

# Incident Investigation

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# What Will Be Covered Module 1

- ▶ Introduction
- ▶ Major Incidents
- ▶ Employers' Duties
- ▶ Employees' Duties
- ▶ In Practice
- ▶ What Should be Investigated
- ▶ What Will an Investigation Achieve
- ▶ Cultural Aspects
- ▶ Investigation Process

# Introduction

Investigation of workplace accidents and incidents is an essential part of the proactive management of health and safety. Undertaking investigations of both those accidents that result in injury or death, as well as near misses, in a systematic and organised way will benefit any organisation. Analysis of accurate information about previous accidents and near misses helps to prevent them recurring.

# Major Industrial Accidents

October 1957: The Windscale fire,

June 3, 1979: Ixtoc oil spill.

May 1962: The Centralia mine fire

March 4, 1965: The Natchitoches explosion:

October 1963: The Vajont Dam

November 19, 1984: San Juanico Disaster.

March 1967: The Torrey Canyon supertanker

January 15, 1919: Great Molasses Flood

May 5, 1988: Norco, Louisiana, Shell Oil refinery explosion.

March 12, 2008: Morin-Heights, Quebec

March 28, 1979: Three Mile Island accident.

January 25, 2019: Brumadinho dam disaster, Minas Gerais

May 4, 1988: PEPCON disaster, Henderson, Nevada.

April 18, 2007: Qinghe Special Steel Corporation disaster

April 17, 2013: Fertilizer plant explosion in West, Texas

# Major Industrial Accidents

**December 3, 1984:** The Bhopal disaster in India is one of the largest industrial disasters on record. Estimates of the death toll range from 3700 to 16,000.

**July 10, 1976:** Seveso disaster, in Seveso, Italy, in a small chemical manufacturing plant released of dioxins into the atmosphere 193 people in the affected areas suffered from chloracne and other symptoms.

**August 4, 2020:** Beirut explosions. A massive explosion of a large cache of ammonium nitrate at least 158 people have been reported dead and another 6,000+ injured.

**January 30, 2000:** Romania Baia Mare cyanide spill, 100,000 tons was a released into the rivers Although no human fatalities were reported, the leak killed up to 80 percent of aquatic life in some of the affected rivers.

**July 6, 1988:** Piper Alpha disaster. An explosion and resulting fire on a North Sea oil production platform killed 167 men. The total insured loss was about US\$3.4 billion.

**September 3, 1991:** Hamlet chicken processing plant fire in Hamlet, North Carolina, where locked doors trapped workers in a burning processing plant, causing 25 deaths

# Construction Accidents

Key non-fatal injury statistics in Great Britain's construction industry in 2017/2018, according to a Health and Safety Executive report. 82,000 workers suffered from work-related ill health

- Slip, trip, and falls on the same level 29%
- Manual lifting and handling 22%
- Struck by object 10%
- Fall from height 8%
- Acts of violence 7%
- Contact with machinery 4%
- Strike against something fixed /stationary 4%

# Construction Accidents

According to the UN's ILO, these are the top causes of deaths on construction sites as of April 2019:

- Falls
- Electrocution
- Crush injuries
- Caught-between injuries
- Crane collapse
- Fires
- Asbestos, ionising radiation, and cancer-causing chemicals
- Slips and trips
- Exhaustion
- Heat strokes

# What is an Incident

An incident is an unplanned sequence of events that includes:

- All Accidents
- All Near misses
- Dangerous occurrences
- Occupational Diseases

*Therefore all accidents are incidents but not all incidents are accidents*

Key difference between an incident and accident is that accident apply a negative implication where as a incident can refer to any event that could happen, both positive or negative.

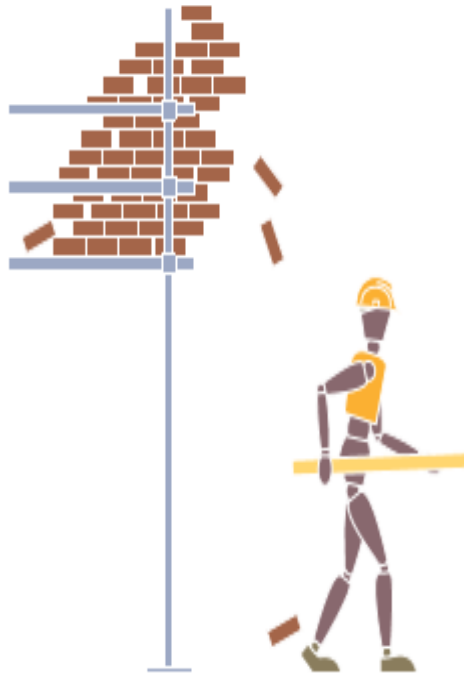


# Incidents



Any unplanned event that resulted in injury or ill health of people or damage to property, plant, materials or the environment or a loss of business opportunity.

# Near Miss



A “near miss” incident can be defined as any event which under slightly different circumstances may have resulted in injury or ill health of people or damage or loss to property, material or the environment or a loss of business opportunity

# Dangerous Occurrence

A dangerous occurrence can be defined as any incident that has the high potential to cause death or serious injury which are specified in QCS 2014 (RIDDOR) e.g.

- Lifting equipment
- Pressure systems
- Overhead electric lines
- Collapse of scaffolding
- Explosions



# Unsafe Act/Unsafe Condition

Unsafe act: is any act that deviates from a generally recognised safe way or specified method of doing the work that increases the potential for an accident

Unsafe conditions: are hazards that have the potential to cause injury, death

Unsafe act are more difficult to recognised because they involve human factors.

# Unsafe Act/Unsafe Condition

Unsafe  
condition



Unsafe  
act



Potential Incident

# Unsafe Act/Unsafe Condition

It is only when we have a combination of both we have the potential for an incident



Therefore an accident arising from both an UA and UC is both predictable and foreseeable and therefore preventable.

As investigators we need to investigate root cause to identify the reason for the UC and UA and not just the direct cause

# Employers' Duties

There is no explicit legal duty to investigate accidents, certain regulations do imply the need to carry out accident investigations.

Most Health and Safety Management Systems imply that investigating the causes of workplace incidents is considered an essential part of good health and safety management, and of the risk assessment review process. It forms the “check” part of the Plan, Do, Check, Act approach in the HSE’s HSG65 Managing for Health and Safety

# Explicit Legal Requirements

- Ionising Radiations Regulations 1999
- Railways (Safety Case) Regulations 2000
- Control of Major Accident Hazards Regulations 2015
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 (RIDDOR), as it applies to railways and mines and quarries
- Nuclear Installations Act 1965
- Safety Representatives and Safety Committees Regulations 1977.



# Investigation Other Requirements

- ▶ QCS 2014 (Part 10.1.4 (7))

Incident Investigation final reports to be submitted for all lost time major / reportable Incidents within 10 days of the incident. All incidents that result in lost time from work, near miss, dangerous occurrence or damage to property (asset) shall be reported.

- ▶ ISO 45001:10.1 Incident, nonconformity and corrective action.

- ▶ Client requirements

# Employees' Duties

Employees have a duty to co-operate with employers to enable them to fulfil their statutory duties under Health and Safety management

Systems which would include reporting:

- dangerous occurrences
- near misses
- incidents whether or not they resulted in injury, damage or disease.

Employees are also required to co-operate in an investigation.

# In Practice

There are both implicit requirements for employers to undertake accident investigation, as well as in some situations specific explicit requirements. •

- ▶ Gathering information.
- ▶ Analysing information.
- ▶ Identifying risk control measures.
- ▶ Producing and implementing an action plan.

Three levels of accident causation that need to be included.

- ▶ Immediate causes.
- ▶ Underlying causes.
- ▶ Root causes.

# So What Should be Investigation

- All high risk environments
- Near misses with the potential of injury and ill health
- Proportionate
- Significant Incidents will be required to be reported
- Legal and Client Requirements

# What Will an Investigation Achieve

The benefits to employers who undertake accident investigation include:

- a better understanding of risk and provision of information for use in risk assessment
- prevention of accidents and incidents in the future
- a powerful vehicle for motivating organisational learning and activating cultural change
- a means of understanding and obtaining information on management systems
- a useful means of demonstrating the status of safety management in an organisation which in turn can be used to assist in litigation claims and developing arguments for lowering insurance premiums
- providing evidence of any discrepancy between what should be in place, e.g. safe systems of work, and what is actually happening.

# Cultural Aspects

At the cultural/attitude level, if the idea is held that accidents are always a result of negligence and that somebody (an individual) is always to blame then the progress of the investigation and its outcomes will be limited. A positive culture of enquiry and continual improvement is more likely to lead to frank and thorough approaches to investigation.

# Investigation Process

Immediate  
Action

Plan the  
Investigation

Collect  
Information

Organize  
Information

Annalise  
Information

Recommend  
Solutions

Report  
Outcomes

# Accident Investigation Module 2



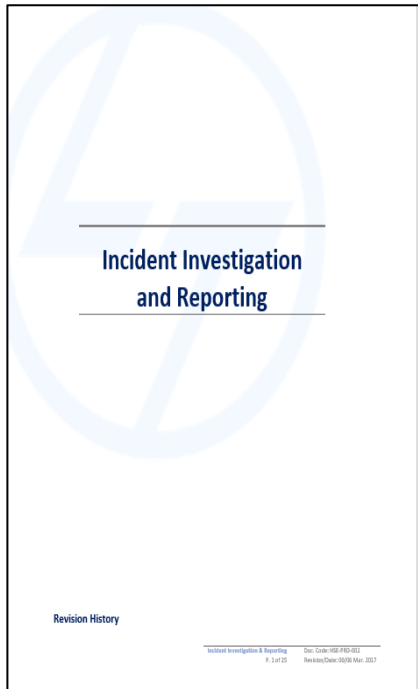


# Incident Investigation Module 2

- ▶ Accident Investigation Policy/Procedure
- ▶ Immediate Action
- ▶ Who Should Investigate an incident
- ▶ Planning the Investigation
- ▶ Checklist for Accident Investigation
- ▶ Evidence Collection



# Accident Investigation Policy/Procedure



- The responsibilities for accident investigation,
- The support in terms of resources, facilities and personnel
- The competencies of those tasked with investigation, including training arrangements
- Notification of next of kin, relatives
- Dealing with the media
- Dealing with the enforcement authority,
- Linking the policy requirements to the Legal/Client Requirements

## Which Incidents should be investigated

Having been notified of an the incident and provided with basic information on what happened, you will need to consider ?

- Who to notify
- Investigation Depth.
- Investigation Team:

# Level Of Investigation

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

Risk	Blue	Minimal	Yellow	Low	Orange	Medium	Red	High
Investigation level	Blue	Minimal level	Yellow	Low level	Orange	Medium level	Red	High level

# What Should be Investigated

Depending on the level of the investigation supervisors, project managers, health and safety professionals, may all be involved.

Specialist may also include:

- ▶ Electrician
- ▶ Scaffold Inspectors
- ▶ Confined Space
- ▶ Fire Specialist
- ▶ Doctors
- ▶ Etc



# Immediate Action

When appointed to undertake the investigation of an incident dependent of the severity of the incident it will be necessary to take some immediate action. If the incident has just occurred, it is important to go immediately to the incident scene to consider:

- Does anyone require medical attention
- How can the incident scene be secured and taken control of
- Are there any hazards that pose a danger to yourself or to other persons
- Was any equipment involved in the incident
- Does any individual need to be informed of the incident

# Plan the Investigation

Start the investigation by preparing a simple investigation plan outlining what steps are to be taken to successfully conduct the investigation. Use a diary or notebook to record what action needs to be taken

- What is the time frame for the investigation
- Who do I need to speak to and write down their names
- Does anything need to be photographed
- Do you need to draw a sketch plan of the incident scene
- What other documents need to be collected or sighted
- Who do you report the investigation findings to



# What should be in the Investigation Kit

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- Camera equipment
- Tape recorder
- Tape Measure
- High visibility tape
- Scissors
- Scotch Tape
- Sample Container
- PPE
- First Aid
- Gloves
- Large Envelopes
- Report forms
- Graph paper

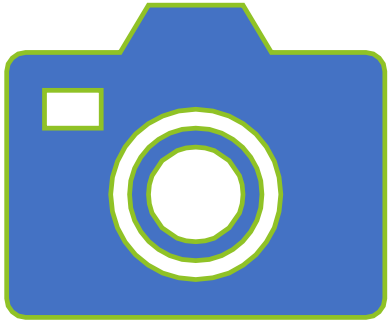


# Incident Site

► If you attend the incident scene shortly after the incident has occurred or if the incident scene has been preserved, spend a few moments observing the scene.

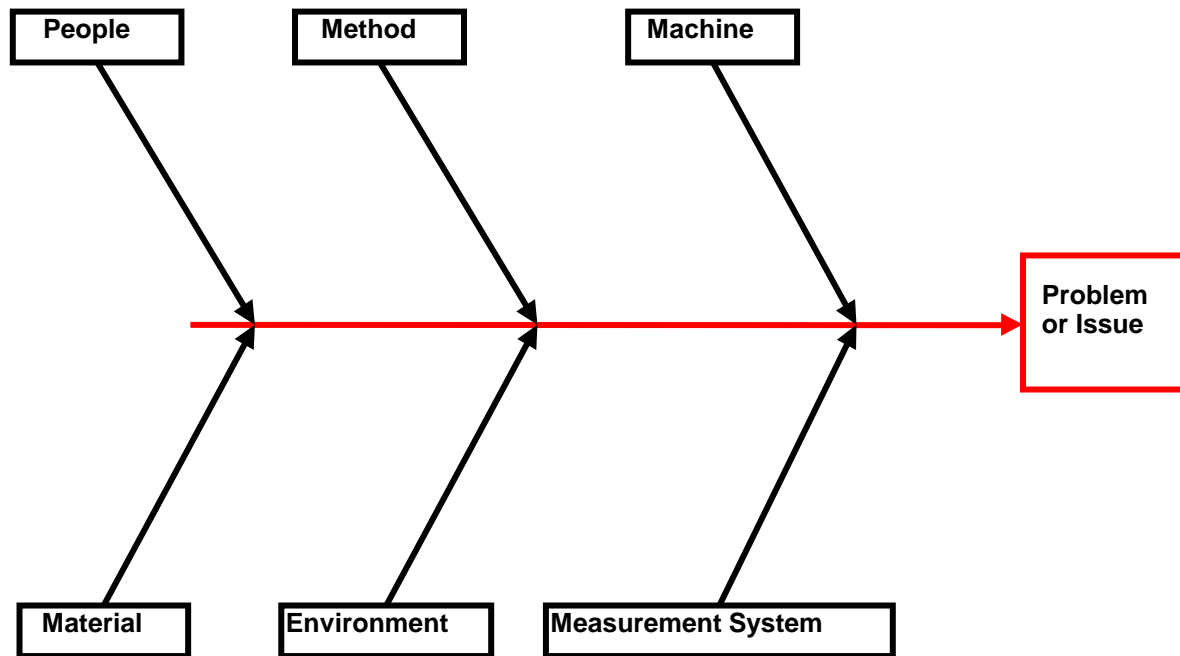


# Investigation Check List

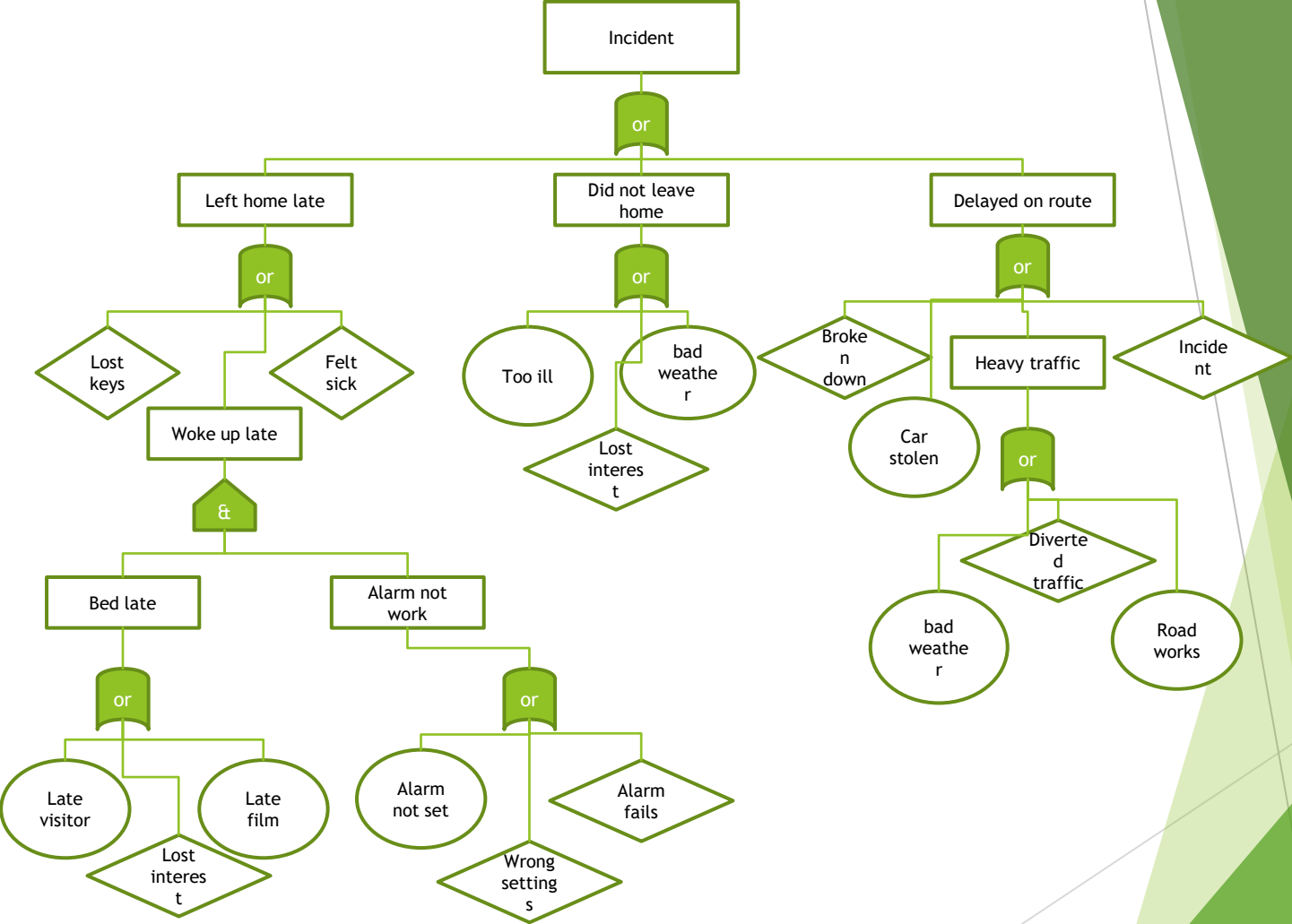


- ▶ photographs/video recordings
- ▶ plan of the scene
- ▶ list of witnesses
- ▶ list of equipment and plant
- ▶ measure distances/sizes
- ▶ institute immediate control measures.
- ▶ Identify and locate relevant documents, such as procedures, COPs
- ▶ manufacturer's/supplier's information
- ▶ training records and content
- ▶ risk assessments.
- ▶ take statements.
- ▶ record methods used and maintain results/charts,

# Investigation Check List



# Investigation Check List



# Collect Information



- ▶ Need to consider:
  - ▶ The time and location of the incident
  - ▶ The people involved
  - ▶ Any know events leading up to the incident
  - ▶ What was happening at the time of the incident
  - ▶ Weather conditions
  - ▶ Lighting Condition
  - ▶ Traffic
  - ▶ Incident Trends
  - ▶ HSE reports.

# Collect Information

## Record the scene

Napoleon Bonaparte once said: A picture is worth a thousand words. Photographs are one of the most useful investigation tools. Taking photos can eliminate the need for lengthy written descriptions. Photographs can assist the investigation by providing a permanent record of:

- ▶ The original scene and as things change
- ▶ Any scratches, dents and perishable evidence ( e.g. tyre marks, bruises)
- ▶ Before and after views (e.g. scene, equipment)

# Collect Information



You will also be required to collect information relating to one of or all the following:

- ▶ Processes
- ▶ Environment
- ▶ Management systems
- ▶ Plant and equipment
- ▶ People

Record all your activities, interviews and notes in the same diary or notebook as your investigation plan

# Collect Information

- ▶ Risk assessments
- ▶ TBT
- ▶ Training records
- ▶ Induction records
- ▶ Pre Start Briefing records
- ▶ Procurement Process
- ▶ Method statements
- ▶ SOPs
- ▶ HSE Plan
- ▶ Env Plan



Remember you won't get  
rid of the weeds by just  
concentration on the foliage  
we need to get to the roots



# Accident Investigation Module 3



# Accident Investigation Module 3

Interviews

Witnesses

Recording  
Statements  
Organise

Information  
Analyse  
Information

Write the  
Report

Conclusion

# Interviews



- ▶ Should be conducted separately and as privately as possible
- ▶ Should be held as soon as is practicable after the event being investigated
- ▶ Photographs of the scene so that witnesses can relate themselves to the incident.
- ▶ Interviewer must bear in mind that not all witnesses will be helpful and cooperative
- ▶ Some may be hostile, and deliberately misleading
- ▶ Those being interviewed may wish to be accompanied by a colleague or representative

# Witnesses



Anyone who has seen or partly seen the events leading up to or taking place during the accident should be interviewed to determine what they saw and/or heard.

Witnesses should be handled with care. If traumatised by the incident it is generally better to obtain just overview impressions early on.

- ▶ Where they were
- ▶ What they were doing
- ▶ And at the time of the event

# Open Questions



- ▶ **Open** questions demand an explanation such as who, what when where, why and how.
- ▶ **Who** questions identify all parties involved.
- ▶ **What** questions identify pertinent actions, events, and physical objects.
- ▶ **Where** questions locate participants, witnesses, and key objects involved in the accident.
- ▶ **When** questions determine the time of the accident and establish relationships between pairs of activities or events.
- ▶ **How** questions provide information on the interaction and relationships among participants, equipment, and the events leading up to, during, and after the accident.
- ▶ **Why** questions determine unsafe acts or hazardous conditions

# Open Questions



It does not necessarily matter that facts are given out of sequence providing that the sequence itself can be pieced together. It is generally better to let witnesses tell their own story assisted by questions, such as:

- ▶ what happened next?
- ▶ what did you see?
- ▶ could you explain why in happen?

Keep an open mind, Assumptions as to the cause of any accident should be avoided.

# Leading Questions

Under no circumstances should you ask leading questions because they can

- ▶ Cloud the information you are collecting
- ▶ Put words in the mouth of the person you are speaking to.
- ▶ Suggest an answer or answer





# Multiple Questions

- ▶ A multiple question is a question that contains two or more questions. But is phased as one question,
- ▶ E.g. did you see the staircase tread break when Mr Bob was walking down the stairs case carrying a box.
- ▶ By asking such questions you are putting words in witness's mouth - they might not have known that the tread broke. In one question we have asked 3



# Multiple Questions Examples



- ▶ Did you see the staircase break
- ▶ Did you see the teacher walking down the stairs
- ▶ Did you see the teacher carrying a box

# Recording Statements



As the Health & Safety investigation is a no blame or no-liability investigation the way in which you record oral information is not of such importance as long as;

- ▶ The person know why you are speaking to them
- ▶ What is recorded is a true reflection of what the person has to say
- ▶ It is recorded in a manner that the person is comfortable with

# Recording Statements

## Witness Statement

Interviewer's name:

Interviewer's job title:

Mobile number:  Email:

Witness name:

Witness job title:

Mobile number:  Email:

Incident date:  Incident time:

Site:

Exact location:  Email:

**Statement**

I certify that the details on this form are correct to the best of my knowledge.

Witness signature:  Date:

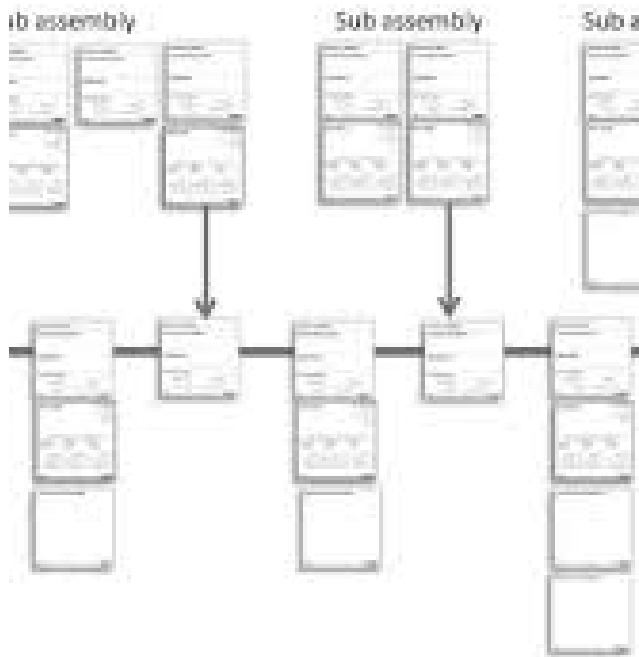
The following are all appropriate for a health and safety investigation

- ▶ Email Response
- ▶ Notes in a diary
- ▶ Written explanation by witness
- ▶ Formal statement



# Organise Information

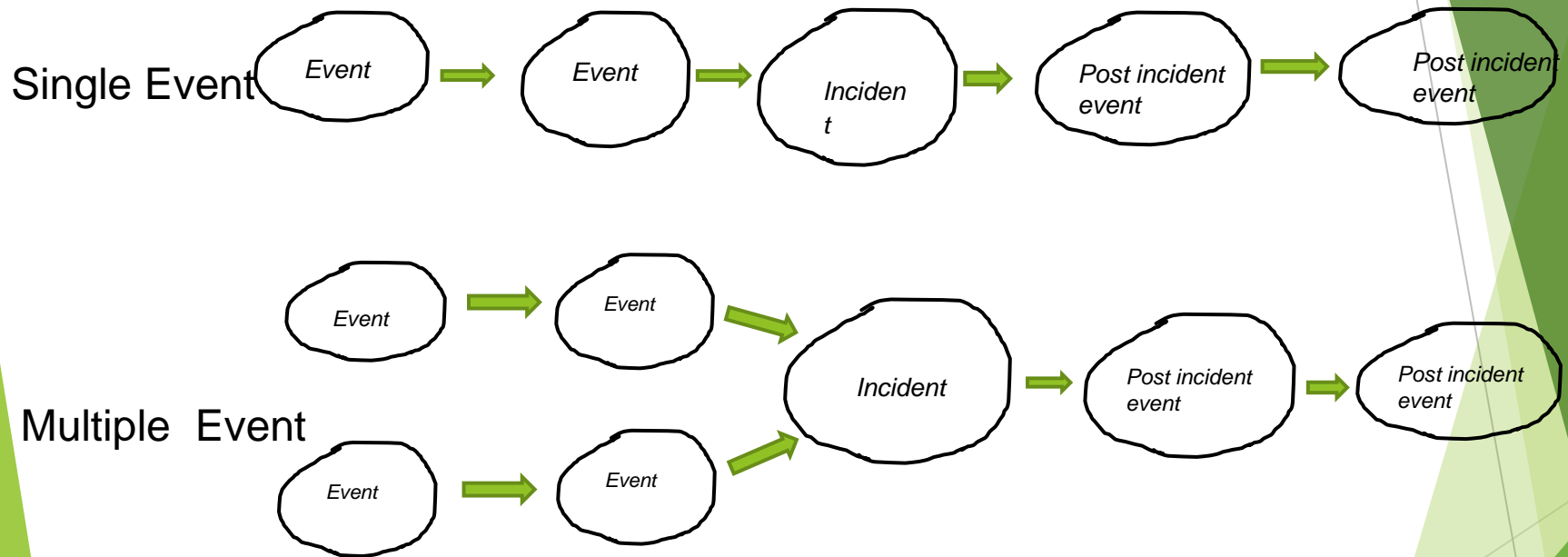
# Organise Information



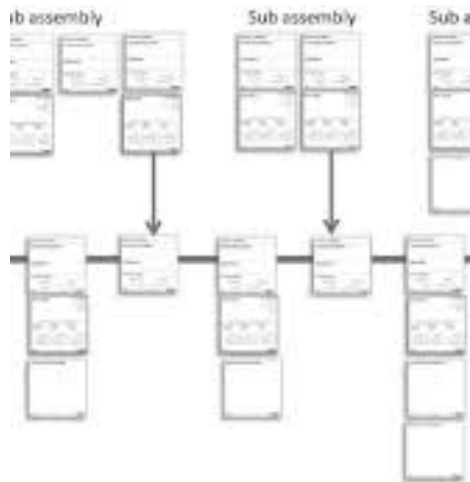
Once you have collected all the information, it is important to put them in some sort of order to understand what happen and analyse each event. Timeline can be created in a number of way, i.e.

- ▶ Drawn in a notebook
- ▶ On a white Board
- ▶ Or created using Post IT stuck on a wall.
- ▶ The event should be arranged from left to right

# Organise Information



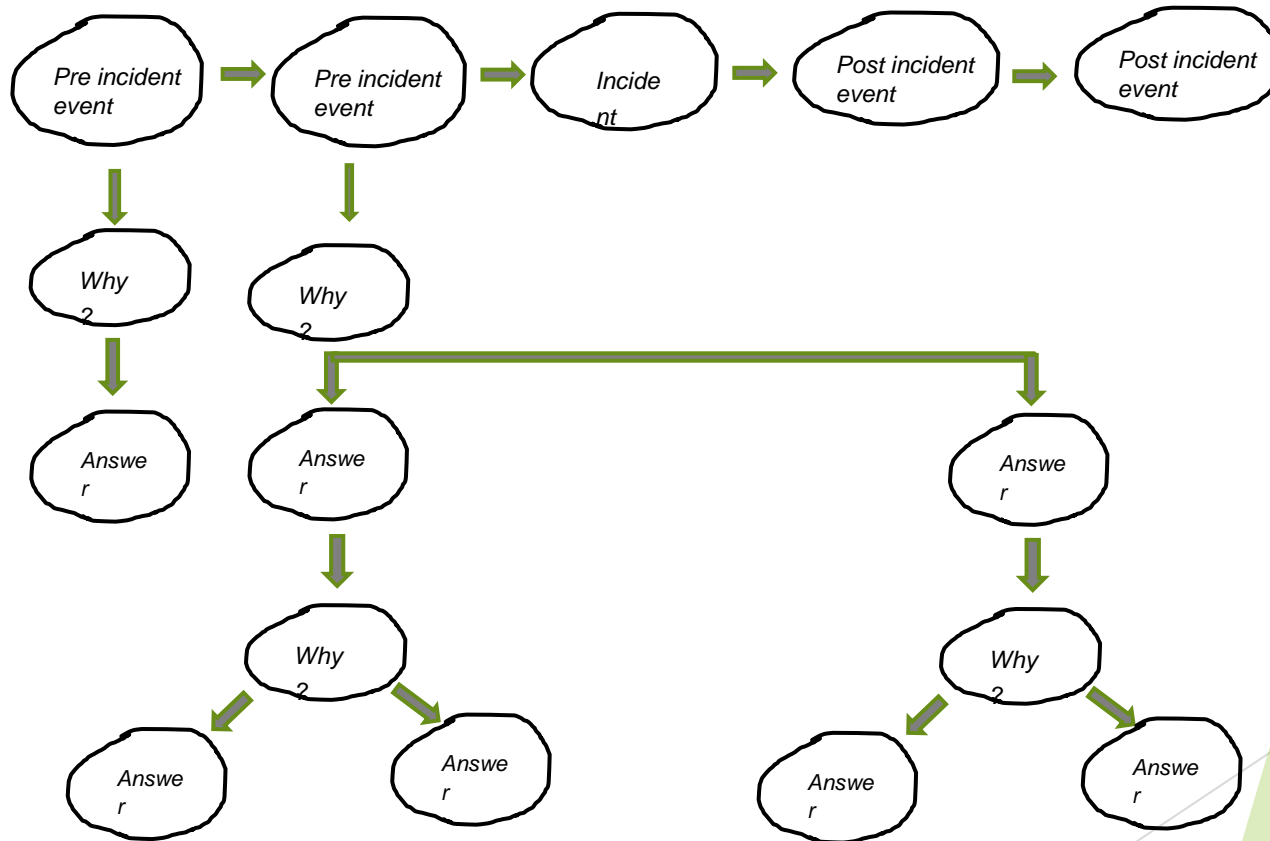
# Analyse Information



To determine the cause of the incident, the events on the timeline need to be analyzed or examined to do this you need to ask why an event occurred and keep asking why until you know why the event occurred



# Analyse Information



# Write the Report



Answer the following in the report.

- ▶ When and where did the accident happen
- ▶ What was the sequence of events?
- ▶ Who was involved?
- ▶ What injuries occurred or what equipment was damaged?
- ▶ How were the employee injured

# Write the Report



The report should include:

- ▶ An accurate narrative of “what happened”
- ▶ Clear description of unsafe act or condition.
- ▶ Recommendation immediate corrective action
- ▶ Recommendation long term corrective action
- ▶ Recommendation following up to corrective is in place.
- ▶ Recommendation review to ensure corrective is effective

# Conclusion of Report



Report conclusions should answer the following:

- ▶ What should happen to prevent future accidents
- ▶ What resources are need
- ▶ Who is responsible for making changes
- ▶ Who will follow up an insure changes have been implemented
- ▶ What will be the future long term procedures

# Accident Investigation Module 4



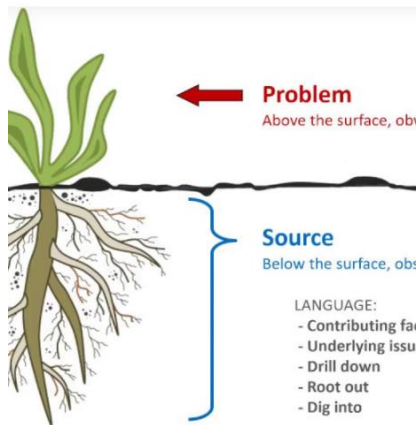
# Accident Investigation

## Module 4

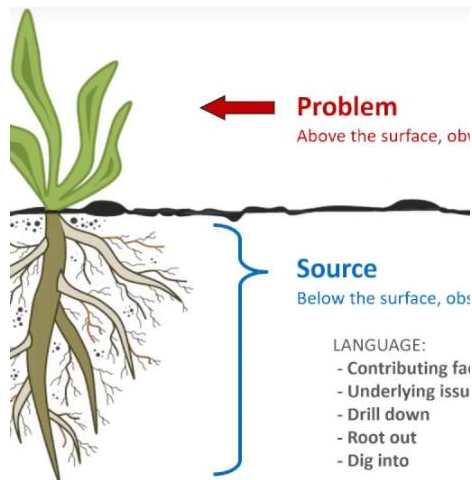
- The "5 Why" method.
- Cause & Effect (Fishbone Diagram)
- Fault Tree.
- Event Tree.
- SCAT (Systematic Cause Analysis)

# Root Cause Analysis

Is a systematic process for identifying “root causes” of problems or events and an approach for responding to them. RCA is based on the basic idea that effective management requires more than merely “putting out fires” for problems that develop, but finding a way to prevent them



# Root Cause Analysis



- ▶ Define the Problem
- ▶ Collect Data
- ▶ Identify possible causes
- ▶ Identifies Root Cause from the possible causes
- ▶ Fix the Problems that lead to event happening



# Five Whys



The “five Whys” is one of the simplest of the root cause analysis methods. It is a question-asking method used to explore the cause/effect relationship underlying a particular problem. Ultimately, the goal of applying the five whys method is to determine a root cause of a defect or problem.

# Five Whys



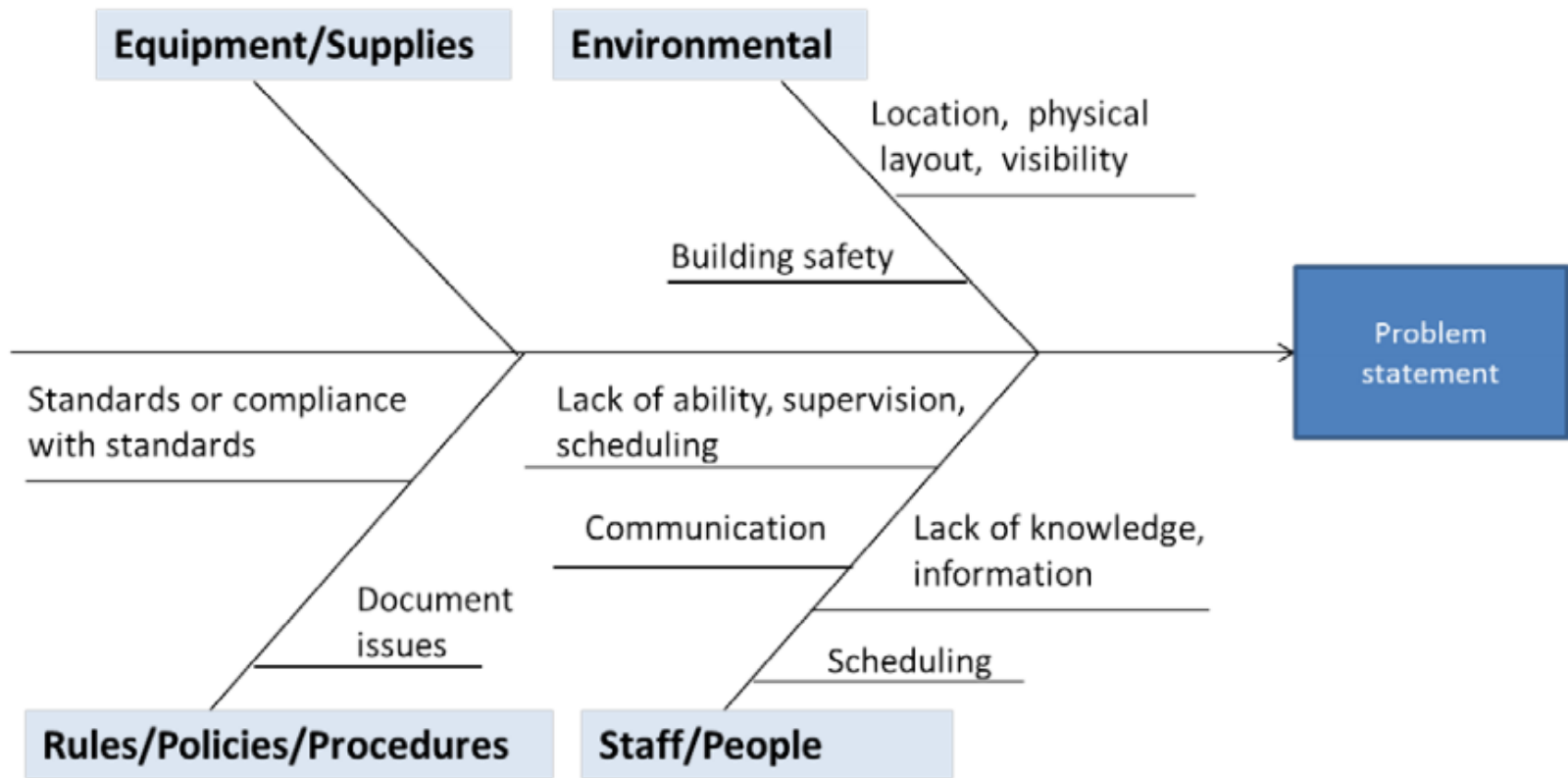
My car will not start

- ▶ Why: The battery is dead
- ▶ Why: The alternator is not functioning
- ▶ Why: The alternator belt has broken
- ▶ Why: The alternator belt was well beyond its useful service and has never been replaced
- ▶ Why: I have not been maintaining my car according to the recommended service schedule.

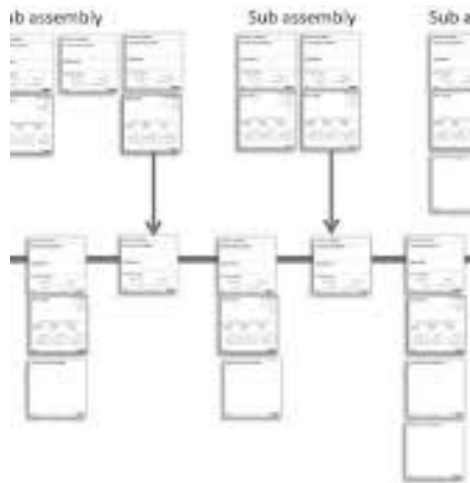
# Cause & Effect

- ▶ Agree on the problem statement (also referred to as the effect (incident))
- ▶ Agree on the major categories of causes of the problem
- ▶ Brainstorm all the possible causes of the problem. Ask “Why does this happen”  
Causes can be written in several places if they relate to several categories.
- ▶ Again asks “Why does this happen?” about each cause. Write sub-causes branching off the cause branches.
- ▶ Continues to ask “Why?” and generate deeper levels of causes and continue organizing them under related causes or categories.



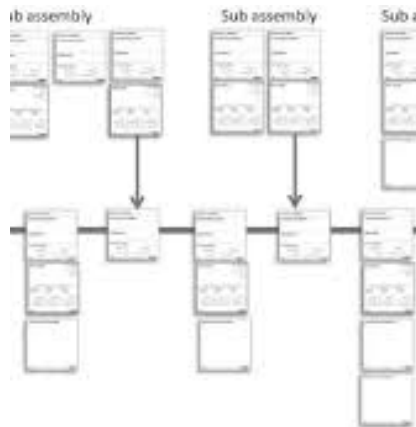


# Event Tree Analyses (Application)



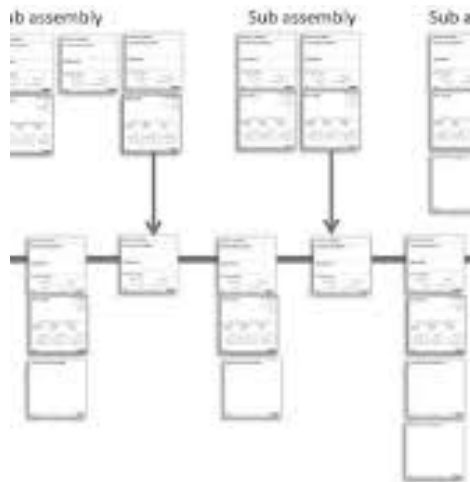
- ▶ The Event Tree analysis method is used to analyse event sequences following after an initiating event.
- ▶ Risk analysis of technological systems
- ▶ Identification of improvements in protection systems and other safety functions

# Event Tree



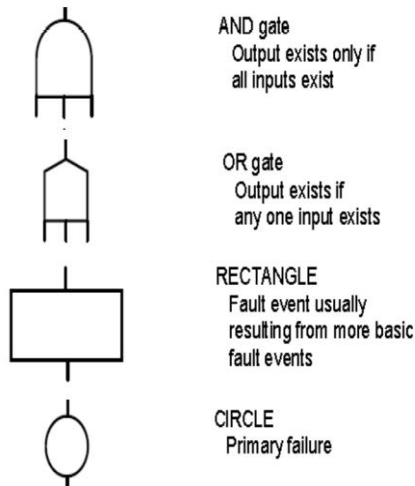
- ▶ Identify (and define) a relevant accidental (initial) event that may give rise to unwanted consequences
- ▶ Identify the barriers that are designed to deal with the accidental event
- ▶ Construct the event tree
- ▶ Describe the (potential) resulting accident sequences
- ▶ Determine the frequency of the accidental event and the (conditional) probabilities of the branches in the event tree
- ▶ Calculate the probabilities/frequencies for the identified consequences (outcomes)
- ▶ Compile and present the results from the analysis

# Event Tree (Results)



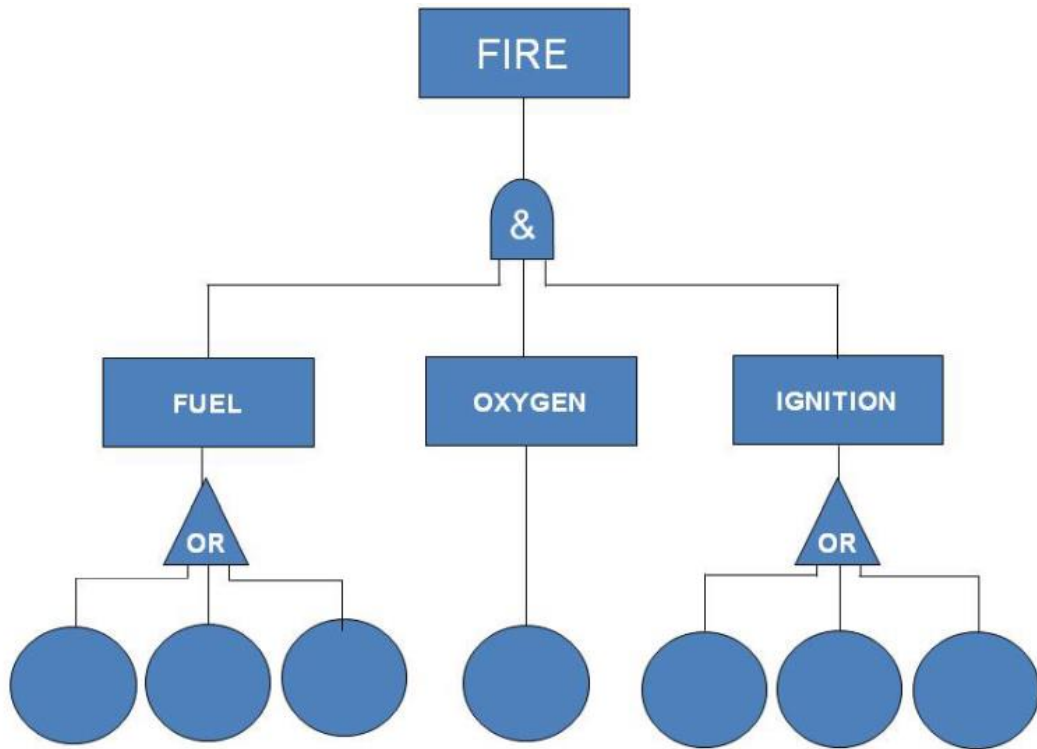
- ▶ Judge the acceptability of the system
- ▶ Identify improvement opportunities
- ▶ Make recommendations for improvements
- ▶ Justify allocation of resources for improvements

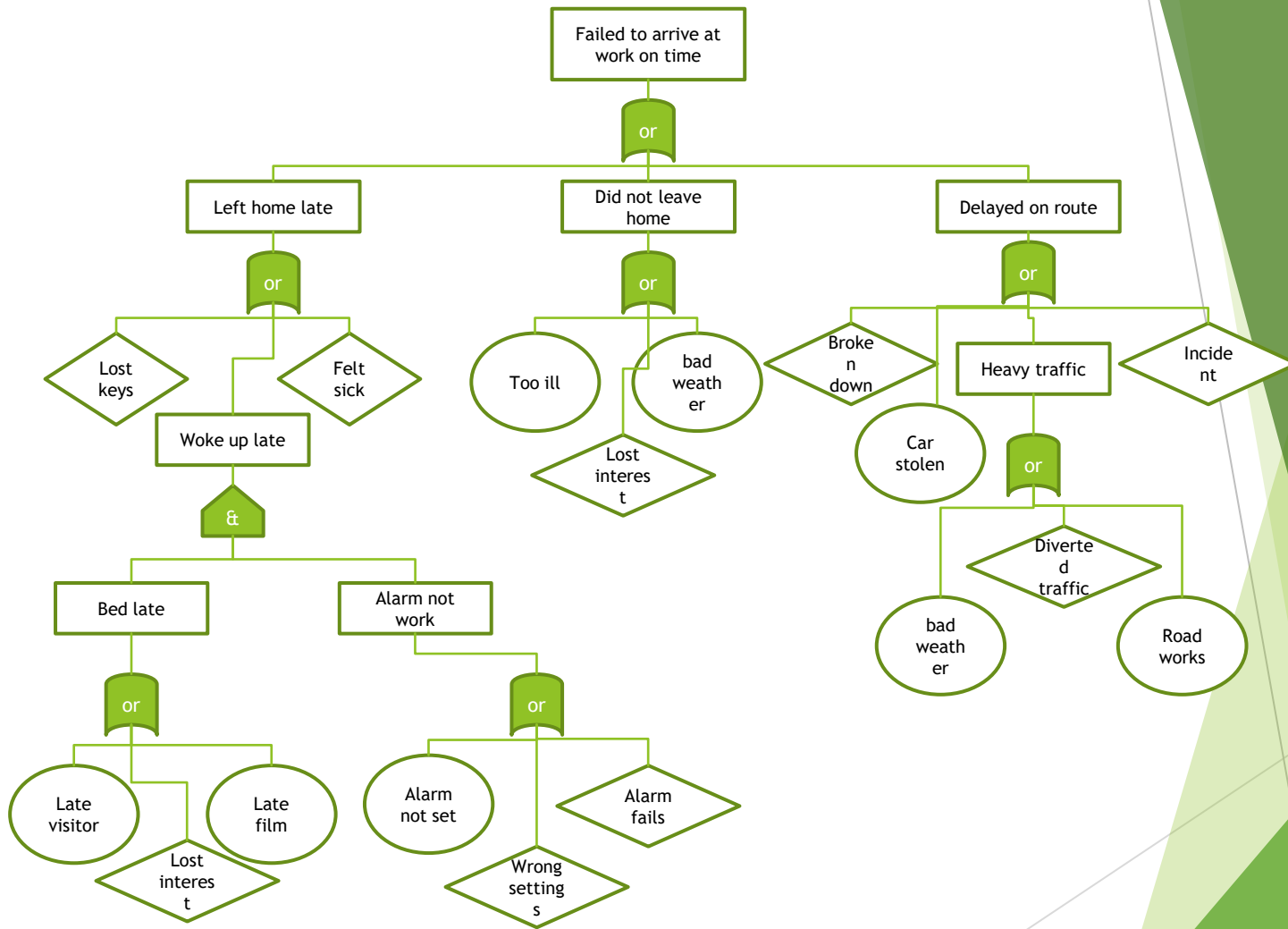
# Fault Tree Analyses



- ▶ Fault Tree analysis is a deductive reasoning method (from generic to specific information) for determining the causes of an incident.
- ▶ Each event is analysed by asking, “How could this happen?”
- ▶ Using gate symbols (AND, OR) which represent a condition in which all the events shown below the gate must be present for the event shown above the gate to occur.







# SCAT (Systematic Cause Analysis Technique)

Direct Cause is a substandard act or substandard conditions that triggered the Event.

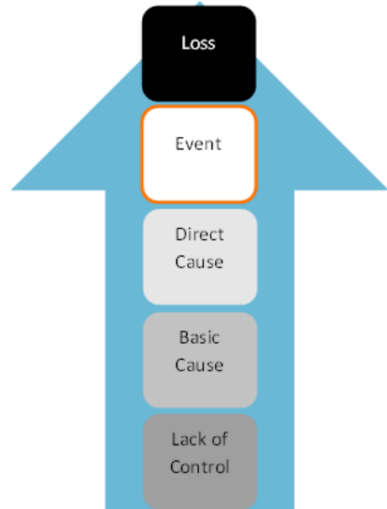
- ▶ Inspection not performed by new employee
- ▶ Failure to secure lift
- ▶ Safety valve is broken

▶ The Basic Causes include personal and job or system factors that together made it possible for the Direct Cause to occur. Examples are:

- ▶ Maintenance department understaffed
- ▶ High workload
- ▶ Wear and Tear

A Lack of Control factor can be inadequate program standards or compliance to standards that cause the Basic Causes to occur. Examples are:

- ▶ Inadequate leadership
- ▶ No task or risk assessments
- ▶ Lack of training



# Incident Investigation Process



**Thank you all very much for your Time**