CS-IM-04
(AMD 11/14)

Incident Investigation Standard

CS Energy's process to manage investigations into incidents and near misses to a consistent standard using the ICAM methodology.

Incident or Near Miss

ICAM Reference Guide Sections
Relevant sections of the ICAM methodology are denoted in the flowchart and attached to this PDF. ##

Provide **first aid to injured** & make **area safe & secure**. Report incident in SAP. — 02

Report incident in SAP using Portal or using paper form - S0024

- **Notify internally** as per category determined.
- **Notify externally** to regulators as per legislation

Determine category using the incident category matrix. Near misses are based on risk → **Notify using SAP or manually using S1819(1) Template**

Category 1 and 2 Investigation

Identify **investigation team** as required. Usually Supervisor, workers and H&S Coordinator are involved.

Complete Cat.1&2 investigation using **S0024 Incident Report Form**

Determine probable cause using the **5-Why Methodology**

Document investigation in SAP including probable causes

Implement and complete **corrective action plan** in SAP against incident

Category 3 and 4 Investigation

Identify **investigation facilitator, leader and team** as required - refer to CS-IM-01 — 04

Complete Cat. 3&4 Investigation using **S1937 Significant Incident** Report. Permitted to be used for Cat. 2.

Create or arrange DMO to create a **TRIM Folde**r for incident and add TR5 link in SAP for reference. — 05

Begin investigation - gather **data, statements, photos, documents, ICMS** to determine sequence of events → Use the following templates: 1.**S1937(2) PEEPO Analysis** 2. **S2034 Witness Statement**

06 — Recreate an **incident timeline or event tree**. ↔ Use ICAM analysis to produce **ICAM chart** As an appendix — 07

Identify a **basic cause** and **contributing factors** — 08

Determine **recommended corrective actions** and complete **Investigation Report** — 09

11 — **Obtain sign-off** management relevant to the category level → Disseminate **key learnings** to stakeholders using S1819 (3)

Implement and complete **corrective action plan** in SAP against incident

Resource Toolkit

Incident Management Forms

- S0024 Incident Report Form
- S1814 Injury/Illness Report Form
- S1819 (1,2,3) Incident Notification Series
- S1937 Investigation Report
- S1937 (2) PEEPO Analysis Tool
- S2034 Witness Statement

Investigation Report Examples

- S0024 Investigation Report **Example 1 – Cat.1/2 FAI Injury**
- S1937 Investigation Report **Example 2 – Cat.3 Near Miss**
- S1937 Investigation Report **Example 3 – Cat.3 LTI Injury**

Other CS Energy Processes

Investigation findings support decision making in response to the facts presented during data gathering and analysis. The findings/learnings are presented for consideration and potential implementation in other processes such as Asset Management and Performance Management (e.g. Fair and Just Culture process).

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02 Post Incident Immediate Action

2.1 Securing the Site

Following an incident, the supervisor, senior person present, or emergency response group coordinator should:

- Initiate the site Emergency Response Plan as appropriate/required.
- Take action to make the area safe and prevent escalation of the situation.
- Evacuate people as necessary.
- Provide the necessary first aid and medical care to the injured.
- Account for all people.
- Preserve the incident scene in a manner consistent with their responsibility to retain valuable information for the incident investigation.
- Identify and implement immediate corrective actions necessary to prevent further incidents from occurring. Individuals responsible for securing the incident scene should balance these two activities after careful consideration.
- Notify senior management.
- Notify, liaise and observe the requirements of the relevant local authorities.
- Conduct testing for substance abuse as appropriate.
- Photograph/video the scene before too many changes are made.
- Ensure perishable evidence is preserved.
- Carry out a preliminary assessment of the incident level.
- Document the emergency response actions for analysis later.
- Complete and submit an incident notification report.

2.2 Immediate Actions

Supervisors of employees who are injured, become ill from an occupational incident or are involved in a high potential near-miss situation must conduct the preliminary analysis to obtain the information required for the supervisor's initial incident notification report.

This analysis will often identify preventative actions necessary to remove any immediate danger of a re-occurrence and provide some information for senior management to assist with their decision regarding the necessary level of the investigation.

2.3 Notification

The work site supervisor must be advised of all incidents as soon as practicable. Initial notifications should be made in accordance with Local Authority and Company requirements.

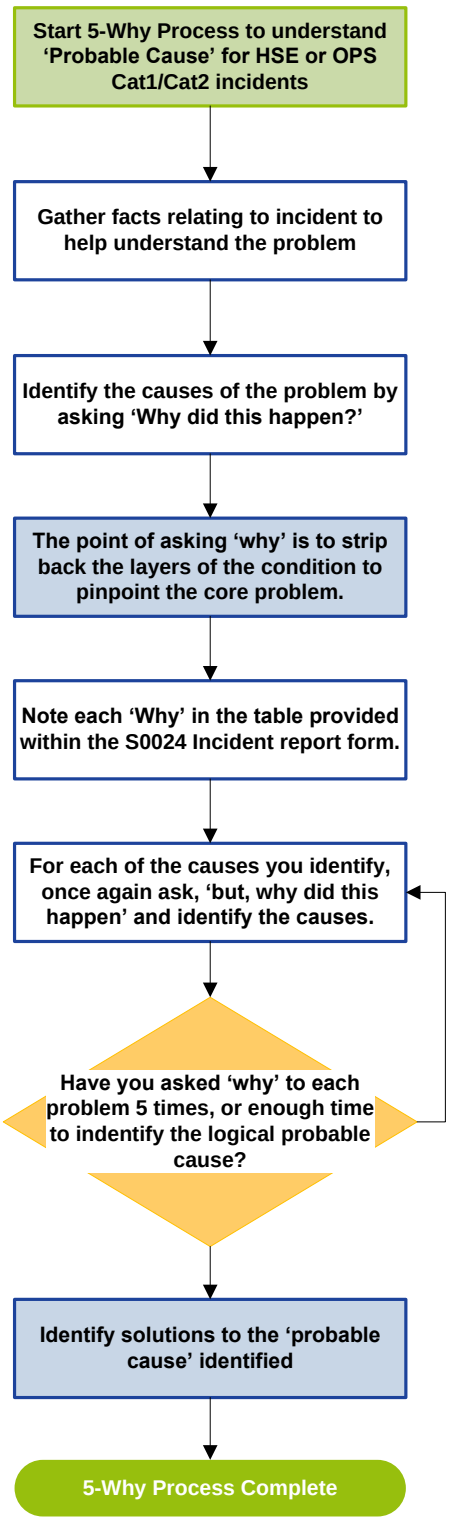
The following data (as a minimum) should be included in the initial notification:

- Time and date of the incident.
- Location of the incident.
- Contact person and contact details.
- Persons' name(s), occupation(s) and status (married-single, contractor-employee).

Incident Information

- Brief description of the circumstances, activity and the incident.
- Brief description of the **actual** consequences and consequence severity ranking.
- Brief description of the **potential** consequences and consequence severity ranking.
- Description of notification and any action by local authorities.
- Immediate corrective action undertaken by responsible line management.
- Contributing factors (if known at this stage).

1 5-WHY PROCESS FLOWCHART



2 INTRODUCTION TO 5-WHY

The 5-why is a basic methodology or tool to discover the probable causes of a problem.

More often than not, people fix a problem by dealing with issues that are immediately apparent. While it may provide a quick fix, the problem tends to rear its ugly head in the same form or with a different face later on. Fixing the problem by address the underlying causes is what all leaders should aim to do.

For example, suppose we had a tree which was wilting and dying. We could make it look better in the short run by cutting the wilted leaves, but surviving leaves will continue to wilt and the tree would still be dying

Instead, we need to investigate the cause of the wilting. Did we water the tree recently? Are there tell-tale signs of fungi, bacteria or perhaps termites? Once we know the true issue, then we can fix it.

Most people get stuck in the Do-Do-Do-Do cycle, in which they carpet bomb every possible solution with no guarantee that they will fix the true problem, wasting time, effort, and often money. 5-why analysis provides the tool to engage in precision targeting to fix the right problem in one go.

3 USING 5-WHY

The concept of 5-why is simple:

1. Identify the problem.
2. Ask yourself: why did this happen? Come up with all the causes you can think of.
3. For each of the causes you just identified, ask “why did this happen?” again.
4. Repeat until you’ve done steps 2 and 3 for five times. You should have identified the probable cause by this stage.
5. Find solutions and countermeasures to fix the probable cause.

4 PROCESS

Visualising your 5-whys analysis in a table is the best way to show the causal links between your causes and the ultimate probable causes.

Imagine that you just finished organising a Gala Dinner, and you had a problem in which the catering service delivered the food 2 hours behind schedule. To find the probable causes, we would do the following:

Step	Reason	Why?
1	The caterer delivered food 2 hours late.	Why did this happen?
2	Because we did not prepare the purchase order on time.	Why was the purchase order not prepared on time?
3	Because we did not get all approval signatures on time.	Why didn’t get the signatures on time?
4	Because we prepared the PO 3 days before the event.	Why did we prepare it late?
5	Because we forgot to prepare a Purchase Order.	Why did we forget about it?
Probable Cause:	**Because we didn’t have a checklist to clearly identify the tasks we needed to complete at what time.**	

In this case, the probable cause is that we lacked a checklist to ensure everything was prepared at the designated time. The solution is to prepare it.

4.1 Will there always be only one probably cause?

The example above provides a simplified solution model. When performing 5-why analysis, multiple causes will emerge from each causation branch. As a result, there will likely be several probable causes identified and they must be prioritized, so you solve the most severe and pressing probable cause.

4.2 Why 5-Why?

In the Toyota method, asking why five times is believed to lead to the conclusion. In reality, the number of times you ask why will depend on the depth of the problem. Sometimes three or four “why’s” is sufficient to reach the probable cause. With a more complex problem, we can go up to seven or eight “why’s”.

Of course, if there are too few “why’s” then it would indicate that the problem hasn’t been analysed in enough depth and detail. Too many “why’s” could alternatively indicate over-analysis, and that you’ve lost sight of the big picture.

4.3 Weaknesses of 5-why

5-why can be based on personal opinion on what the causes are, and two people performing 5-why analysis on the same problem can come up with widely differing causes and completely different probable causes.

The issue is slightly negated as long as the person involved in the problem performs the analysis. If they do, then they should have enough expertise to perform an accurate analysis.

5 SUMMARY

1. Identify the problem, then ask “why did this happen” to find causes. Ask “why did this happen” to the causes, and repeat until we’ve done it five times.
2. Finding probable causes allows us to solve the true problem.
3. Be open to the possibility that there can be more than one probable cause to a problem.
4. Too few “why’s” may indicate insufficient analysis.
5. Too many “why’s” beyond five-why may indicate over-analysis.
6. The person involved or a person who is experienced in the problem is best suited to do the 5-why analysis.
7. 5-why is subjective by nature and can be flawed with bias, closed viewpoints and incorrect logic.

04 The Investigation Team

4.1 Team Composition

The responsible manager selects the team members and designates the team leader in consultation with the Health, Safety and Environment (HSE) Department. Team members should not have supervisory control over each other or of the work site involved, nor should they have a potential for conflict of interest with the investigation process or findings. All members must be willing and able to devote the time necessary to the assignment and at least one member should have had training and experience in the ICAM incident analysis technique. Other members should have experience relevant to the nature of the event.

The team should have the following minimum composition:

Team Leader	A line manager or best qualified person with the appropriate experience and skills.
Team members	With managerial, technical and investigative skills.
Specialists	To conduct specialist studies as required.
HSE Professional	To provide guidance on the investigation process.
Analyst	Incident Cause Analysis Method (ICAM) trained and experienced analyst.
Admin. Support	To control and log data.
Legal Advice	To provide advice and review reports.

Consideration should be given to selecting at least one member from:

- a separate department/business that is not involved in the incident; and
- a member from the workforce or union.

Employees of the Occupational Health and Safety Section should not be appointed as the leader of an incident investigation team, as the ultimate responsibility for incident investigation lies with line management.

Consultants and specialists who have detailed and specialised knowledge or skills that may be useful during an incident investigation should be included as appropriate. Their involvement may not be required for the duration of the investigation.

Selection of legal council should be made in consultation with the organisation's legal department.

It is important that the core investigation team is assembled promptly to enable team members to view the site of the incident as early as practicable. Important evidence can often be identified by having more than one individual present.

4.2 Terms of Reference

Depending on the scope of the investigation, there may be a need to establish the Terms of Reference for the Investigation Team. These should address:

- The requirements of stakeholders. These may vary dependant on the type of stakeholder (e.g. internal, external, regulator, non-government organisation (NGO), community etc.).
- The requirements for legal privilege and confidentiality agreements with external team members.
- The investigation boundaries. These may be restricted to the period over which the incident occurred, but would normally provide for much greater scope, potentially including commissioning, design and pre-feasibility stages of the project.
- Scope of the Team's jurisdiction. In general, the team should not be unnecessarily restricted. Eliminating superfluous information during the investigation is much easier than expanding the Terms of Reference during an investigation.
- The authority of the Team Leader and Team Members.
- Access to resources (e.g. computers, administrative support, transport, communications, interview facilities, etc.).
- Operational/site specific issues such as purchasing procedures, contractor engagement requirements, induction procedures and training.
- Expected date for completion of the report.

4.3 Objectives

The objectives of incident investigations using this procedure are to:

- Establish the facts.
- Identify contributing factors and latent hazards.
- Review adequacy of existing controls and procedures.
- Report the findings.
- Recommend corrective actions which can improve efficiency, reduce risk and prevent recurrence.
- Detect developing trends that can be analysed to identify specific or recurring problems.
- Identify any key learnings for distribution within the organisation and externally as required.

It is not the purpose of this activity to apportion blame or liability.

4.4 Roles and Responsibilities

4.4.1 Team Leader

The Team Leader's role is to:

- Direct the investigation.
- Communicate and liaise with stakeholders and external parties as required.
- Assign duties to the team.
- Obtain the services of specialist advisers as required.
- Schedule and co-ordinate investigation activities and resources.
- Supervise preparation of the investigation report.
- Brief management on the team's findings.

The Team Leader should:

- Be trained and competent in applying incident fact finding and analysis tools.
- Have previous experience in comparable scale investigations.
- Be skilled in effective management of a small investigation team.
- Be able to act as liaison between senior management and the investigating team.

4.4.2 Investigation Team

Team members should not have supervisory control over each other or of the work site involved, nor should they have a potential for conflict of interest with the investigation outcome. All members must be willing and able to devote the time necessary to the assignment. The team's role is to:

- Collect data, facts and evidence.
- Establish the sequence of events leading up to the occurrence.
- Analyse and integrate available information.
- Develop findings and conclusions.
- Determine the significance of findings.
- Write the investigation report.
- Present the report to management.

The Team should:

- Have an ICAM Analyst who has been trained and experienced in incident analysis techniques and has facilitated at least two significant incident investigations.
- Have collective managerial, technical and investigative skills.
- Have members with open and logical minds who are thorough, able to maintain perspective and can overcome preconceptions or bias.
- Have at least two of the team who have attended formal accident investigation training.
- Include personnel with subject matter expertise in areas related to the accident.

- Have access to specialist consultants, advisors or technical personnel as required.
- Have access to legal advice.

The Team should not:

- Have a supervisor and his or her subordinate serve on the same team.
- Have members selected solely on availability.

4.5 Investigation Team Qualities

Certain qualities are fundamental to an investigator. Since investigators are normally selected by position and knowledge needed in the particular investigation, the desired characteristics need to be developed by the investigator rather than the investigator selected by his present characteristics. Among the fundamental qualities are:

Integrity – being immune to influences of any kind, which may distort their objective use of information or bias the investigation. Fact finding requires truthful disclosures. Distorted findings lead to fault finding and blame fixing, and do not prevent other incidents.

Objectivity – to refrain from premature conclusions, to welcome evidence contrary to hypotheses and to consider alternative explanations for evidence.

Perseverance – to trace each symptom back to basic causes. Diligence to identify each deficiency and trace its roots back to the organisational factors within the system.

Curiosity – an insatiable desire to know more, to ask *why? why? why?* A team member who continually seeks deeper explanations of initial findings will be an effective investigator.

Observation – to see things as they are in detail rather than looking to see how they are in general. Looking with the mind as well as the eye detects the unusual, the out of place, and the source of contributing factors.

Imagination – to view things as they might and ought to be and mentally contrasting them with things as they are. Imaginative control of thought allows creative ideas to rise in response to the stimulus of a piece of evidence, and to subsequently reject those ideas and search for better alternatives.

Humility – to consider and admit that another can comprehend aspects of one's own area of expertise and offer credible observations and ideas.

Intuition – to recognise a valid idea when it emerges after painstaking collection of data for analysis. In particular, the intuition to recognise the simple solution to a potentially complex problem.

Tact – and patience to overcome reticence to reveal self-critical information, and to use that information to enhance the investigation, not the investigator.

Technical skills – for equipment examination, photography, mapping, recording and writing are important, but secondary to the skills of perception described above.

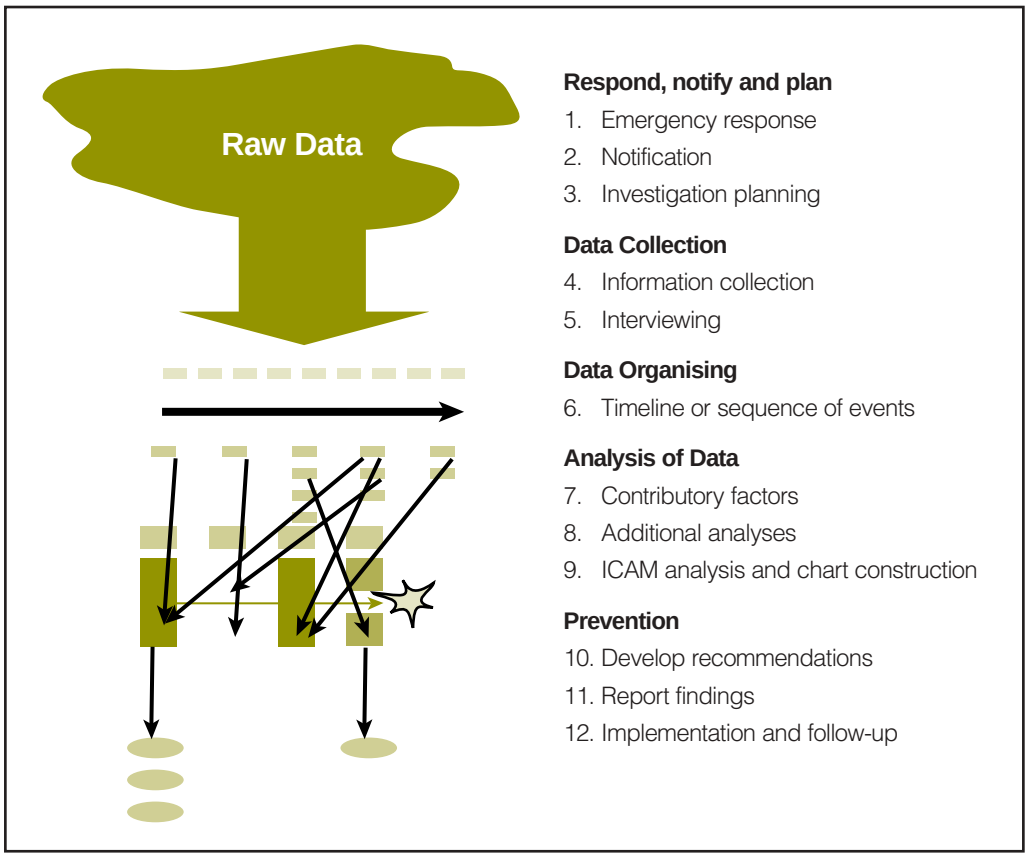
Appendix 5D: Investigator's 'Go Kit'

- Pocket Investigation Guide.
- Clipboard, lined paper, graph paper and pencils.
- Camera and film. Digital camera.
- Incident report form.
- Hard hat, safety boots, hearing protection, safety glasses and reflective vest.
- Sunscreen, sunglasses and cap.
- Industrial or medical gloves.
- Insect repellent, small first aid kit and water
- High visibility barrier tapes.
- Cassette recorder, spare batteries and tapes.
- Tape measure.
- Identification tags or labels.
- Specimen containers and zip-lock bags.
- Compass.
- 'Out of Use' or 'Danger' tags.
- Lockout padlock.
- Magnifying glass.
- Crayons/chalk.
- Fluorescent spray paint.
- Torch and batteries.
- Paper towelling.

05 The Investigation Process

An incident investigation team operates under the general guidance of the team leader. Other members are assigned tasks as the leader deems necessary, but major decisions made during the investigative process should be agreed upon by the majority before execution. An overview of the investigation process is shown as Figure 3 below.

Figure 3



5.1 Site Inspection

Unless otherwise designated by the appointing manager, the team leader should take immediate action to assume control of the incident scene and to obtain any items that have been removed. If the incident involved an emergency, they shall assume control as soon as the emergency response group is stood down. Before any clean-up efforts are attempted, team members shall remind others involved with the incident to secure the scene and any significant physical evidence such as damaged equipment, spill residue, videotapes and data logs.

5.2 Planning Meeting

After taking the necessary steps to preserve the incident site, the team leader shall schedule a meeting and arrange for a presentation from the site/operation giving an overview of the operation and detailing the event sequence and pertinent facts.

Note: This presentation is not to be used to draw preliminary conclusions. The facilitator must ensure that the presentation is only used to familiarise the investigation team with the operations and the event sequence.

Depending on the complexity of the incident the investigation team may need to conduct a formal planning stage prior to collecting data and interviewing personnel. The planning stage would normally commence with the following:

- Select a suitable secure room to be used as the investigation team headquarters.
- Obtain the services of an administrative assistant.
- Decide when to visit and photograph the incident scene.
- Obtain copies of written statements (to the company and external authorities) that may have been requested of individuals at the incident scene. These statements should be reviewed prior to conducting further interviews.
- Arrange to interview participants, witnesses, management staff, support staff, or anyone who may have useful information.
- Obtain maps, diagrams, and photographs that may be helpful to the investigation.
- Brainstorm the scope of the investigation.
- Outline a plan of action and allocate tasks.
- Identify any additional specialists required to assist in the investigation.
- Set up control and recording procedures for gathered evidence.
- Select a date to start preparing the incident report.
- Minute the meeting.
- Set the date, time, and place for the next meeting.

5.3 Team Safety

The team leader is responsible for the safety of all team members, whilst overall responsibility for safety remains with the operating site management. The team leader should request guidance from the site Safety Department where necessary. Team members must exercise care when conducting the investigation and follow all established procedures and warning signs designed to protect the health and safety of site personnel. Enthusiasm for the task at hand should not overcome safety awareness.

Caution: If it is necessary to reconstruct the incident, be sure that the team does not generate another incident. Do not allow the operation of valves, switches, or control buttons unless a risk assessment is conducted and the relevant isolations/permit to work are in place.

5.4 Gathering Information from the Incident Scene

Important evidence can be gained from observations made at the scene of the incident, particularly if equipment remains in position. Witness statements can usually be better understood and verified on site. Witnesses should be available to the investigation team for clarification.

The investigation team should be looking for any conditions in the immediate area which could have contributed to the incident.

The investigation team should verify the following:

- Positions of injured workers.
- Materials being used.
- Position of all equipment in relation to other equipment.
- Position of valves, switches, controls etc.
- Condition of the load bearing surface.
- Safety devices in use.
- Position of appropriate guards.
- Damage to equipment.
- Accessibility and evidence of congestion.
- Illumination, visibility and noise levels at the site.
- State of housekeeping at the site.
- Condition of the facility and equipment.
- The effects of weather.
- Presence and location of witnesses.
- Presence of unauthorised personnel.
- Evidence of safety equipment failures.
- Evidence of loss of containment.
- Witness marks (gouges, scratches, smears, discolouration, burn marks etc.).
- Evidence of excessive force.
- Presence or absence of warning signs or barriers.
- Results of other inspections by company representatives or external authorities.

5.4.1 Photography

Photography is one of the most useful tools to the investigation team. It can document the situation as it exists now, or the situation as it changes due to movement or disassembly. The camera can permanently record fractures, dents, scratches, instrument readings or perishable evidence such as skid marks. The camera can be used to compare before to after, correct to incorrect and damaged to undamaged situations. It is useful for showing witness eye views of the incident. Polaroid, 35mm SLR, digital and video cameras are all useful tools.

Inspect the incident scene and other relevant locations as necessary and supervise the taking of photographs. Collect other information of significance to the incident as soon as practicable. Use a professional photographer or someone with photography skills and a reliable camera.

Take plenty of photographs soon after the incident is reported, including close-up photographs of significant details (e.g. scratches, gouges, smears, fractures, relative positions of items). At least one member of the team should accompany the photographer to direct his/her efforts and to record information about each photograph. Appendix 5A contains a sample log. Do not hesitate to tell the photographer the angles at which the photographs should be taken and whether reference items (e.g. rulers and coins) are required to give the picture size-perspective. All photographs used in the report must be numbered and captioned. Captions should explain in detail what the picture is supposed to show. Captions will include type of equipment, date of the incident, and location of the incident. The direction toward which the photograph was taken may be included; for example, NE or SW.

A photograph without a proper caption is confusing and of little value. Photographs taken at the accident scene should include the following:

- An overall view of the incident site (wreckage) taken from a minimum of four directions. Eight photographs taken at 45-degree angles is recommended.
- A view of the path of the equipment from point of initial and major impact to the place where it came to rest. Impact marks are vulnerable to rain and traffic; therefore, a photographic record of this type of evidence should be obtained.
- Aerial views of the accident scene (equipment and weather permitting).
- Photos of objects struck by the equipment.
- Larger portions of the equipment wreckage.
- Detailed photographs of suspected failed parts that contributed to the accident.
- Photos of failed personal protective clothing and equipment and the agents causing the failure or injuries.
- Photograph and measure skid marks, ground scars etc.
- Any other photographs deemed of interest to the investigation team.

Remember you are recording what you see at the incident scene. Once you have left the scene, the photographs taken will be the only way for you to accurately recall exactly where something was. You are basically recording history. Have some pride in the way you record it.

5.4.2 Preserving Evidence

All gathered evidence should be logged and securely preserved to allow for retrieval at a later date. This could be a matter of years in a coronial inquiry.

5.4.3 Releasing the Incident Scene

Upon obtaining the information needed from the incident scene and once satisfied with the thoroughness of data gathering, the team should release the area to the responsible manager unless another investigation team (police, coroner, regulatory authority etc) is conducting a concurrent investigation. The team leader should advise the manager of any hazardous condition and the removal of any equipment from the scene.

5.5 Interviews

The gathering and evaluation of accurate and unbiased evidence is essential for the successful conduct of any incident investigation. However, it is well established, both by experimental and anecdotal evidence, that human beings are notoriously unreliable as observers, particularly when asked to recall the detail of significant events.

A major potential for error occurs at the 'playback' stage, when the recorded memory of an event is being accessed through interview. While most of us feel we can interview competently, and gathering evidence sounds simple, facilitating unbiased testimony is a surprisingly difficult and consistently underestimated task. Contrary to popular belief, getting witnesses to say what we want to hear is not representative of an efficient interviewing technique. Even subtle, unintended variations in questioning technique or terminology can dramatically influence the content of recall.

Relevant to this, yet historically an aspect of some neglect, is the training of prospective witness interviewers and incident investigators in the techniques of eliciting accurate and unbiased testimony from witnesses.

5.5.1 General Principles

The following general principles should be applied to all witness interviews:

Principle	Note
Timeliness	– Interviews should be conducted as soon as possible after the incident/accident. Delays in conducting interviews can affect the quality and quantity of information collected as memories deteriorate or are contaminated by outside influences (i.e. media, other witnesses etc.). – If there will be a delay before an interview can take place, ask the witnesses to write down their recollection of the event including any relevant events leading up to the actual occurrence.
Preparation	– Preparation is essential to the success of the interview. Take the time to gather background information on the accident/incident prior to the interview. If time permits, visit the scene of the occurrence or familiarise yourself with the equipment involved. – Give some considered thought to information that is required, how best to structure the interview, who will be involved and the background of witnesses. – Think ahead and arrange for items to be available that may be of use in the interview such as maps, models, checklists, procedures, photographs etc.

Principle	Note
Witness Assessment	– Prioritise the order of witness interviews according to availability or relationship to occurrence. – Consider their experience/expertise (i.e. how familiar are they with the equipment/operation?) – Assess their motivation/credibility (e.g. explore the possibility they may be protecting someone)
Location/setting	– Ensure witnesses are interviewed in a private setting with no distractions. – In some situations, it may be beneficial to interview witnesses at the incident site to allow the environmental context to aid recall. – It's best to interview each witness individually with a team of two interviewers – one to lead the interview and one to provide support and take notes.
Record of interview	– The record of the witness's testimony should accurately and completely reflect all information obtained. – The record of the witness's testimony should be verified by the witness after the interview to ensure correct interpretation and accuracy. – Legal, organisational and personal issues should be considered prior to the use of a tape/digital recorder.
Explanation of the interview process	– To avoid intimidation and enhance cooperation, introduce yourself and explain the aim of the interview prior to asking questions. – Develop an early rapport with witnesses. – Emphasise that the aim of the investigation is to establish what happened in order to prevent recurrence, not to apportion blame or liability.
Active listening	– Be attentive to the information the witness is relating and ensure your body language reflects your interest. (e.g. maintain eye contact, sit facing the witness, give feedback to indicate you are listening and understand what has been said). – Avoid interrupting the witness; remember you are there to obtain the witness's recall of the incident.
Communication	– Use everyday language; try to avoid technical terms, jargon and acronyms to avoid misunderstanding or confusion. – Ask the witness to answer questions in as much detail as they can.

Principle	Note
Understanding and empathy	– Investigators should remain conscious of the witness's emotional state (e.g. defensive, anxious, stressed, confused, angry or distressed). – If this occurs, offer a glass of water, a short break or re-schedule the interview. – If the witness would feel more comfortable with a friend or representative present try to arrange this.
Discuss recommendations to prevent recurrence	– The people involved, or who witnessed an occurrence, are often well placed people to offer suggestions to avoid a recurrence. – Prior to ending the interview, ask the witness "What do you think happened?" and "What do you think could be done to prevent a similar occurrence?"
Ending the interview	– Always end the interview on a positive note and thank the witness for their time and cooperation. – Ensure they have your contact details to pass on any details they may recall after the interview has finished.
Follow-up	– After an interview, many witnesses spend time thinking about the event again, the information they related during an interview and quite frequently will recall additional details they did not remember during the interview. – It is well worth the time and effort to call witnesses a few days after the initial interview to see if they have recalled any added information.

Interviews should be conducted individually and should begin soon after an incident to obtain information about the immediate events associated with the incident, including how the activity that was involved in the incident was planned and conducted.

Interviews should include the following individuals:

- Individuals directly involved in the incident.
- Supervisory personnel.
- Personnel at the scene.
- Management.
- Emergency Services personnel (if illness or injuries involved).
- Safety personnel.
- Subject matter experts.

People being interviewed should not be denied the right to have an adviser present if they so wish. Keep the interview short, informal, simple and use language the person understands. Opinions are acceptable provided they are recognised as such.

Set a positive tone during the interview. Put the person at ease by conducting a friendly interview, not an interrogation. Do not irritate or argue with a person being interviewed. On the other hand, control the interview, do not allow the person to take charge.

If the information exchange stagnates, an occasional lead-on sentence may be, "Can you tell my anything more?" Do not rush the interview, and do not be afraid of silence. Some points to remember:

- 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.
- 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.
- Take plenty of 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.
- Use closed-ended questions later to gain more detail.
- After the person has provided their explanation, these types of question can be used to clarify –
  - "Where were you standing?"
  - "What time did it happen?"
- 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.
- Summarise what you have been told.
- Correct misunderstandings of the events between you and the witness.
- Ask the witness for recommendations to prevent recurrence; they will often have the best solutions to the problem.

- Get a written, signed testimony from the witness.
- It is best if the witness writes his or her own testimony. Interview notes signed by the witness may be used if the witness declines to write a testimony.

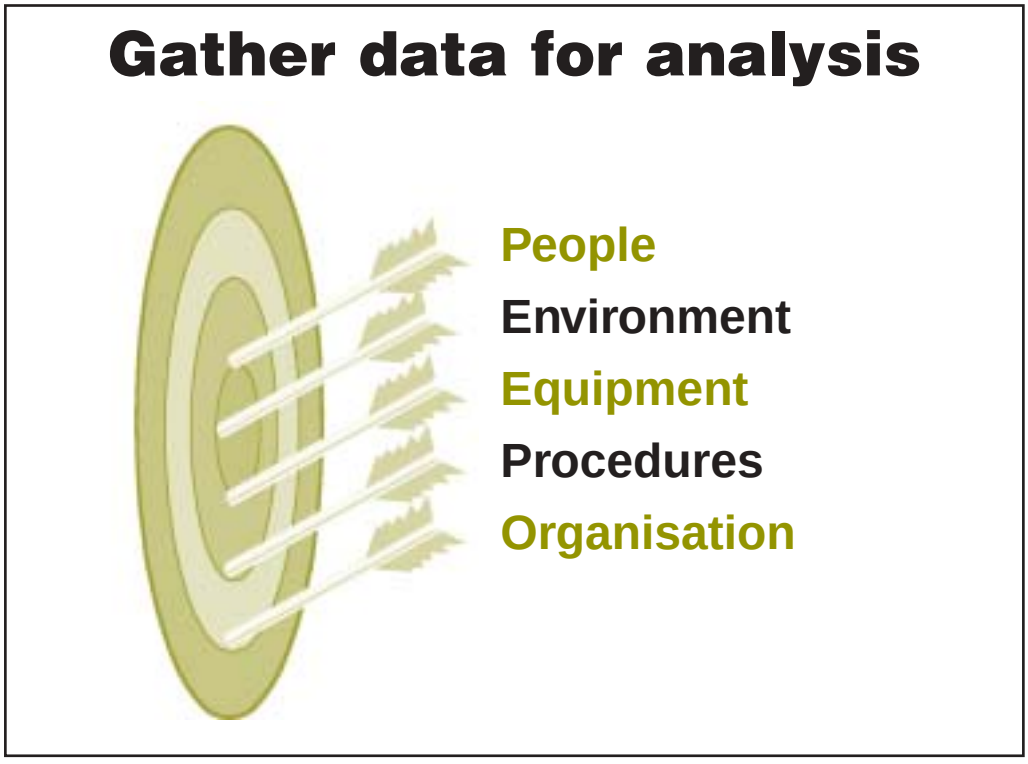
Examine in detail pertinent facts uncovered from the interview in order to determine if they make sense, to corroborate prior information, to plan subsequent interviews and to evaluate the interviewee's perspective.

Where there is a discrepancy between witness testimonies, find a logical explanation if possible. If the witness made an error in judgment, conduct the interview in a way that determines the 'original logic' that led to the error.

This is not always easy because the witness may have forgotten the original logic or may not want to admit to the error in judgment. It is important to understand the original logic (not to be confused with post-incident perceptions and rationalisations) in order that similar errors are eliminated in the future. Remember, the team's objective is not to apportion blame but to establish the facts and causal factors leading to the incident. If possible, site management should keep witnesses busy with normal work activities until it is their turn to be interviewed.

5.6 Collection of Relevant Data

It is recommended that investigators have a 'Go Kit' fully stocked and maintained at their office. The basic content of this kit is detailed in Appendix 5C. During this phase of the investigation as many relevant facts as possible should be collected to help in understanding the incident and the events leading up to it.



The collection of data can be divided into five main areas:

- People.
- Environment.
- Equipment.
- Procedures.
- Organisation.

Conditions, actions or deficiencies in each of the five main areas may be identified as contributing factors to the subsequent incident. To ensure that all the facts are uncovered, ask the broad questions such as "who? what? when? where? why? and how?"

Each category should be investigated and is examined more closely below. Remember that these are **sample** questions and no attempt has been made to develop a comprehensive checklist.

For most of these questions, an important follow-up question is "If not, why not?"

5.6.1 People

Try to identify all the people who might have information about the incident and obtain testimonies from them as soon as possible. Interview witnesses individually away from distractions. If possible, interview them at the scene of the incident to confirm at the scene information. Reassure witnesses the investigation is being conducted to promote safety and not to apportion blame.

Ask those being interviewed:

- To explain in their own words what happened, taking care not to ask leading questions.
- To explain their actions immediately prior to the incident.
- To explain any actions taken to reduce risk in the task being conducted.
- Whether they knew of any safety features or PPE required for the task.
- Whether they knew of any previous incidents or near misses associated with conducting the task.
- What could have been done differently to prevent the outcome.

The physical and mental condition of those individuals directly involved in the event must be explored. The purpose for investigating the incident is **not** to establish blame, but the investigation will not be complete unless personal characteristics are considered. It is important to determine:

- What experience in the task did those involved in the incident have?
- What training had they received?
- What physical limitations may have affected the way they conducted the task?
- What was the status of their health?
- What do you know about the period of time they have been at work or previously had off?
- Are you aware of any stress or time pressures (work or personal) that may have affected them?

5.6.2 Environment

Examine the scene of the incident for information and to help understand the nature of the task being conducted and the local environmental conditions.

The physical environment, and especially sudden changes to that environment, are factors that need to be identified. The situation at the time of the incident is important, not what the 'usual' conditions were. For example, incident investigators may want to know:

- What were the weather conditions?
- Were any housekeeping issues involved?
- What were the workplace conditions?
- What surrounding noises were present?
- What were the light conditions?
- Were toxic or hazardous gases, dusts or fumes present?

5.6.3 Equipment

Examine the equipment involved in the incident. Pay particular attention to the condition of equipment, anything that may have changed or be out of the ordinary e.g. abnormal stress, modifications, substitutions, distortions, fractures etc. Identify any design flaws, mismatched components or confusing labelling or marking. Ensure that the equipment was appropriate for the task being conducted. To seek out possible causes resulting from the equipment and materials used, investigators might ask:

- How did the equipment function?
- Were hazardous substances involved?
- What identification did they have?
- Were any alternative substances available?
- What was the state of the raw material?
- What personal protective equipment (PPE) was being used?

5.6.4 Procedures

Review the task that was being conducted. Examine the work procedures and the scheduling of the work to ascertain whether they contributed to the incident.

Examine the availability, suitability, use and supervisory requirements of standard operating procedures or work instructions.

Ensure the actual work procedure being used at the time of the incident is explored. Members of the incident investigation team should look for answers to questions such as:

- What work procedure was used?
- Was a Job Safety Analysis conducted as part of the planning prior to the task?
- Had conditions changed that would have effected the way the normal procedure worked?
- What tools and materials were available?

- Were they used?
- How did the safety devices work?
- What lockout or isolation procedures were used?

5.6.5 Organisation

Management holds the legal responsibility for the safety of the workplace and the workforce. The role of supervisors and management must always be considered in an incident investigation. Answers to any of the preceding types of questions logically lead to further questions such as:

- What applicable safety rules were communicated to employees? When?
- What written procedures were available?
- How were they enforced?
- What supervision was in place?
- What training was given in how to do the work? When? Is it still valid and current?
- How were hazards identified?
- What procedures had been developed to overcome them?
- How were unsafe conditions corrected?
- Was regular maintenance of equipment carried out?
- Were regular safety inspections carried out?
- Were there any changes to equipment, environment, people or procedures?

Further data checklists to aid investigators are detailed in Appendices 5D - 5H, and although not exhaustive, they can assist in ensuring thoroughness of the data collection.

5.6.6 Additional Data Sources

The following may also provide useful data for the investigation:

Pre-incident photographs – If available, these photographs may be compared with post-incident photographs to help explain the incident. Staged photographs of the incident may be taken at a later time if they will help clarify the final report.

Diagrams and sketches – These may be used as substitutes for photographs and can be especially useful when it is necessary to illustrate movements (e.g. personnel location or vehicle movements before and during an incident). Record directions, distances, and other relevant factors.

Maps – These show the relative locations of buildings and events. Maps should be used for plotting the location of personnel who are injured or have become ill as a result of a hazardous material release. This empirical 'time and place' information is also useful for planning adequate evacuation distances in future emergencies.

Documents – A review of documents may also uncover contributing factors and should include:

- Applicable regulations.
- Training, medical and work history records.
- Applicable procedures, work instructions, equipment manuals and maintenance records.
- Incident reports, audit reports.
- Material Safety Data Sheets (MSDS).
- Organisational policies and procedures.

5.6.7 Scope of Data Gathering

For the incident investigation to be successful in identifying all of the contributing factors it will be necessary to establish:

Events leading up to the incident:

- The system of work being carried on.
- The instructions given for the work.
- The location of key personnel and their actions prior to the incident.
- Variations from instructions or safe work systems.
- Workplace conditions.
- The materials in use or being handled.
- The type of vehicle or equipment in use.

Facts of the incident itself:

- The state of the system and the actions that occurred at that the time of the incident.
- The persons directly involved, and those involved at a distance.
- The tools, equipment, materials and fixtures directly involved, their capabilities and any failures.
- The time and exact location of the incident.

Relevant facts of what occurred immediately after the incident:

- The injuries or damage directly resulting.
- The events leading to consequential injury or damage.
- The persons involved, including those rendering aid.
- Any problems in dealing with the injuries or damage such as no method for releasing a trapped person, a faulty extinguisher, isolation switch difficult to locate, and similar specifics.

06 Data Organisation

6.1 Building the Sequence of Events

After the collection of data and analysis, it should be possible to organise the data to provide the sequence of events leading up to the incident, the incident itself and events post incident until control was regained.

The data collected during the investigation should be correlated in a logical and sequential way. Several data organising techniques such as Timelines, Event and Condition Charts, Time Ordered Event Charts, and Incident Trees are available to assist in understanding the incident. The technique used for determining the sequence of events in the incident should meet the following requirements:

- Provide a framework to organise the data collected.
- Assist in ensuring the investigation follows a logical path.
- Aid in the resolution of conflicting information and the identification of missing data.
- Provide a diagrammatical display of the investigative process for management briefing.

6.2 Event and Condition Charts

Incidents are the result of a chain of successive events combined with error producing conditions that result in unintentional injury to persons or damage to property. Criteria for events and conditions are:

Event

- An event is something that happened during the incident sequence i.e. a decision made to act in a certain way, failure of equipment or environmental occurrence (rain shower, thunderclap).
- Events should have a time of occurrence.
- Events should be quantified where possible.
- Events should be based on valid evidence.
- Events should range from the start to the end of the incident chain.
- Each event should derive from the preceding event.

Condition

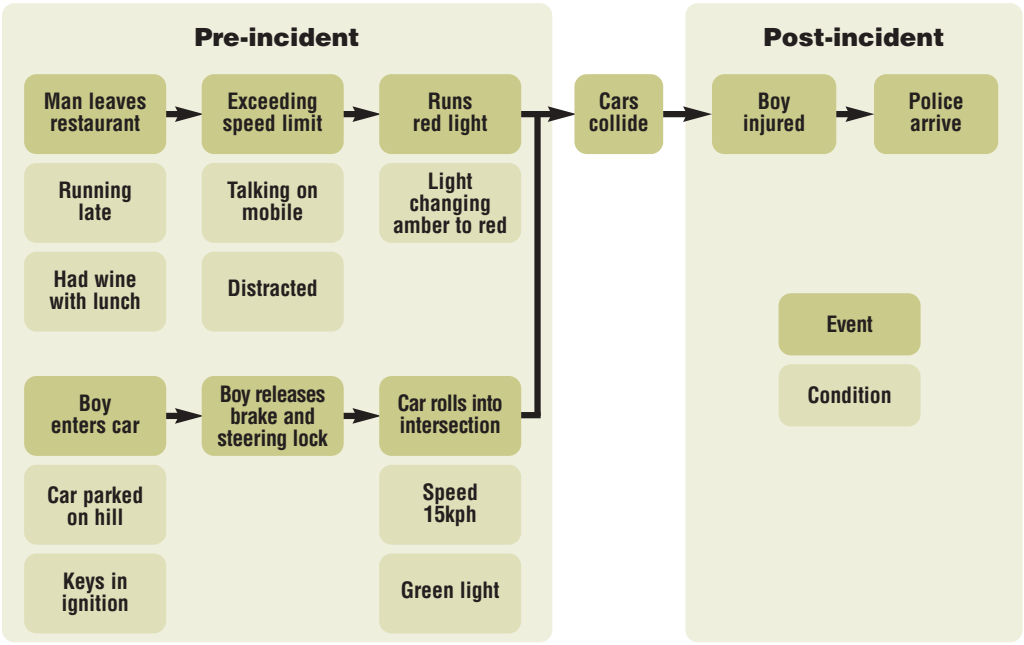
- A condition is a state of being during the incident sequence i.e. toxic atmosphere, foggy night.
- Conditions are a result of an event. i.e. a wet road is the result of a rain shower.

6.2.1 Preparing an Event and Condition Chart

Below are the steps for preparing a single-line and multi-level Event and Condition Chart:

- Construct the chart using a large sheet of paper, a whiteboard, or even the wall of a room.
- Enter each event or condition on a 3 x 5in index card or Post-it note with the date and time the event occurred in a lower corner. Each card must clearly describe a discrete action of one operator using a noun and an active verb. A modifying phrase may also be added.
- Enclose an event from validated information within a solid rectangle. Use a dashed rectangle if the event is only presumptive.
- Start the chart with the card that describes the main event or 'incident'. This should be a single line statement usually describing the instant in time when the control of a potentially damaging energy source was lost.
- Progressing backward in time, identify the pre-incident sequence of events from the information collected through interviews and document reviews adding horizontally cards that describe the events of the operator primarily associated with the incident. Cards should always be placed in time sequence, going from left to right.
- If each event in the sequence is not derived logically from the one preceding it, leave a space between the event for the missing information.
- For multi-level Event and Condition charts, add the cards describing the events associated with other operators at different levels above or below the event sequence of the principal operator. Vertically align the event cards for different operators only if the events occurred at the same times. This way, time will run along the x axis and different operators will run along the y axis.
- Add cards that describe any special conditions under which a particular event occurred above or below the event card to which they refer. Enclose validated conditions in solid ovals and presumptive conditions in dashed ovals.
- Progress forward in time from the incident and identify the post-incident event sequence and conditions.
- Show the interrelationship between events and conditions with lines or arrows.
- Identify questions that still need to be answered using cards with distinctive colours. Place these cards in the appropriate location on the chart.
- Ensure each Event and Condition card is discretely numbered so that the Timeline can be reconstructed. A Flowcharting or Excel spreadsheet is recommended to record the Timeline.
- Once the Investigation Team has agreed on the Timeline, those personnel directly involved with the incident should be consulted to verify that the Timeline is correct. This step is extremely important to ensure the Team's findings are accurate and credible
- A sample Event and Condition chart is shown as Figure 4 on the next page.

Figure 4



All significant information the Investigation Team collected should be included in the Event and Condition chart, which can be used to explain the sequence of events from when control was lost, through the incident event until control was regained. This chart will also be useful when the team formulates its conclusions and prepares the analysis of the incident using ICAM.

6.3 Incident Tree

An incident tree is an effective method of guiding the investigation process. The incident tree arranges the facts in a logical and sequential fashion. It provides a graphical display of information to aid the investigation team in recalling what facts must be considered, what their relationship is to one another and to identify what facts are missing or conflicting. It also allows the investigation team to hypothesise over possible causes of events and discard those that are not supported by factual data.

Commencing with the incident event, identify the earlier events or conditions which were necessary for the incident event to happen. These are known as contributing factors. Trace each contributing factor back in a similar way, identifying further contributing factors. The process of tracing back should be continued for each chain of events to a point where it is considered to be outside the control or prevailing influence of the organisation.

Validate all contributing factors. If removal of a factor is seen not to affect the outcome, it cannot be considered a contributing factor.

Care should be taken to describe contributing factors accurately. For example, “failure to wear protective equipment” may imply there was a procedure that was not followed. This would lead the investigation team to examine areas such as supervision and motivation. The statement “no procedure for wearing protective equipment” would lead to areas of policy and procedures.

From the tree it should be possible to see where the operation deviated from its expected course, and identify not only the specific actions or inactions of people involved, but also influencing conditions and deficiencies in the management systems. These are often referred to as the Root Causes, in the ICAM process they are called the Organisational Factors and can be categorised into Organisational Factor Types (OFTs) which will be explained in the next chapter.

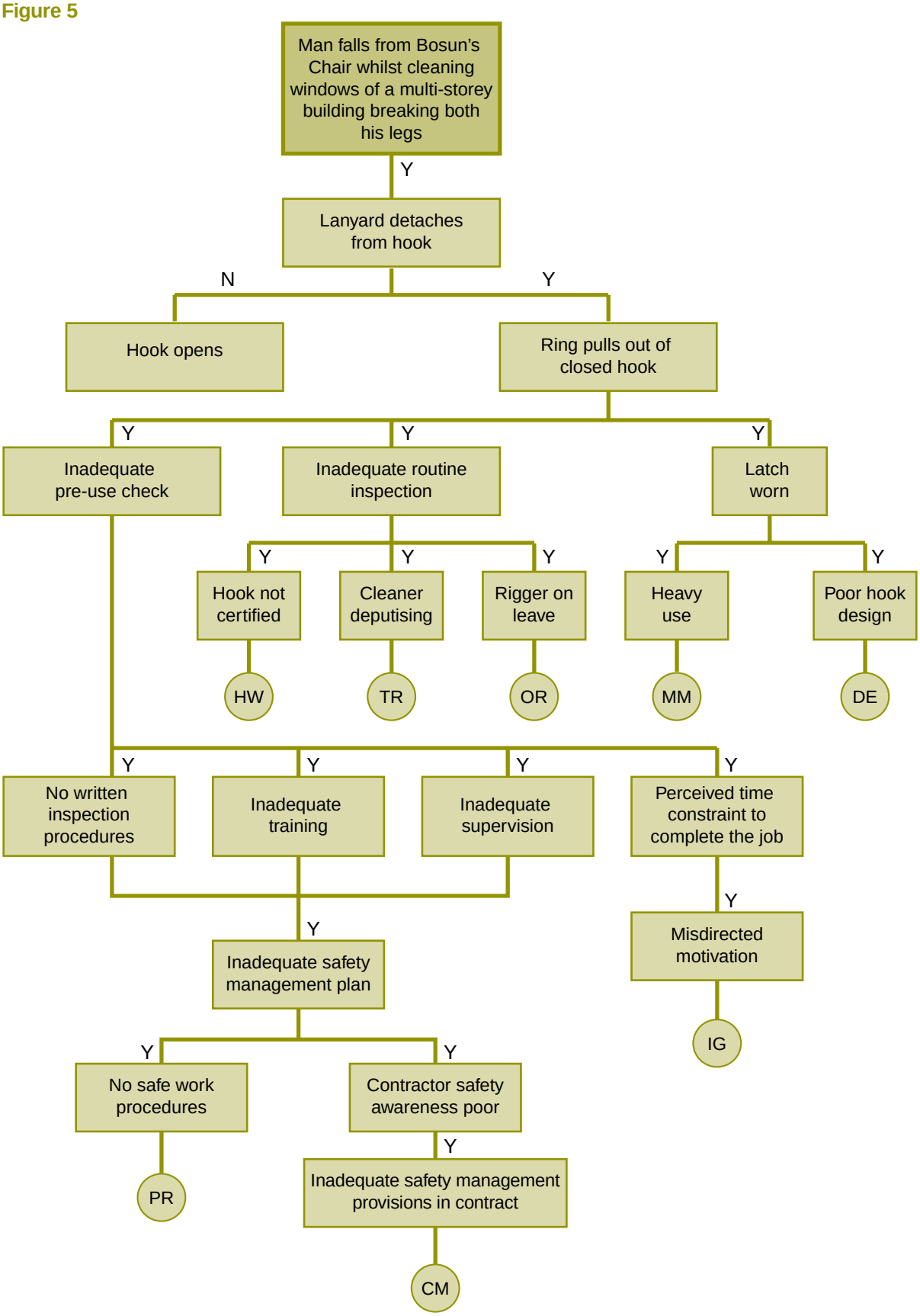
On a large whiteboard or a clean smooth wall, use Post-it Notes (or similar) to write all the contributing factors. This permits easy modification of the tree as the team discussion progresses.

6.3.1 Preparing an Incident Tree

- Describe the incident event. From the incident event inquire "What prior events or conditions were necessary for this event to happen?". Be sure to use words which are responsive to the question "why?"
- Determine what essential factors may have led directly to the event, ask yourself "why?" There is no minimum or maximum number of factors in any branch of the tree.
- Develop each of these branches in turn, always asking "why?" Remember, there may be one, two or more answers. Create as many lines as are necessary. This allows the investigation team to hypothesise over possible causes of events and discard those that are not supported by factual data. This can be shown on the tree branches with a "Y" for a cause with supporting data and "N" for an unsupported possibility.
- When you feel you cannot progress any branch further, it is likely that you are able to assign an OFT in relation to the essential factor at the end of that branch.

A sample Incident Tree is shown as Figure 5 on the next page.

Figure 5


Man falls from Bosun's Chair whilst cleaning windows of a multi-storey building breaking both his legs
Y
Lanyard detaches from hook
N
Y
Hook opens
Ring pulls out of closed hook
Y
Y
Y
Inadequate pre-use check
Inadequate routine inspection
Latch worn
Y
Y
Y
Y
Y
Hook not certified
Cleaner deputising
Rigger on leave
Heavy use
Poor hook design
HW
TR
OR
MM
DE
Y
Y
Y
Y
No written inspection procedures
Inadequate training
Inadequate supervision
Perceived time constraint to complete the job
Y
Misdirected motivation
IG
Y
Inadequate safety management plan
Y
Y
No safe work procedures
Contractor safety awareness poor
PR
Y
Inadequate safety management provisions in contract
CM

6.4 Summary

The production of a diagram depicting the sequence of events leading to an incident provides a number of advantages:

- Diagrams enable everyone involved in the investigation to visualise the sequence of events in time, and the relationships of conditions and events.
- A good diagram will serve to communicate the incident more clearly than pages of text, and ensure more accurate interpretation.
- Summary diagrams can be used in reports to provide a concise, easy-to-follow representation of the incident for the report readers.
- Diagrams should help prevent inaccurate conclusions by revealing any gaps in the logical sequence of events.
- Where gaps are identified, the requirement for further analysis/investigation can be raised.
- Diagrams provide a means of checking the conclusions with the facts uncovered.
- Recommendations can be evaluated against the events and causal factors identified in the diagrams.

Furthermore, it will be evident that sequence diagrams alone do not identify the basic causes of the incidents, and that they should be used in conjunction with analysis techniques such as ICAM.

6.5 Data Validation

The role of the investigation team is to establish the facts of the incident. Therefore it is important that the team differentiates between fact and opinion. The tables below provide guidance on fact versus opinion and objective versus subjective information.

Fact	Opinion
A fact is the statement of a thing done or existing.	An opinion/analytic information is a personal view or judgement based on what seems to be true, or an interpretation of fact.
e.g., Australia won the 1999 Cricket World Cup	e.g., The 1999 Australian cricket team were as good as the Bradman Invincibles.

Objective	Subjective
Not an interpretation – based on a factual description.	*Interpretations* – based on personal interpretations/biases.
Observable – based on what is seen or heard.	*Non-observable* – based on events not directly observed.
Reliable – two or more people independently agree on what they observed.	*Unreliable* – two or more people don't agree on what they observed.
Measurable – a number is used to describe behaviour or situation.	*Non-measurable* – a number isn't used.
Specific – based on detailed definitions of what happened.	*General* – based on non-detailed descriptions.

07 Analyse Findings

The data gathered and organised should be analysed using Incident Cause Analysis Method (ICAM) to identify the underlying causes of the incident, which are systemic in nature, e.g. related to factors such as failures in design, procedures, training, auditing or risk management. This technique is designed to ensure that the investigation is not restricted to the errors and violations of people; ICAM identifies the workplace factors that contributed to the incident and the organisational deficiencies within the system that act as forerunners to an incident.

7.1 Background on ICAM

ICAM is the Incident Cause Analysis Method, is an industrial safety initiative that draws on the work of the organisational psychologist and human error expert Professor James Reason (University of Manchester, UK).

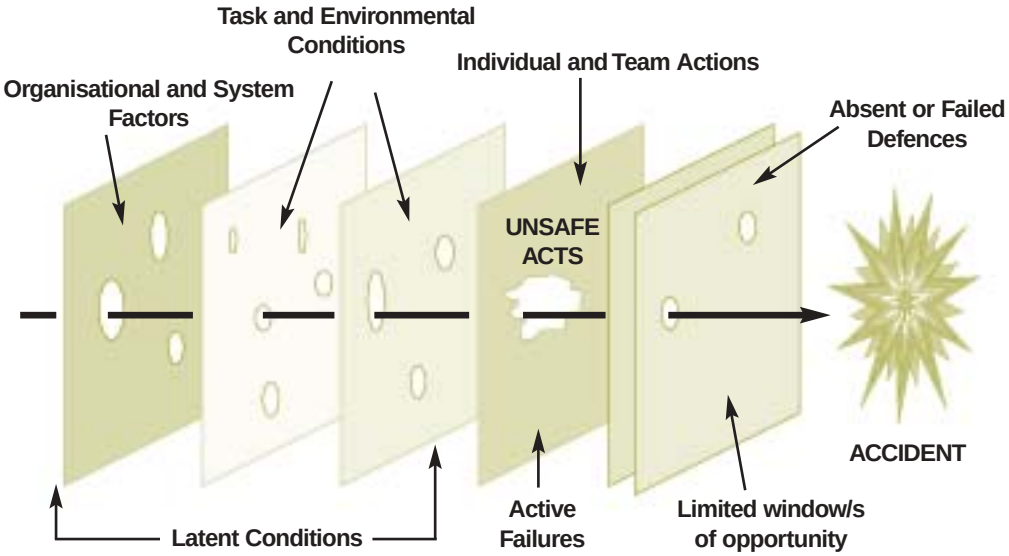
7.2 The Elements of an Organisational Accident

Reason defines organisational accidents as situations in which *latent conditions* (arising mainly from management decisions, practices, or cultural influences) combine adversely with 'local triggering events' (weather, location, etc.) and with *active failures* (errors and/or procedural violations) committed by individuals or teams at the 'sharp end' of an organisation, to produce the accident. Reason developed a model with which to identify safety deficiencies within organisations. The model can be applied both proactively, by safety managers, and reactively, by accident investigators. An adaptation of the Reason Model depicting ICAM terminology appears in Figure 6 on the following page.

As can be interpreted from Figure 6, *latent conditions* may include:

- Organisational and system factors (including actions or decisions of management); and
- Task and environmental conditions (These are 'psychological precursors' of unsafe acts, situational characteristics or conditions which may have influenced decisions or actions taken by operational staff. They might include issues of personnel or resource management, the outcome of information transfer or training, employee attitudes and practices influenced by work-group cultures or sub-cultures, or an individual's emotional or physical state.)

Figure 6



Reason also applies the medical metaphor of 'resident pathogens' to describe latent conditions. Such conditions are usually initiated at a time and place remote from the accident site, and frequently lie dormant within a system for considerable time, until activated by active failures and/or local triggering events.

Active failures are individual or team actions (unsafe acts) which usually involve errors (often 'honest mistakes') and/or violations made by workers at the front line. These factors typically combine with environmental or other local triggering events to find or breach a hole in the defences (engineered or human) which have been established by organisations in an attempt to avoid accidents.

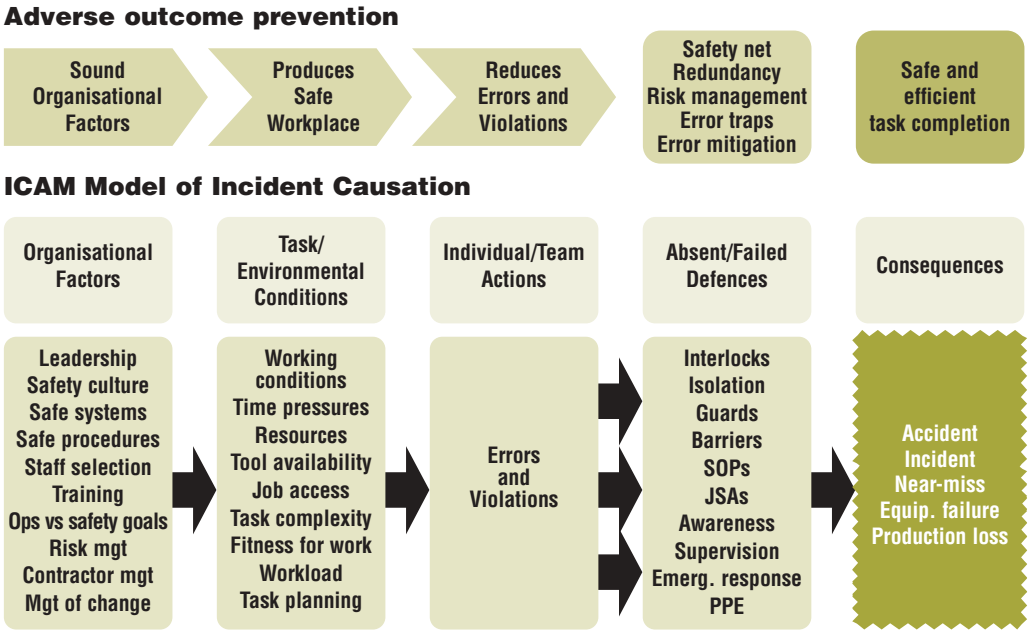
For an organisational incident, Reason maintains that failures in the three basic elements are required:

- Organisational processes.
- Task and environmental conditions.
- At the individual level a variety of errors or violations.

These failures combined with a limited window of opportunity where the system defences that normally control the hazard are absent or failed results in the adverse outcome – an accident, incident, near miss or operational failure.

The ICAM Model of incident causation is show as Figure 7 below:

Figure 7



7.3 Building the ICAM Chart

From the analysis of the findings, the facts can be classified and charted in the ICAM model for inclusion in the investigation report and for briefing management on the investigation findings.

7.3.1 The Key Steps

In the first stage of the analysis, the objective is to extract each piece of factual information from the investigation findings or the draft incident report and to classify them into one of the following five 'contributing' levels. Some of the findings will just be facts and will not be contributing factors to the incident or outcome. The Check Questions detailed in the next pages should be asked to ensure that the information has been correctly classified:

- Contributing levels.
- Non Contributing facts.
- Absent or Failed Defences.
- Individual/Team Actions.
- Task/Environmental Conditions.
- Organisational Factors – OFTs.

As you persist with your probing into the incident, continually asking the question "Why?" – these gaps will eventually be filled. Resist the temptation to speculate on possible causes at this stage in case they lead you to make inappropriate conclusions.

To construct the ICAM chart the following steps must be taken:

7.3.2 Identify the Absent or Failed Defences

Defences are those measures designed to prevent the consequences of a human act or component failure producing an incident. Defences are equipment or procedures for detection, warning, recovery, containment, escape and evacuation, as well as individual awareness and protective equipment.

These contributing factors result from inadequate or absent defences that failed to detect and protect the system against technical and human failures. These are the control measures which did not prevent the incident or limit its consequences.

Note: Absent/Failed Defences are inanimate and may fail or be absent due to an Individual/Team Action, Task/Environmental Condition or an Organisation Factor. There does not have to be a direct link to an action.

Check question: Does this contributing factor describe the equipment, work process, control measure, detection system, procedure or attribute which normally prevents this incident or limits the consequences?

The table below shows successive layers of defence; where each defensive layer comes into operation on the failure of its predecessor. Defences in incident investigation order:

Awareness	Awareness is knowing the risks and how to manage them. To understand the nature and severity of the hazardous conditions present at the worksite. Awareness problems reflect continuous shortcomings in those involved on site or those supervising and managing processes	Examples include: Induction Training, Ongoing Training, Communication, Hazard/Aspect Register
Detection	Detection is how to see the event coming and prevent it. To provide clear warning of both the presence and the nature of a potentially hazardous situation.	Examples include: Warning Lights, Traffic Warning Signs, Gas Detectors, Speed Sensors
Control and interim recovery	Control and interim recovery is getting out of trouble without injury or damage. To restore people or equipment to a safe state with minimal injury or damage.	Examples include: Procedures, Residual Current Device, By-pass Valves, Emergency Shut Down Systems
Protection and containment	Protection and Containment is preventing escalation of the problem. To limit the adverse consequences of any unplanned release of mass, energy or hazardous material.	Examples include: PPE, Fire Extinguishers, Spill Response Kits, Bunded Areas
Escape and rescue	Escape and Rescue is caring for the injured and making the site safe. To evacuate all potential victims from the hazard location as quickly and as safely as possible.	Examples include: Safe Access/Egress, Emergency Planning, Emergency Communication

7.3.3 Identify the Individual/Team Actions

These are the errors or violations that led directly to the incident. They are typically associated with personnel having direct contact with the equipment, such as operators or maintenance personnel. They are always committed 'actively' (someone did or didn't do something) and have a direct relation with the incident. For most of the time however, the defences built into our operations prevent these 'human errors' from causing harm.

Once again, keep asking "Why?" someone acted (or was allowed to act) or didn't act in the way they might have leading up to the incident.

Note: These are active failures so they will have a verb attached. Fatigue, stress or drug/alcohol are behavioural influences that led to the error or violation.

Check question: Does this contributing factor tell you about an error or violation of a standard or procedure made in the presence of a hazard?

Human error types:

Slips – errors in which the right intention or plan is incorrectly carried out. These usually occur during well-practiced and familiar tasks in which actions are largely automatic.

Lapses – failures to carry out an action. Lapses typically involve failures of memory.

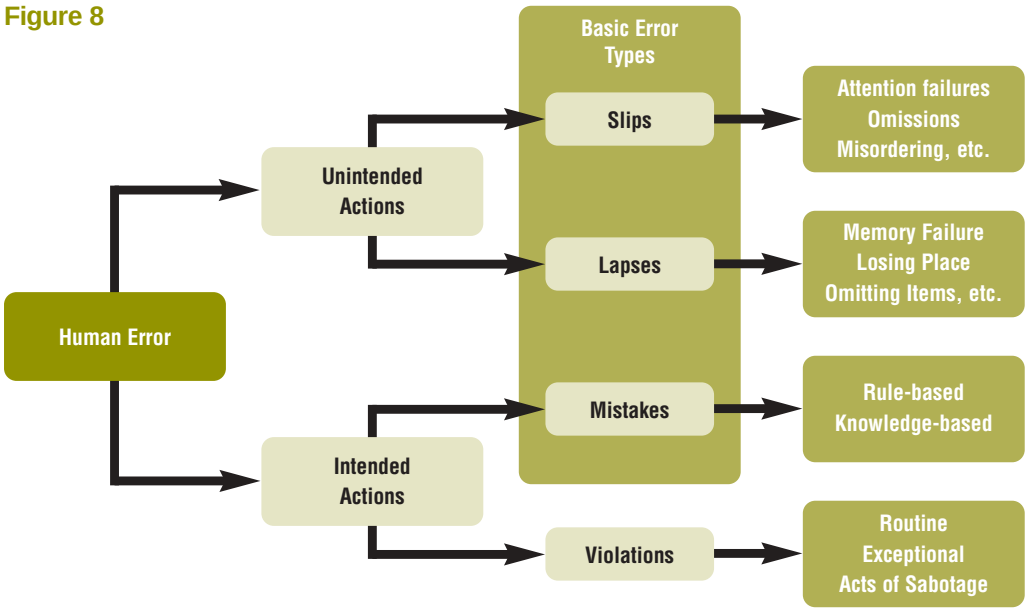
Mistakes – involve deficiencies or failures in the judgement process. These occur when rules are applied incorrectly or knowledge relevant to the situation is inadequate, and a flawed plan is developed. When carried out, the plan will not lead to the desired outcome.

Violations – deliberate deviations from safe operating practices, procedures, standards or rules. These can be further categorised as:

- Routine (the breach of rules or corner cutting has become implicitly accepted, and a normal activity)
- Exceptional (one-off violation enacted in unusual circumstances)
- Acts of sabotage (deliberate action intended to cause damage).

Figure 8 below shows the various categories used to classify human error, which are initially separated into intended or unintended actions.

Figure 8



7.3.4 Identify the Task/Environmental Conditions

These are the conditions in existence immediately prior or at the time of the incident that directly influence human and equipment performance in the workplace. These are the circumstances under which the errors and violations took place and can be embedded in task demands, the work environment, individual capabilities and human factors. Deficiencies in these conditions can promote the occurrence of errors and violations. They may also stem from an Organisational Factor Type such as Risk Management, Training, Incompatible Goals, or Organisation, when the system tolerates their long term existence.

Check question: Does this contributing factor describe something about the task demands, work environment, individual capabilities or human factors that promoted errors/violations or undermined the effectiveness of the system's defences?

The Task/Environmental Conditions can be categorised in two groups: Workplace Factors and Human Factors. Within the two groups we can categorise factors which encourage the commission of errors or violations and common factors which may promote errors and/or violations. The tables below detail some of these pre-existing conditions that promote human error.

Workplace Factors		
Error Factors	**Common Factors**	**Violation Factors**
• Change of routine • Negative transfer (interference of previous learning) • Poor signal/noise ratio • Poor man/system interface • Designer/user mismatch • Educational mismatch • Hostile environment • Domestic problems • Poor communications • Poor mix of 'hands on' work and written instruction. (Reliance on undocumented knowledge) • Poor shift patterns and overtime working	• Time shortage • Inadequate tools and equipment • Poor procedures and instructions • Poor tasking • Inadequate training • Hazards not identified • Under-resourcing • Inadequate supervision • Poor access to job • Poor housekeeping • Poor supervisor/worker ratio • Poor working conditions • Inadequate mix of experienced and inexperienced workers	• Violations tolerated • Compliance goes unrewarded • Procedures protect the system not the individual • Little or no autonomy • Macho culture • Perceived licence to bend rules • Adversarial industrial climate • Low operator pay • Low operator status • Unfair management sanctions • Blame culture • Poor supervisory example • Task allows for easy shortcuts.

Human Factors		
Error Factors	**Common Factors**	**Violation Factors**
• Attention capture: – preoccupation – distraction • Memory Failures: – encoding interference – storage loss – retrieval failure – prospective memory • Strong motor programmes: – frequency bias – similarity bias • Perceptual set (tendency to perceive one thing and not another) • False sensations • False perceptions • Confirmation bias • Situational awareness • Incomplete knowledge • Inaccurate knowledge • Inference and reasoning • Stress and fatigue • Disturbed sleep patterns • Error proneness	• Insufficient ability • Inadequate skill • Skill overcomes danger • Unfamiliarity with task • Poor judgement: – illusion of control – least effort • Overconfidence • Performance anxiety • Time pressures • Arousal state: – monotony and boredom – emotional status	• Age and gender • High risk target • Behavioural beliefs – (gains > risks) • Subjective norms condoning violations • Personality: – unstable extrovert – non-compliant • Perceived behavioural control • Low morale • Bad mood • Job dissatisfaction • Attitude to the system • Misperception of hazards • Low self esteem • Learned helplessness

7.3.5 Identify the Organisational Factor Types

The next step of the analysis is to identify which of the Organisational Factor Types (OFTs) are primarily implicated in producing the identified Task/Environmental Conditions, allowed them to go unaddressed or undermined the system's defences.

These are the underlying organisational factors that produce the conditions that affect performance in the workplace. They may lie dormant or undetected for a long time within an organisation and only become apparent when they combine with other contributing factors that led to the incident. These may include management decisions, processes and practices.

Check question: Does this contributing factor identify a standard Organisational Factor present before the incident and which:

- produced adverse task/environmental conditions, or allowed them to go unaddressed,
- promoted or passively tolerated errors or violations,
- undermined or removed the system defences?

ICAM classifies system failures into 14 Organisational Factor Types (OFTs) as follows:

- HW – Hardware
- TR – Training
- OR – Organisation
- CO – Communication
- IG – Incompatible Goals
- PR – Procedures
- MM – Maintenance Management
- DE – Design
- RM – Risk Management
- MC – Management of Change
- CM – Contractor Management
- OC – Organisational Culture
- RI – Regulatory Influence
- OL – Organisational Learning

Hardware	
The quality, availability and position in the life-cycle of tools, equipment and components. It is concerned with the materials selected rather than design or poor maintenance of the equipment.	
Inadequate hardware can be caused by:	• poor stock or ordering system • poor quality due to the local availability • poor state of existing equipment • equipment not fit for purpose • lack of resources available to buy, maintain or improve equipment • theft
Inadequate hardware can lead to:	• inappropriate use of tools or equipment • absence or unavailability of tools or equipment • improvisation i.e. using tools unsuitable for the job

Training	
The provision of the correct knowledge and skills of employees which are necessary for them to do their job safely. Failures may involve insufficient or too much training, lack of resources or assessment and mismatch of abilities to tasks.	
Inadequate training can be caused by:	• training not directed to all the job skill requirements • ineffective pre-employment selection process • poor training needs assessment • no assessment of training effectiveness • differing standards of training • training the wrong people • making assumptions about a person's knowledge or skills
Inadequate training can lead to:	• employees unable to perform their jobs • excessive time spent in training • excessive supervision needed • increased numbers of people required for the job • jobs taking longer, of poor quality, wasting material

Organisation	
Deficiencies in the structure of responsibility and accountability which are not appropriate to current work. May involve co-ordination, supervision and provision of communication and feedback.	
Inadequate organisation can be caused by:	• poorly defined departments or sections • unclear accountability, responsibility or delegation • lack of definition of objectives • no structure to co-ordinate different activities • poor planning • excessive bureaucracy • frequent re-organisations
Inadequate organisation can lead to:	• multi-layer hierarchy, slow response to changes • wrong person, or nobody, takes responsibility • resources used for non-business needs • decisions delayed or deferred • people are only held responsible not accountable for their actions/decisions • poor control or management of events • rules and procedures not enforced

Communication	
Failures to communicate when the target is known but the message fails to get through or is late. Involves inadequate hardware and miscomprehension by those involved. Failure to validate reception.	
Inadequate communication can be caused by:	• language problems and cultural barriers • lack of clear line of communication • poor feedback • no standard communication format • missing or excessive information • inability to make contact with the correct person • unreceptive or hostile target
Inadequate communication can lead to:	• misunderstanding or incorrect interpretation • doing the wrong thing, at the wrong time or place • missing information, people not informed, do not report • people not knowing who to inform • not knowing where information is located

Incompatible Goals	
The presence of conflicts between production, safety, planning, and economic goals as well as conflicts between group and peer pressures and personal goals. Incompatible goals become a problem when senior management give no guidelines on priorities.	
Incompatible goals can be caused by:	• conflict between safe work and production priorities • conflict between work and personal priorities • imbalance between safety requirements and budget constraints • taking procedural shortcuts for personal/production gain • conflict between appearance and functionality in a design
Incompatible goals can lead to:	• suppressing information about hazards or injuries • shortcutting a procedure • overruling or relaxing procedures • putting people under pressure • operating closer than normal to operating limits

Procedures	
The presence of accurate, understandable procedures which are known and used. Relates to the way in which procedures are written, tested, documented and controlled.	
Inadequate procedures can be caused by:	• poor knowledge of the procedure writer • poor feedback on practicality • poor indexing or retrieval methods • gaps in the inventory of procedures needed • non-operational objectives (political/organisational) • failure to have a revision control system
Inadequate procedures can lead to:	• ambiguous, non-comprehensive, incorrect and outdated documents • difficult access for the users • no procedures for some specific tasks • too many, overlapping or conflicting procedures • failure to communicate existing or new procedures • documents in the wrong language • difficult procedures which encourage shortcuts • toleration of violations

Maintenance Management	
The appropriateness of the management of the maintenance system, involving planning, resourcing and type of maintenance rather than the execution of maintenance jobs. Poor practices, involving procedures, tools and training are covered elsewhere.	
Inadequate maintenance management can be caused by:	• poor planning, controlling, execution and recording of maintenance • state of equipment not communicated to relevant people • shortage of specialised maintenance personnel • absent/inadequate manuals and documents • incorrect maintenance strategy
Inadequate maintenance management can lead to:	• defective or malfunctioning equipment • makeshift or unplanned maintenance • breakdown before life expectancy • unexpected rapid corrosion • equipment not operable in the way intended

Design	
The way in which equipment is constructed to make certain operations difficult or allow unexpected usage. Poor design may require extra effort and unusual maintenance. Inadequate design capacity may lead to extending the equipment beyond limits. Many design failures result from the physical and professional separation of the designer and end user.	
Inadequate design can be caused by:	• no standardisation of equipment or usage • no adapting to human needs and limitations • poor designer – user communication • time or financial constraints • no indication of system status provided by design (on/off, working or not, etc.) • inadequate design premise data
Inadequate design can lead to:	• extra effort to do the job • unexpected performance of tools and equipment • inability to operate equipment properly • inability/difficulty in controlling processes • long or repeated training requirements • equipment is unused or improvised usage

Risk Management	
The systematic application of management policies, processes and procedures to the tasks of identifying, analysing, assessing, reducing to *ALARP* (As Low as Reasonably Practical), and ongoing monitoring of risk in man-machine systems that contain a potential to have an adverse effect on people, the environment, equipment, property or the community.	
Inadequate risk management can be caused by:	• inadequate or poorly conducted risk management process • goals, objectives, scope and boundaries of risk management activity not clearly determined • level of risk analysis (JSA, QRA, Safety Case etc.) inappropriate for the degree of risk or phase of life-cycle • hazard identification process not being systematic, or covering all operations and equipment • risk assessment conducted without the appropriate competencies and experience • inappropriate selection or poor implementation of risk control measure • inadequate monitoring of risk control effectiveness
Inadequate risk management can lead to:	• risk levels above ALARP • uncontrolled hazards and consequences • unexpected incident and accident rate • inappropriate risk ranking and allocation of risk control resources • incomplete, inadequate or out of date Risk Register • breach of local regulatory requirements

Management of Change	
The systematic assessment of change to operations, processes, equipment, services and personnel for potential risk and the application of appropriate action to ensure existing performance levels are not compromised.	
Inadequate management of change can be caused by:	• inadequate or poorly conducted management of change process • objectives and scope of change activity not clearly determined • inadequate risk vs benefit assessment of the impact of change • poor change implementation plan • poor communication of change • too fast or too slow implementation of change • inadequate tollgate mechanism to approve proposed change • inadequate monitoring of the effects of change to existing performance levels
Inadequate management of change can lead to:	• adverse impact on production and safety performance • risk levels above ALARP • unexpected near-misses, incidents and accidents • gaps in organisational structures and responsibilities • mismatch between equipment, operating procedures and training • insufficient manning levels, confusion and low morale • increase in equipment breakdown or damage • mismatch between policy, procedures and practice • breach of local regulatory requirements

Contractor Management	
The evaluation, selection and retention of contracted services, equipment, personnel and material to ensure risks to people, the environment, equipment or property are reduced to a level which is ALARP.	
Inadequate contractor management can be caused by:	• inadequate or poorly conducted contract management process • lack of consideration of risk associated with the contract • poorly defined selection criteria giving undue weight to cost over performance • lack of formal contractor evaluation procedure • lack of a clearly defined workscope • contract not clearly defining HSE obligations, performance and reporting requirements • unclear reporting relationships, lines of communication, roles and responsibilities • failure to identify/plan bridging requirements between the contractor and company standards • inadequate or poorly conducted HSE compliance and performance monitoring and review
Inadequate contractor management can lead to:	• risk levels above ALARP • deterioration in production and safety performance • requirement for additional supervision • substandard competency and manning levels • differing, conflicting or poor interface of procedures and systems of work • poor employee/contractor relations, industrial relation issues, high personnel turnover • imbalance between contract compliance, production and HSE goals • lack of reporting of hazards, near-misses and incidents

Organisational Culture	
Culture includes the set of beliefs, values (what is important), norms and fundamental assumptions (the way we do things around here) that define the organisation. In effect, the shared values and beliefs interact with an organisation's structures and control systems to produce a set of 'unwritten rules' that govern behavioural norms.	
Inadequate organisational culture can be caused by:	• competing company policy • ineffective management decisions about policy • diverse and conflicting values and beliefs of the people within an organisation. • poor (or filtered) organisational level reporting and relationships • factions and politics • unaddressed employee fears and anxieties • low levels of trust and stress • getting away with unnecessary risk taking • inappropriate social interaction • poor leadership • inconsistency between organisation's values and actions • lack of compliance, performance monitoring and review.
Inadequate organisational culture can lead to:	• poor communications between divisions • failure to complete tasks • non-adherence to rules • poor commitment to safety, environment and community issues • reluctance for voluntary resolution of identified hazards • low occurrence reporting • lack of clear management structures/processes • low staff morale and motivation • miscalculation of the level of acceptable risk • ambiguous expectations of behaviour requirements • slow acceptance of change, restricting continual improvement process • unsafe work conditions not addressed

Regulatory Influence	
The regulatory body has an influence on safety culture by defining and controlling the safety framework in which the organisation must operate. The framework includes: legislative requirements, documentation and safety practices required of organisations and regulatory oversight.	
Inadequate regulatory influence can be caused by:	• ambiguous regulations • duplicated safety practices • multiple requirements for documentary evidence • conflicting regulatory requirements • lack of knowledge regarding regulatory requirements
Inadequate regulatory influence can lead to:	• delays in meeting regulatory requirements • additional resources to meet regulatory requirements • prescriptive regulatory requirements • restrictive work practices • difficulties in interpreting regulations • non-reporting of hazards due to fear of enforcement action/penalty • inability to demonstrate compliance or satisfy other legal requirements • potential revocation of operating licence or other regulatory sanctions

Organisational Learning	
The strategies that organisations have in place for ensuring lessons are learnt from occurrence investigations, corrective action implementation, audit findings, risk management processes and reviews.	
Inadequate organisational learning can be caused by:	• investigating occurrences systemically • failure to communicate lessons to the workforce • poor evaluation of effectiveness of corrective actions • failure to appreciate the risk exposure or vulnerability within an organisation • failure to investigate and rectify non-compliance findings from audits • lack of leadership/commitment to learning • ineffective sharing of lessons • inadequate incident reporting • lack of resources (financial and human) • inadequate safety records/data systems • lack of effective data/trend analysis
Inadequate organisational learning can lead to:	• poor communications between divisions • failure to complete tasks • non-adherence to rules • poor commitment to safety, environment and community issues • reluctance for voluntary resolution of identified hazards • low occurrence reporting • lack of clear management structures/processes • low staff morale and motivation • miscalculation of the level of acceptable risk • ambiguous expectations of behaviour requirements • slow acceptance of change, restricting continual improvement process • unsafe work conditions not addressed

7.3.6 Validate the OFTs

The approach you have been shown works backwards from the incident to the OFTs. A disadvantage of this approach is that things which are not on the causal line might be missed. One method of validation is to work from each OFT towards the incident. For example, ask the question, “Is the hardware OFT implicated anywhere in this incident?” and then ask the same question for each of the other thirteen OFTs. This approach can help the team to find things which might not be on the causal line. It’s like shaking a tree and seeing how many apples fall out. We want to collect as many apples as possible.

7.3.7 Contributing Factor Types

The tables on the following pages contain coded contributing factor types that organisations may wish to incorporate in their Investigation forms as prompts to aid the Investigation Team. The codes are not designed to be used as check-lists, but are particularly valuable for trend analysis and data entry.

08 Corrective Action Development

The investigation should identify recommendations for corrective actions to prevent recurrence, reduce risk and advance safety. This can best be achieved by addressing all absent or failed defences and organisational factors identified by the ICAM analysis. Not all contributing factors can be completely eliminated, and some may be eliminated only at a prohibitive cost. The investigation team should work with line management in the development of corrective actions.

Recommendations must have a direct link back to the incident and must target:

- **Prevention of recurrence**
- **Reduction of risk**

Recommendations must address each:

- **Absent or failed defences**
- **Organisational Factor**

The corrective actions recommended by the investigation team should be:

SMARTER

S Specific

M Measurable

A Accountable

R Reasonable

T Timely

E Effective

R Reviewed

8.1 Developing the Corrective Action Recommendations

Each recommendation is a written statement of the action management should take to correct a contributing factor. The team reviews each contributing factor and:

- formulates recommendations which, if implemented, will reduce the likelihood of that factor contributing to future incidents;
- recommends improvement to the system defences to limit the consequences of the contributing factor, so that residual risk is recognised by management as acceptable;
- makes interim recommendations for immediate corrective actions after an incident or near-miss as a short-term measure to mitigate current risks prior to the establishment of long-term corrective actions

It is essential any corrective action be fully evaluated by Management to ensure change/s do not weaken other defences or expose other risks.

A recommendation must address an organisational or systemic deficiency; it should not be a one-time or band-aid fix.

For example:

An incident occurs in a plant when a leak develops in a piping system carrying a toxic substance. The findings of the investigation determined that the gaskets (made of material 'A') used in the piping system reacted with the toxic substance over a long period. The gradual breakdown of gasket 'A' allowed the toxic material to leak.

The following are two possible recommendations for this condition:

Survey the plant and, where this condition is found, replace all gaskets with gaskets 'B' (made of material that will not react with the toxic substance).

Survey the plant and, where this condition is found, replace all gaskets with gaskets 'B' AND provide some organisational mechanism to prevent gaskets 'A' from being used in the future.

The second recommendation, although more difficult to implement, has a much greater chance of reducing the risk of a future incident because it provides a long term correction.

8.2 Hierarchy of Controls

Recommendations should be based upon the Hierarchy of Controls.

Hierarchy of Controls	
Elimination	The complete elimination of the hazard.
Substitution	Replacing the material or process with a less hazardous one.
Engineering	Redesign the equipment or work processes.
Separation	Isolating the hazard by guarding or enclosure.
Administration	Providing controls such as training, procedures etc.
PPE	Use appropriate properly fitted PPE where other controls are not effective.

Administrative and PPE provide interim solutions in a planned program to eliminate or reduce a particular risk or may be used to supplement other control methods. However, they are not the preferred control measures. Elimination or substitution removes the risk so that other controls are redundant.

8.3 Tracking Recommendations

Each recommendation is numbered individually to ensure and simplify action assignment and completion control. The investigation should cross reference their recommendations to the identified absent/failed defences and organisational factors to ensure they have all been addressed.

09 Investigation Report

9.1 Introduction

The incident investigation is a closed-loop process consisting of gathering information, evaluating and organising the information, and formulating various hypotheses to explain how the incident occurred. This process continues until the team fully understands how and why the incident occurred and is satisfied all significant discrepancies and inconsistencies are resolved.

The investigation report is the formal presentation of the investigation team's findings and recommendations. The format of the report is the responsibility of the organisation, however, inclusion of the ICAM chart will assist management in understanding the factors contributing to the incident.

As a minimum the report should include:

- *Incident* – A summary of the incident – what? when? where? who?
- *Circumstances* – A full description of what happened -and how
- *Findings* – What did the investigation reveal?
- *Conclusions* – This will cover underlying causes and contributing factors arising from the failure to control risks associated with: the process itself, the facilities and equipment used, the management systems used, and the competencies and behaviour of line management and personnel.
- *Key learnings, recommendations and actions* – The key learnings, recommendations for corrective action, both immediate and long term, completion dates and who is responsible.
- *Outcomes* – This will include actual consequence such as a fatality, permanent disabilities as a result of injury, costs of plant damage, retraining, overtime, strikes or stoppages, lost production, prosecutions, fines etc.

9.2 General Recommendations

The following should be considered when preparing an investigation report:

- The report should be factual, concise and conclusive.
- Interpretations of findings should be based on the facts as identified during the investigation.
- Assessment of basic causes should be based on the ICAM analysis of the findings.
- Events or conditions that are major contributing factors to the incident should be clearly identified as such.
- The report should be readable as a stand alone document – references to other documents not open to inspection by others i.e. the general public, should be avoided.
- Strict document control procedures should be in place and previous drafts of the report should be destroyed.
- Reference to all documents and records relevant to the incident should be established.

9.3.2 Key Findings

The key findings outline why the incident occurred and the contributing factors deduced from the investigation are categorised using the Incident Cause Analysis Method (ICAM). (The ICAM analysis chart is shown as an appendix in the report).

- Basic cause (i.e. "Why did the incident occur?").
- Contributing factors
  - – Absent or failed defences
  - – Individual or team actions
  - – Task or environmental condition
  - – Organisational factors.

9.3.3 Conclusion and Observations

This section includes the conclusions drawn from the analysis of the findings. Conclusions identify the immediate and root causes of the incident and comment on the effectiveness of the rescue and damage containment activities where appropriate. Conclusions are based on factual and analytical information with a logical and understandable continuity.

Conclusions are presented in brief statements that:

- Highlight one finding per conclusion.
- Are organised sequentially, chronologically or in logical sets.
- Are kept to a reasonable number as they are the recap of contributing factors and analytical highlights.

Conclusions based on circumstantial evidence should be highlighted as such.

These investigation conclusions permit the reader to arrive at, and agree with, the logical processes and results of the investigation.

9.3.4 Recommendations

The recommendations address the *Absent or Failed Defences* and *Organisational Factors* identified as key findings of the investigation. The investigation should identify recommendations for corrective actions to prevent recurrence. This can best be achieved by addressing all absent or failed defences and organisational factors identified by the ICAM analysis. Not all contributing factors can be completely eliminated, and some may be eliminated only at a prohibitive cost.

The investigation team should work with line management in the development of corrective actions. Advice on the development of recommendations is covered in Section 8 of this guide.

Recommendations should identify corrective measures for as many of the listed contributing factors as possible and may be related to:

- Eliminating the causes.
- Minimising possible consequences.
- Improving rescue or damage containment measures.
- Emphasising that all causes identified should be eliminated.

Action parties and a time schedule for implementation should be identified.

9.3.5 Significant Learnings

Significant learnings are the generic learnings for the organisation from the investigation. They should include those issues that if corrected should prevent similar incidents elsewhere within the organisation or within the industry. Significant learnings should not include issues unique to the incident site. Significant learnings could also include comment on defences within the system that were effective during the event sequence.

9.3.6 Appendix A – ICAM Analysis

The ICAM Chart should be included in this section of the report. This section should include an overview of the ICAM analysis process and guidance on interpreting the ICAM chart for the benefit of those readers unfamiliar with ICAM.

Sample Overview

The contributing factors of this incident were analysed using the ICAM process. ICAM is an analysis tool that sorts the findings of an investigation into a structured framework. Like sorting a deck of cards into suits, the contributing factors are classified into four categories.

These are:

- *Absent or failed defences:* the situations, systems, conditions, equipment, measures or human factors which normally prevent this type of incident from occurring.
- *Individual or team actions:* the errors or violations made by people directly involved in the event.
- *Task and Environmental Conditions:* the 'situational characteristics' which existed immediately prior to the incident, including the work situation, physical or social environment, or a person's mental, physical or emotional state.
- *Organisational Factors:* those latent system-based factors present before the incident which may have contributed to the occurrence of specific adverse task or environmental conditions, individual or team actions, or failed defences.

ICAM classifies the system failures into Organisational Factor Types (OFT's) as follows:

- HW – Hardware
- TR – Training
- OR – Organisation
- CO – Communication
- IG – Incompatible Goals
- PR – Procedures
- MM – Maintenance Management
- DE – Design
- RM – Risk Management
- MC – Management of Change
- CM – Contractor Management
- OC – Organisational Culture
- RI – Regulatory Influence
- OL – Organisational Learning

A required outcome of applying the ICAM process is the formation of clear recommendations to address deficiencies in system defences and organisational processes. The process is designed to make recommendations which address all absent or failed defences and organisational factors identified as contributing factors.

The features of the ICAM chart for the purposes of this Report are:

- It provides a graphical representation of all the key circumstances and factors relating to the incident.
- It outlines the relationship of the various elements considered throughout this report.

In addition ICAM is designed to:

- Provide a framework to organise the data collected.
- Assist in assuring the investigation follows a logical path.
- Aid in the resolution of conflicting information and the identification of missing data.
- Provide a diagrammatical display of the investigative process for management briefing.

Accordingly, this ICAM table should not be considered in isolation and needs to be considered in the context of all the comments in this report.

9.3.7 Appendix B – Corrective Action Plan

This Section contains the following information:

- Recommendation
- Responsible Department
- Responsible Person
- Completion
- Date
- Sign off

9.3.8 Report Sign-off

To maximise the preventative potential of the investigation report, the findings and conclusions of the report should be distributed to the various people involved in the incident and as widely as practicable internally within the organisation. This Section would include:

- Feedback to the Involved Person(s) and comments
- Feedback to the Involved Person(s) Supervisor(s) and comments
- Department Manager's acceptance of findings and comments
- Safety Department/Manager's acceptance of findings and comments
- Senior Management's acceptance of findings and comments

The completion of corrective actions must be documented and communicated by the Responsible Manager to Senior Management. Where corrective actions have not been fully implemented, ongoing monitoring should be maintained until implementation is complete.

9.4 Legal Review

Prior to submission to management for final review (see Chapter 10) the investigation report must have been reviewed or be submitted for appropriate legal review.

11 Follow-up and Closeout

An effective incident investigation requires strong management commitment and involvement. Desirably, management will support the investigation process and demonstrate this by acting on the results. Where corrective actions have been agreed and assigned it is the responsibility of those persons to complete the actions in the time frame outlined.

Completion of each corrective action must be recorded and signed off by the appropriate person. Target dates must be realistic and achievable to ensure completion.

It is ultimately the responsibility of the assigning manager to follow-up and ensure completion targets are met. They may also be the subject of discussion and follow-up by the senior site executive and the site safety committee. Completion of all corrective actions should be communicated to all recipients of the investigation report and the workforce in general. This may be a follow-up to a previous communication briefly outlining the findings.

11.1 Distribution

To maximise the preventative potential of the investigation, the findings and conclusions of the report should be distributed as widely as practicable internally within the organisation and externally to industry bodies.

11.2 Implementation of Corrective Actions

Corrective actions should be formally presented to the Responsible Line Manager for implementation. An action plan and time frame should be agreed and endorsed by the appropriate level of management.

11.3 Implementation Monitoring

The completion of corrective actions must be documented and communicated by the Responsible Line Manager to the site senior executive and to the appropriate level within the organisation's senior management. Where corrective actions have not been fully implemented, ongoing monitoring should be maintained until implementation is complete.

11.4 Analyse Effectiveness

The effectiveness of the corrective actions should be evaluated by one of the following methods:

- Compliance audit.
- Independent audit.
- Committee review.
- Key performance indicators.
- Post implementation risk assessment.
- Ongoing monitoring.

11.5 Document Archival

Investigative data and reports shall be archived in accordance with organisational and regulatory guidelines.

Glossary of Terms

For the purpose of this guideline, the definitions below apply:

1.1 ALARP

As Low As Reasonably Practicable.

1.2 Absent/Failed Defences

Inadequate or absent barriers that failed to detect and protect against technical and human failures.

1.3 Acceptable Risk

The outcome of a decision process, (considering risks vs. costs vs. benefits), to determine an acceptable option.

1.4 Active Failure

Actions or inactions of people that are contributing factors of an incident.

1.5 Basic Cause

The fundamental cause of an incident which, if corrected, will prevent its recurrence.

1.6 Benefit

An improvement in health, safety and environmental performance, risk profile, process or economic outcome.

1.7 Common Factors

Workplace or human factors that can promote the occurrence of either errors or violations.

1.8 Condition and Event Chart

Graphical technique used to display the range and sequence of events and conditions of an incident.

1.9 Contributing Factors

Actions, in-actions or conditions that are directly linked to the incident and if removed would prevent or reduce the severity of an incident.

1.10 Consequence

The outcome of an event or action expressed qualitatively or quantitatively, being a loss, injury, damage or disadvantage.

1.11 Continual Improvement

A process of reducing risk and enhancing management systems; to achieve permanent improvements in performance in line with organisational goals.

1.12 Corrective Action

Actions taken to prevent incident recurrence, reduce risk and advance health, safety and environmental performance.

1.13 Defences

Knowledge, equipment, work process, control measure, detection systems or procedures which normally prevent, or limit the consequence of, an incident.

1.14 Environment

Surrounds in which the organisation operates; includes air, water, land, natural resources, flora, fauna, humans and their interrelations.

1.15 Error Factors

Workplace or human factors that can promote the occurrence of errors.

1.16 Error Mitigation

Control measures put in place to limit or mitigate the consequence of errors.

1.17 Error Prevention

Organisational factors put in place to prevent the occurrence of errors.

1.18 Error Tolerant Defences

Defences that enable errors to be trapped preventing immediate and irreversible consequences – the incident.

1.19 Error Trapping

Control measures put in place to contain errors without consequence.

1.20 Facts

Information that can be objectively measured, described or proven.

1.21 Hazard

A source or a situation with the potential for harm in terms of human injury or ill health, damage to property, damage to the environment, or a combination of these.

1.22 Hazard Identification

The process of recognising that a hazard exists and defining its characteristics.

1.23 Hierarchy of Controls

Preferred order of control measures for risks.

1.24 Hierarchy of Defences

Successive lines of defences where each layer comes into operation on the failure of its predecessor.

1.25 Human Error Types

Slips, lapses, mistakes, violations.

1.26 Human Factors

A discipline that defines and applies information about human behaviour, abilities, limitations, and other characteristics to the design of tools, machines, systems, tasks, jobs, and environments for productive, safe, comfortable, and effective human use.

1.27 ICAM

Incident Cause Analysis Method, a systematic incident investigation analysis method.

1.28 Incident

Any occurrence that can have an adverse impact on the environment, people, plant or process.

1.29 Incident Tree

Graphical technique used to display the range and sequence of events and conditions of an incident.

1.30 JSA

Job Safety Analysis, a systematic process identifying tasks, hazards and controls measures for a particular job.

1.31 LTI

Lost Time Injuries – those occurrences that resulted in a fatality, permanent disability or time lost from work of one day/shift or more.

1.32 Lapse

Failure to carry out an action - lapses typically involve failures of memory.

1.33 Latent Conditions

Conditions, created by an individual/organisation, that lie dormant or undetected until they cause, or contribute to, an incident.

1.34 Likelihood

A qualitative description of probability or frequency.

1.35 MTI

Those occurrences which were not lost-time injuries and for which first aid and or medical treatment was administered.

1.36 Mistake

Deficiencies or failures in judgement, these occur when the rules are applied incorrectly or knowledge relevant to the situation is inadequate.

1.37 Near Miss

Any unplanned incidents that occurred and although not resulting in an adverse impact/s on the environment, people, plant or process, it had the potential to do so.

1.38 Non-Contributing Factor

Actions, in-actions or conditions that did not contribute to the incident or its consequence.

1.39 Organisational Factors

Management decisions or processes that create or influence deficiencies in an organisation's operational defences.

1.40 Pay-Off Matrix

Tool used to identify and evaluate the costs, benefits and ease of implementation of recommendations and corrective actions.

1.41 QRA – Qualitative Risk Assessment

Risk analysis which uses a scale of words or descriptions to examine the impacts and likelihood of an event.

1.42 QRA – Quantitative Risk Assessment

Risk analysis which uses numerical values for both consequences and likelihood of an event.

1.43 Risk

The combination of the frequency (or probability of occurrence) and consequence (impact on people, the environment, property, or a combination of these) of a specified hazard.

1.44 Risk Assessment

The overall process of estimating the magnitude of risk and deciding whether the risk is tolerable.

1.45 Risk Reduction

Selective application of appropriate techniques and management principles to reduce either likelihood of an occurrence or its consequences or both.

1.46 Safety

A state in which the risk of harm (to persons) or damage is limited to an acceptable level.

1.47 Safety Case

Formal process for the identification, assessment, control and mitigation, of existing and potential safety hazards for a particular facility.

1.48 Slips

Errors in which the right intention or plan is incorrectly carried out.

1.49 Task/Environmental Conditions

Conditions in existence immediately prior to or at the time of the incident and that directly influence human and equipment performance in the workplace. These are the circumstances under which the errors and violations took place and can be embedded in task demands, the work environment, individual capabilities and human factors.

1.50 Terms of Reference

Details of the purpose, scope and schedule of the investigation.

1.51 Violations

Deliberate deviations from safe operating practices, procedures, standards or rules.

These can be further categorised as:

Routine (the breach of rules or corner cutting has become implicitly accepted, and a normal activity).

Exceptional (one-off violation enacted in unusual circumstances).

Acts of sabotage (deliberate action intended to cause damage).

1.52 Violation Factors

Workplace or human factors that can promote the occurrence of violations.

1.53 Workplace Factors

Circumstances under which the errors and violations took place such as time pressures, poor training, inadequate supervision, poor working conditions.