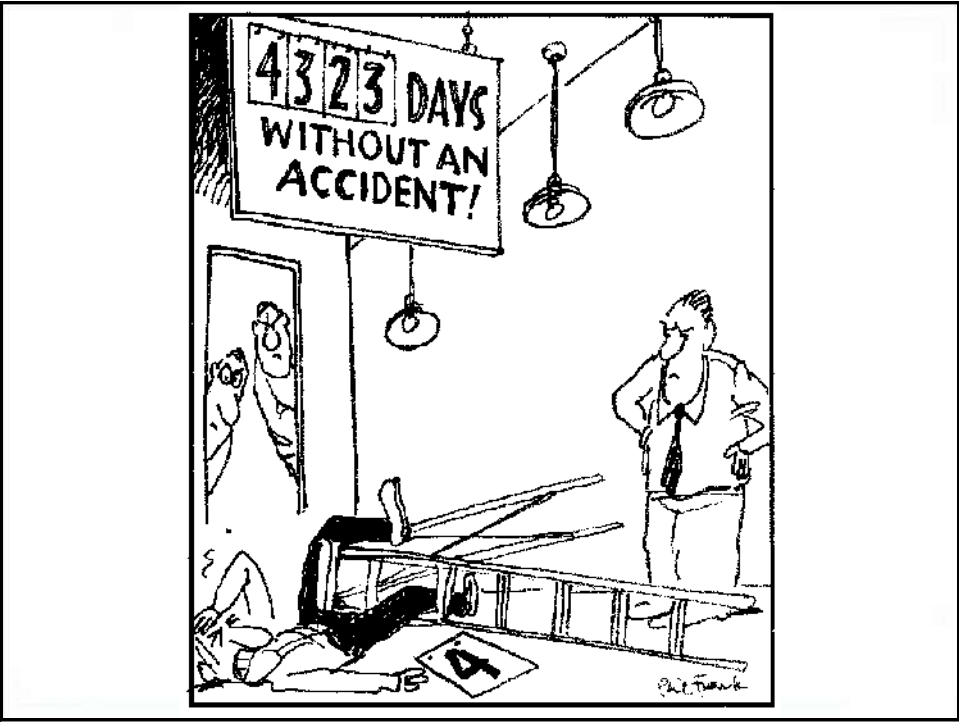
- IMPLEMENT CORRECTIVE ACTIONS
 - INVESTIGATION TEAM
 - Recommendation(s) must be communicated clearly and **objectively.**
 - Strict time table established
 - Follow up conducted

COMPANY ACCIDENT FORMS

- Must be filled out completely by the employee and employee's immediate supervisor (this includes foremen).
- Must be turned in to Safety within 24 hours of incident.

BENEFITS OF ACCIDENT INVESTIGATION

WHEN AN ORGANIZATION REACTS SWIFTLY AND POSITIVELY TO ACCIDENTS AND INJURIES, ITS ACTIONS REAFFIRM ITS COMMITMENT TO THE SAFETY AND WELL-BEING OF ITS EMPLOYEES



Remember, always dig deep for the answers.





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