The AcciMap approach

1. Introduction

What is Accimap?

- It is a systems-based technique for accident analysis, for analysing the causes of accidents and incidents that occur in complex sociotechnical systems.
- Its a graphical presentation of factors within the system that impacted the occurrence of the accident.
- It allows analysis upwards through systems rather than horizontally across speicifc parts of the system.
- The causal factors are arranged into a series of levels representing the different parts of the sociotechnical system in which the event took place.
- The lower levels show the immediate precursors to the accident, while the higher levels incorporate organisational, governmental, regulatory and, in some cases, societal factors that played a role in the occurrence.

What does Accimap do?

- It provides a broader appreciation of accidents and promotes a systemic view of accident causation.
- The diagram extends well beyond the immediate causes of an accident to uncover the range of factors throughout the system that promoted the conditions in which an accident occurred, or which failed to prevent it.
- It prevents excessive attention from being directed towards the immediate causes of accidents (such as human errors) because the diagram shows that these are the result of other influences or contributions.

Why is a systems approach important?

- The systems approach acknowledges the influences and constraints on the behaviour of individuals working in a system and aims not to blame them for honest errors.
- To uncover the systemic deficiencies that provoked those errors and/or failed to prevent them from resulting in an accident.
- The focus is on repairing systemic deficiencies to prevent future accidents, rather than reprimanding the individuals involved and leaving the deficiencies that promoted their actions unaddressed.

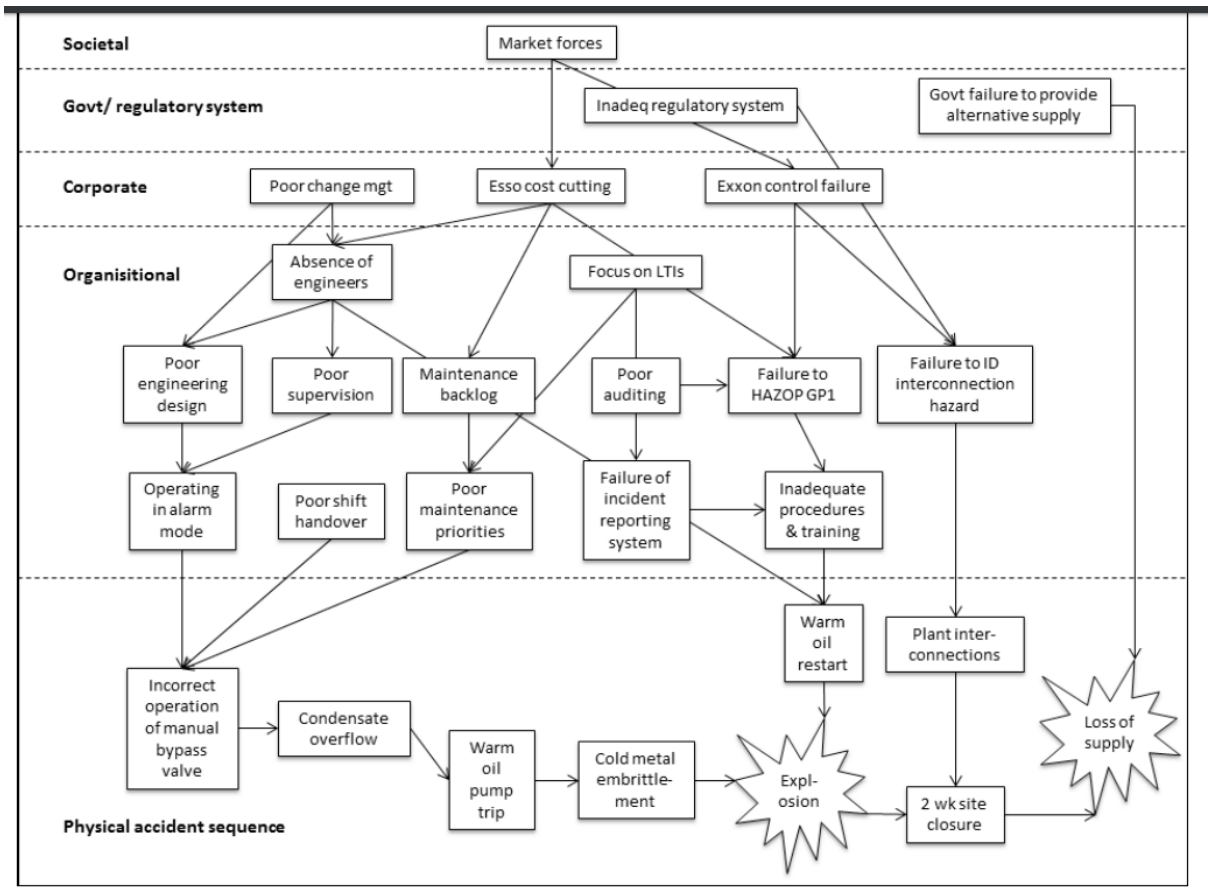
Has Accimap been used extensively?

- AcciMaps have been used to analyse accidents involving the contamination of drinking water, the Toronto severe acute respiratory syndrome outbreak, the Esso Longford gas plant explosion, the Glenbrook train crash, and several Australian Defence Force aircraft accidents.
- There are other related or similar approaches widely used, e.g. HFACS (Human Factors Analysis and Classification System).

2. Example AcciMaps

Three examples are provided to illustrate the Accimap approach, although you will see the structure is different for each.

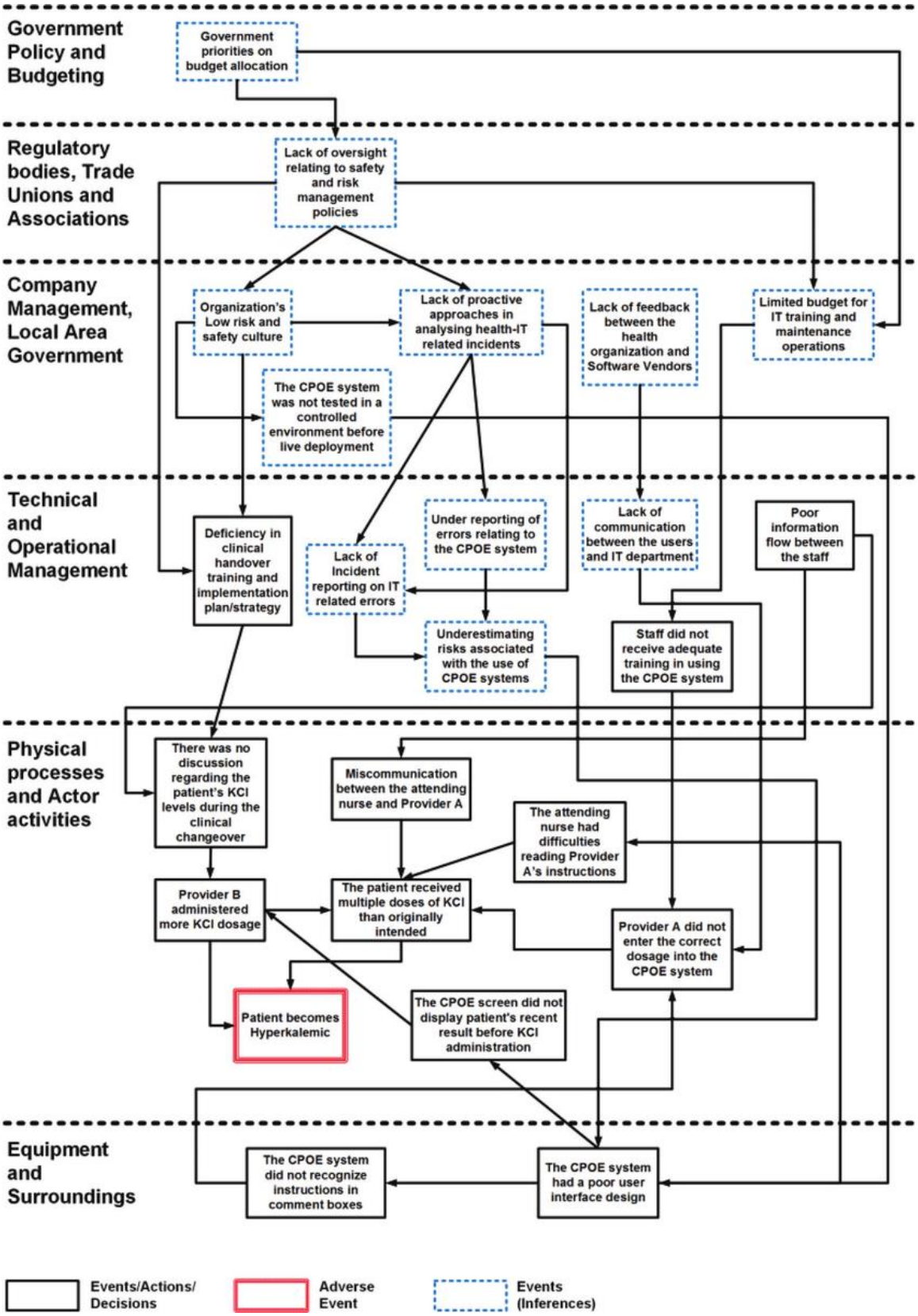
Example 1.



Accimap of an Explosion Accident at a Gas Plant (courtesy C. Goeker, after Hopkins, *op. cit.*)

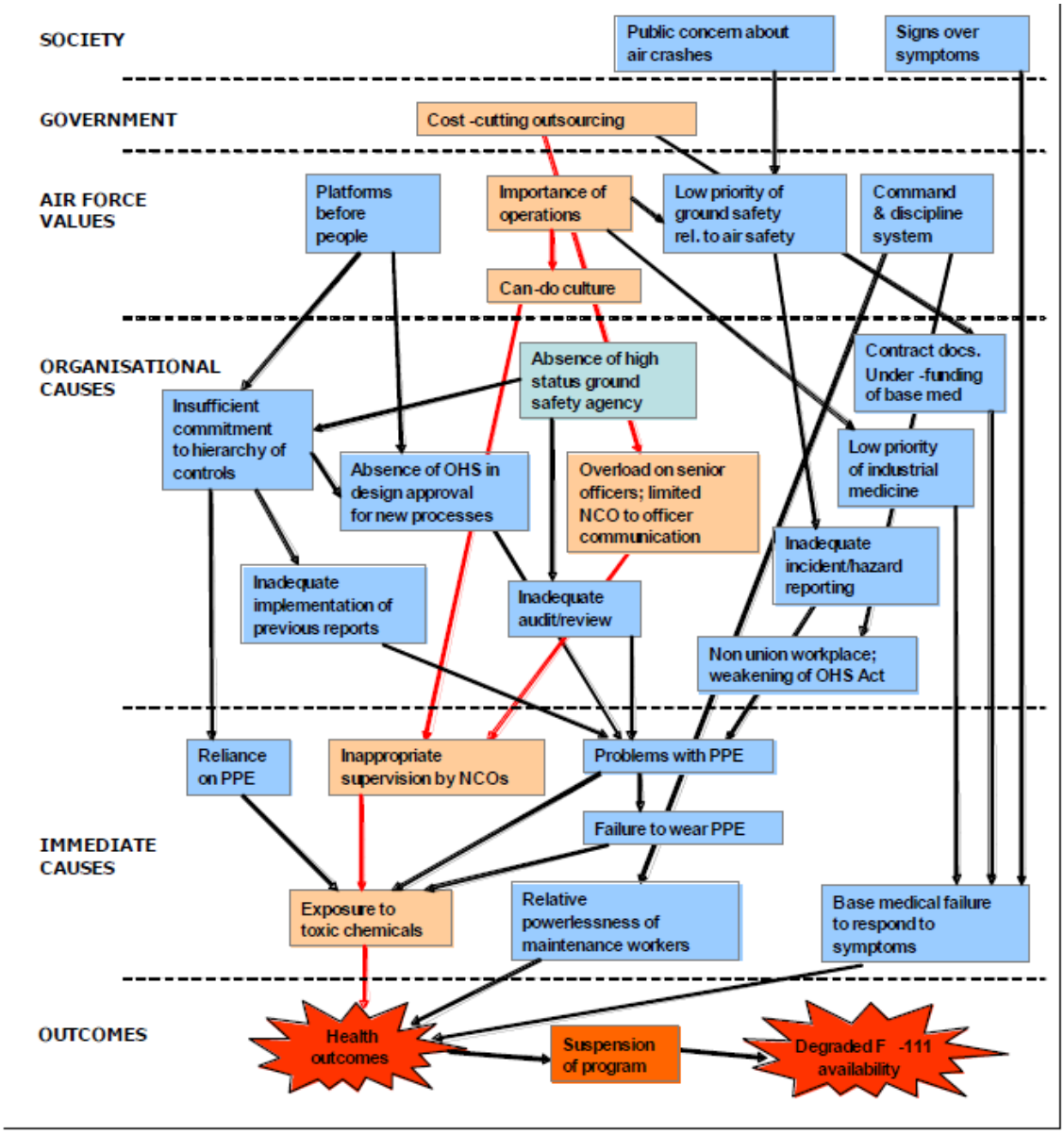
https://rvs-bi.de/publications/Papers/LadkinRCAoverview20130120.pdf

Example 2.



https://www.researchgate.net/publication/326131593_Comparing_HFACS_and_AcciMap_in_a_Health_Informatics_Case_Study_-_The_Analysis_of_a_Medication_dosing_Error

Example 3.



(Qureshi, 2008)

3. Accimap causes and influences

There is a potentially infinite number of causes for any event. Any causal chain could, in theory, be extended back to the big bang. The following provides a range of example causes across the various levels of an Accimap:

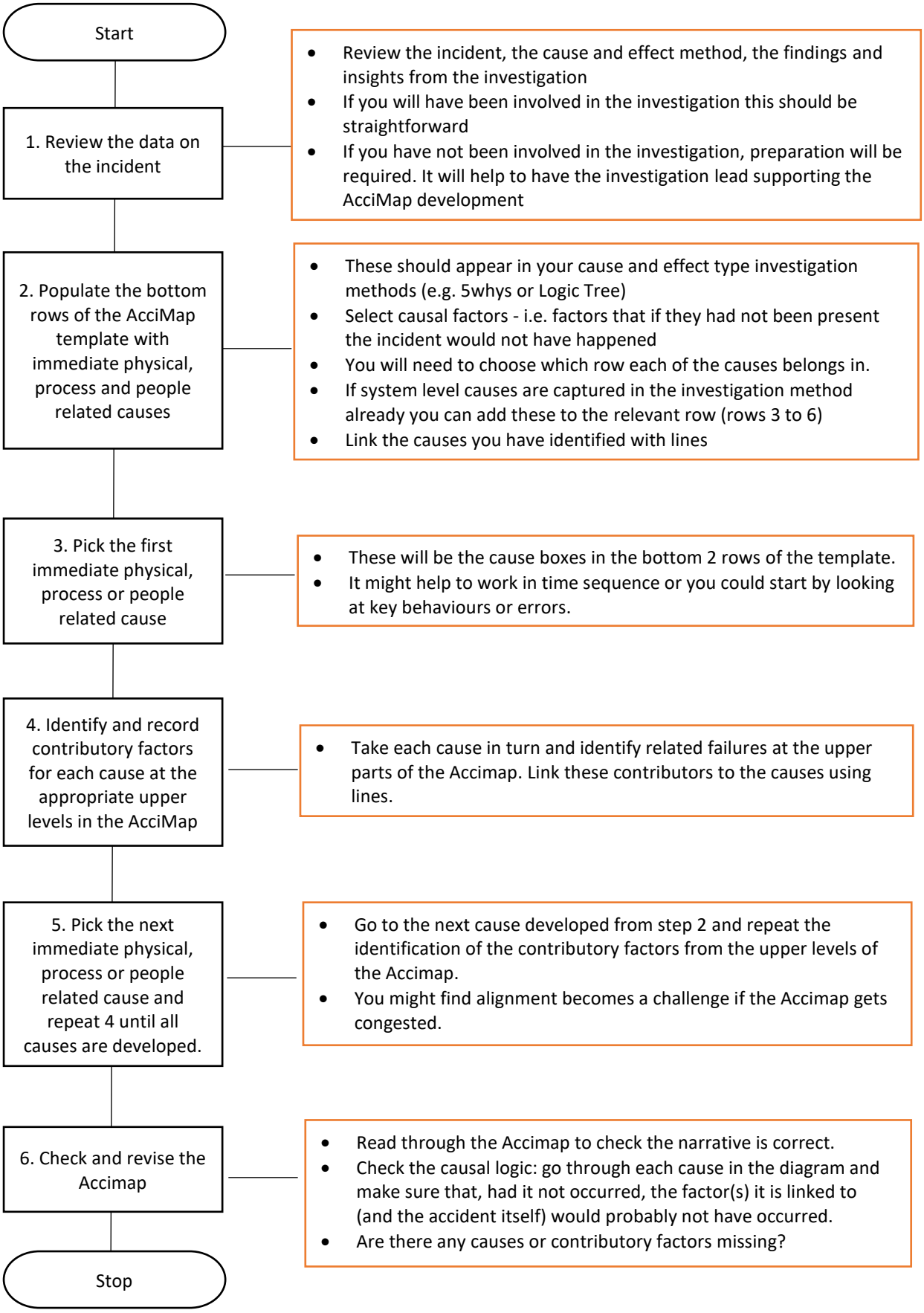
Table 1.

Level definitions	Categories of causes		
The EXTERNAL: level includes causes that are beyond the control of the organisation(s). This level includes factors relating to -	GOVERNMENT, for example: • budgeting issues, government cost cutting • inadequate legislation • privatisation, outsourcing • inadequate provision of services	REGULATORY BODIES, for example, inadequate: • regulations, communication of regulations • certification, permits • safety standards • enforcement of regulations • auditing	SOCIETY, for example: • market forces • societal values, priorities (such as the public's requirement for quality, efficiency, comfort, • affordability) • historical events • global politics
The ORGANISATIONAL: level incorporates causes relating to organisational processes. Factors are placed in this level if they are within the control of the organisation(s) involved, for example -	FINANCIAL ISSUES, for example: • organisational budgeting, cost cutting • resource allocation problems	EQUIPMENT AND DESIGN, for example: • design problems (such as ergonomic issues, inaccessibility) • equipment problems (such as poor quality, defective, ageing, untidy, missing or poorly maintained equipment or tools) • equipment not used as designed	DEFENCES, for example, inadequate, insufficient or missing: • proactive system defences (such as alarms, warnings, barriers, personal protective equipment) • reactive system defences (such as hazard containment, protection, escape and rescue systems)
	COMMUNICATION AND INFORMATION, for example, inadequate: • information or knowledge flow or organisation of information • communication of instructions, hazards, priorities, objectives, etc	AUDITING AND RULE ENFORCEMENT, for example, inadequate: • implementation and enforcement of rules, regulations or procedures • internal auditing, inspection	ORGANISATIONAL: CULTURE, for example: • incompatible goals (between safety and production or safety and budget, etc) • organisational acceptance or encouragement of short cuts, non-compliance, etc
	RISK MANAGEMENT, for example, inadequate: • hazard identification or risk assessment • hazard or defects reporting processes for learning from past mistakes	MANUALS AND PROCEDURES, for example: • inadequate, ambiguous, conflicting, outdated, absent or difficult to follow procedures, rules, regulations or manuals	HUMAN RESOURCES, for example, inadequate or insufficient: • supervision, management, coordination, staff numbers delegation, accountability • staff selection procedures or criteria

	• awareness of risks • security (such as protection • from unauthorised access)		
	TRAINING, for example. inadequate or insufficient: • training. training equipment, training exercises • training needs analysis		
PHYSICAL, ACTORS, EVENTS, PROCESSES AND CONDITIONS are the immediate precursors to the outcome(s) and should include factors relating to ~	PHYSICAL EVENTS, PROCESSES AND CONDITIONS, for example: • physical sequence of events (including technical failures) • environmental conditions and factors relating to physical surroundings which are necessary for making sense of the sequence of events	ACTOR ACTIVITIES AND CONDITIONS, for example: • human errors, mistakes, violations, actions, activities, etc • false perceptions, misinterpretations, • misunderstandings, loss of situational awareness, etc • physical and mental status of actors (such as fatigue, ill health, inattention, • unconsciousness, intoxication)	

This list of examples incorporates causal factors identified by Hopkins (2000a), Kletz (1993), Naikar, Saunders & Hopkins (2002), Rasmussen & Svedung (2000), Reason (1997), RAAF (2001), Snook (2000), Vicente & Christoffersen (2006), and Woo & Vicente (2003).

4. Instructions for AcciMap analysis



5. Tips on preparing your Accimap

A. When preparing the causes:

- keep it brief and use plain language
- use wording that makes it clear how things might have been different, that is, don't just say "training" or "operator actions", say "inadequate training" or "operator failed to monitor temperature" so that what went wrong is clear
- use wording that suits the level that the cause is located in:
    - causes at the "Physical/actor events, processes and conditions" level should be phrased in terms of the actual errors, failures, conditions and events that led to the accident (for example, "life raft failed to inflate" or "pilot failed to adjust heading")
    - causes at the "Organisational" level and above should not focus on the particular individuals involved (for example, say "inadequate pilot training", not "Pete Smith had not been adequately trained").

B. When you insert the causal links:

- arrange the causes in the AcciMap so that the causes lie directly above their effects (whether the effects are in the same level or in the level(s) below).
- Check cause and effect logic is correct:
    - had A not occurred, B would (probably) not have occurred either
    - B is a direct result of A; no other factor needs to be inserted between them.
- There is no limit to the number of causes to be included in any causal chain, and there may be multiple linked causes within the same level or with any other level of the AcciMap.
- Multiple causes can link to a single effect, and a single cause might have multiple effects.

C. Fill in the gaps:

- There may be gaps left in the causal chains where information is missing. These gaps must be filled so that the causal chains are unbroken from the earliest identified causes in each chain all the way down to the outcome(s), and so that every cause relevant to the accident is included in the AcciMap.
- To uncover missing causes, look at each cause on the AcciMap and ask how it occurred. Your AcciMap must include all factors which caused its occurrence or which failed to prevent it from occurring.
- Table 1 is not an exhaustive list but it will serve as a guide to the types of factor that may be relevant.
- Aim to follow each causal chain as far as possible. Each chain should extend at least to the "Organisational" level.
- Be sure to include as many (but only as many) factors as are necessary so that someone reading your AcciMap will be able to understand the sequence of events and conditions without difficulty.

D. Check the logic:

- Go through each cause in the diagram and make sure that, had it not occurred, the factor(s) it is linked to (and the accident itself) would probably not have occurred.

- Go through each causal chain in the diagram and make sure that:
    - anyone reading the AcciMap will have no difficulty in making sense of the sequence of events

- all of the arrows are facing downwards, towards the outcome(s)
- no cause is listed more than once. If you have two or more similar causes, see if they can sensibly be combined into one more general cause.

6. Using your Accimap to form recommendations

- Go through each of the causal factors in your AcciMap and identify those which could potentially be *changed, controlled* or *compensated for* so that a similar outcome could not occur again. Look to develop at least 1 recommendation for each of these.
- Recommendations must be practical to implement:
  - They must identify what *specifically* should be done to change, control or compensate for each cause
  - consider whether or not there is a more *general* problem area that should also be addressed (for example, if there are one or more problems relating to a certain part of a manual, it may be beneficial to recommend that the manual be reviewed, as well as the particular problem parts, to ensure that any inadequacies are addressed)
  - Identify the party responsible for making the required changes.

Note: recommendations should aim to prevent similar accidents from occurring *regardless of the individuals involved or the particular circumstances.*

- Compile a list of these recommendations, grouped according to the parties responsible for carrying out the actions. Each recommendation should be numbered and should identify the party responsible for making the change.

- Not all recommendations will necessarily be accepted by those responsible for implementing them. Issues of practicality, redundancy and cost-effectiveness may be relevant, and alternative solutions may be taken into consideration.

Accimap Template. Adapt content boxes and arrows as required.