

# Incident and accident analysis

The terms 'incident' and 'accident' are often used interchangeably, however, incident can refer to both 'near misses' or accidents. Incidents (near-misses) and accidents happen at the end of a chain of events. Very often, the immediate cause, just before the accident, is a human failure of some kind. But before that, there will be other actions, decisions or events that influence the failure. By finding these underlying causes – the human and organisational factors described in these briefing notes that influenced the failure – it may be possible to prevent future similar accidents.

## Why incident and accident analysis?

"Many accidents are blamed on the actions or omissions of an individual who was directly involved in operational or maintenance work. This typical but short-sighted response ignores the fundamental failures which led to the accident. These are usually rooted deeper in the organisation's design, management and decision-making functions".

Source: HSE (1999), *Reducing error and influencing behaviour*, HSG48.

Incident and accident analysis (hereafter referred to as incident analysis) is, in many cases, carried out at a superficial level in a wide range of industries. Some analyses conclude that the cause of an incident was 'human error'. They may go further and identify that the human error was a result of lack of training, with a typical remedial action being to retrain the person involved in the incident. In terms of modern safety management, there should be a more thorough analysis. Such an analysis ignores the fundamental question 'why' was training, in this case, lacking?

### Purpose of this briefing note

This briefing note introduces the principles of incident analysis. Methods that can be used to help with an analysis are summarised in *El Guidance on investigating and analysing human and organisational factors aspects of incidents and accidents* (Reference 1). It is not necessary to use any particular method; the important element of the analysis is to trace the origin of the incident so that those involved learn lessons from it and take appropriate steps to prevent a future occurrence.

A large number of techniques exist and can appear easy to use, but you should read up on them and also attend a training course before applying them.

## Keep asking 'why?'

In effect, all techniques used for incident analysis are designed to encourage the analyst to keep asking 'why?' until either the most basic underlying cause of the incident is found or the information needed to answer the question cannot be found.

The analysis in Case study 1, as reported, went no further than this: the driver was reprimanded and he agreed that in future he would contact the company if any delivery problems arose. He also agreed to take more care to double-check his connections. This may be a perfectly adequate analysis but a few more 'whys' would be useful in shedding further light on this incident (Table 1).

## What should my company do about it?

Your organisation should be aware of its legal duties to investigate and report incidents. These are summarised in HSE's *Investigating accidents and incidents* (Reference 2).

It should also have a system in place for investigating and analysing both incidents and accidents. The components of such a system are described next and are set out in Reference 1 and also Reference 2.

## Risk assessment/incident investigation

In terms of the human involvement in risk control, an incident investigation can be thought of as the reverse process of risk assessment. An illustration of this is given in Reference 3. Risk assessment consists of identifying hazards and evaluating the controls put in place to keep them contained. These controls include those designed to prevent errors in critical tasks (tasks required to contain the hazard). Incident investigation works from a loss of control over a hazard and identifying what failed and making any necessary improvements.

In the 'Swiss cheese' model of incident causation (Reference 4) – 'barriers' (the slices) put in place to prevent an accident are never perfect but have 'holes'. An incident occurs when the holes line up (see Figure 1).

### CASE STUDY 1

A road tanker driver was making a delivery to a customer. One compartment of his tanker was connected to the customer's diesel tank and was already discharging. The driver then made the connection between the customer's unleaded tank (tank no. 4) and compartment 4 on his vehicle. He opened the valve and a few moments later realised that he should have connected tank 4 to compartment 3 on the tanker. By then, approximately 600 litres of diesel had been delivered. Almost 3 000 litres of unleaded petrol was contaminated by diesel.

**Table 1 Analysis of case study 1**

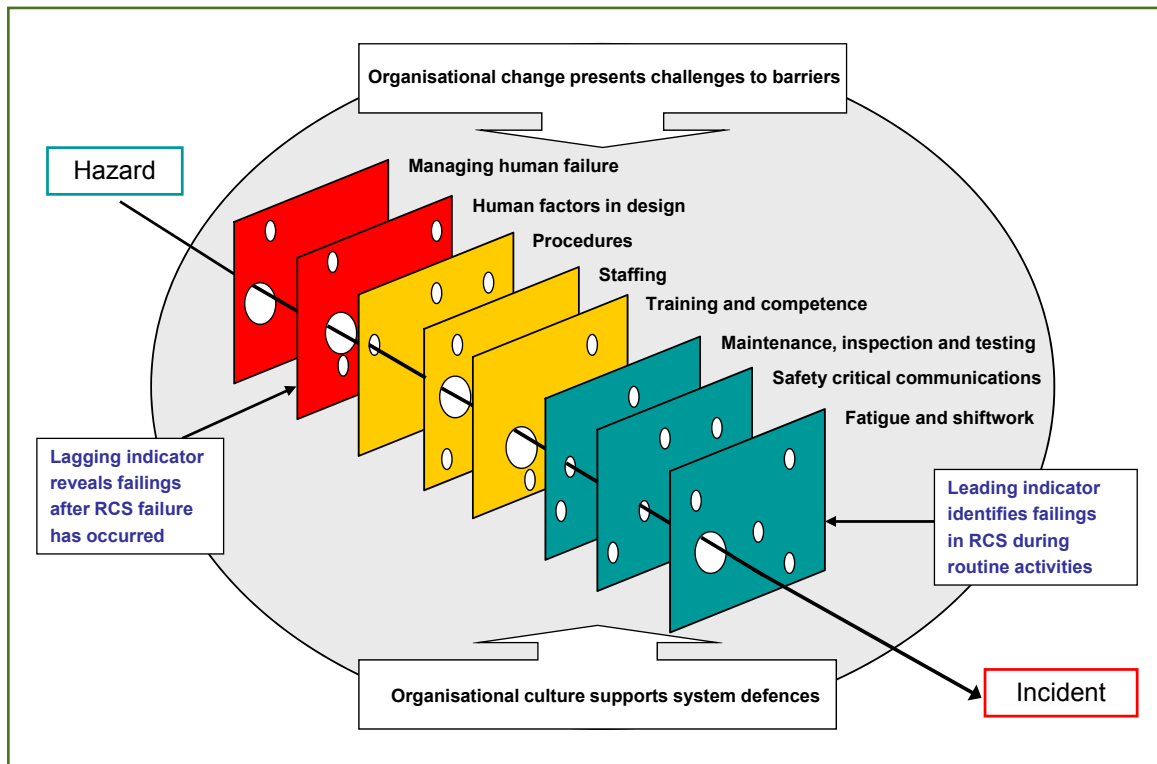
Finding	Why?	Why?	Why?	Recommendation
The driver was rushing and failed to check the connection before delivery. Time saving = less than one minute.	Drivers are highly motivated to meet schedules.  Customers at some sites apply pressure to drivers to hurry.	Drivers are paid bonuses for more deliveries or more distance covered, or work on a 'job and off' basis.  Retail sites close their shop during deliveries and cannot make other retail sales.	Seen as a mutually beneficial incentive scheme for company and driver.  Drivers also have a 'can do' attitude to meeting schedules.	Company should: <ul style="list-style-type: none"> <li>• Work with drivers to review incentives and develop alternatives.</li> <li>• Advise retail sites not to pressurise drivers.</li> </ul> Drivers should: <ul style="list-style-type: none"> <li>• Be encouraged to report negative aspects of incentives.</li> </ul>

## Reporting

The organisation should have in place:

- A system allowing any employee (or contractor) to formally report an incident.
- Clear guidance on how initial reports are to be made (by contacting a supervisor or manager, through a paper form or an online system for example) and the information required in those reports.
- A culture that encourages incident reporting – a 'just culture' that does not automatically assign blame to the person directly involved in the incident.
- An anonymous means of reporting as an alternative to open reporting.
- Rules for determining whether or not to investigate a reported incident and the required speed of response – normally based on the actual or potential severity of the incident.

**Figure 1 Swiss cheese model adapted to show HSE key topics**



## Investigation

The organisation should have in place the resources to conduct an investigation – an internal team with external support available as needed. An investigation should establish:

- What happened.
- Who or what was affected and to what extent.
- Conditions at the time – anything that could have a bearing on the incident – type of task, environmental conditions, interfaces.
- The chain of events – what happened just before the incident and just before that.
- Anything unusual or different relating to working conditions compared to other shifts.

The above should be gathered from various sources such as eyewitness statements and from records such as computer data, CCTV footage, written materials including completed checksheets and shift logs. Investigators should: expect that information may be incomplete, ambiguous, contradictory, misleading etc; be prepared to explore widely for evidence; take care not to 'contaminate' evidence, for example by making assumptions or asking leading questions.

An investigation gathers and organises the information that can be used by the analysis team (which may be the same personnel as the investigation team) to identify the human and organisational factors that contributed to the incident. The investigators should therefore be familiar with how these factors relate to each other and with any formal analysis methods that the organisation uses.

## Analysis

The company should have its own experts or access to external experts who can identify the human and organisational factors that contributed to the incident under investigation. The analysts may use formal methods to structure and analyse the findings (Reference 1 lists 24 such methods) but many experts rely on their in-depth knowledge and expertise to perform the analysis unaided.

The key is to ensure that the approach used discloses the underlying reasons why an incident occurred. It is not sufficient to note 'lack of training' as a root cause. The analysis should find out why the person involved lacked training – what system within the organisation failed? The important thing is to work backwards in time to determine what elements of the organisation's systems failed.



Sunray refinery, Texas.  
Courtesy of US Chemical Safety Board (CSB).

## Recommend improvements

Using the logic of identifying the controls that failed and allowed an incident to occur, recommendations should focus on those controls and how they can be improved.

Key factors that are typically responsible for human performance failures are: workplace design issues; task design; personnel; and organisation – not forgetting that a problem with, for example, the physical layout of the workplace originates in failures of the organisation's systems (the system for designing the workplace and monitoring that it remains fit for purpose).

## Assign, track and close out actions

Recommendations should be turned into actions. These should be assigned to the individuals or teams best placed to make the necessary changes.

The actions should be given a realistic end-date for completion. There should be clear criteria for determining when an action has been achieved and management should take responsibility for checking progress and eventual close-out of actions.

## References

1. Energy Institute (2008), *Guidance on investigating and analysing human and organisational factors aspects of incidents and accidents*, <http://www.energyinst.org/humanfactors>.
2. HSE (2004), *Investigating accidents and incidents - a workbook for employers, unions, safety representatives and safety professionals*, HSG245, HSE Books.
3. HSE (2004), Human factors briefing note No. 3, *Humans and risk*, HSE website <http://www.hse.gov.uk>.
4. Reason, J.T. (1990), *Human error*, Cambridge University Press.

For background information on this resource pack, please see Briefing note 1 *Introduction*.