

# Incident Investigation

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## Introduction

It is important that we learn from the past. Safety and loss prevention measures evolve as lessons are learnt from previous incidents, whether our own or the misfortune of others.

This briefing will concentrate on a very important process – the incident (or accident) investigation.

When carried out properly, incident investigations will identify the root and contributory causes. This leads to actions that can be taken to prevent future similar incidents.

North has observed that standards in incident investigation vary. Some focus too much on the hardware, such as material and equipment failures and disregard the all too important human factors. Some investigations do not go any further than identifying the immediate cause and fail to uncover the root of the problem.

No particular method of incident investigation is best. With this in mind, this briefing outlines the basic investigation process and includes guidance on how to ensure your incident investigations are effective and used to their best potential.

We recommended reading this briefing in conjunction with our loss prevention briefing on *Root Cause Analysis* which can be downloaded from our website at <http://www.nepia.com/media/631126/LP-Briefing-Ships-Root-Cause-Analysis-July-2015.PDF>

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## The Need for a Proper Investigation

The obvious rationale for a proper and effective process of investigation into an incident or near-miss event is to ensure lessons are learnt and the scope for similar incidents to occur is reduced.

For vessels that mandatorily comply with the ISM Code, there is an obligation to properly record, analyse and put corrective measures in place:

### ISM Code – Reporting of Incidents

#### *9 Reports and Analysis of Non-Conformities, Accidents and Hazardous Occurrences*

*9.1 The SMS should include procedures ensuring that non-conformities, accidents and hazardous situations are reported to the Company, investigated and analysed with the objective of improving safety and pollution prevention.*

*9.2 The Company should establish procedures for the implementation of corrective action.*

Fundamentally, an investigation must establish:

- **Who** was involved?
- **What** happened?
- **Why** did it happen?

A structured approach to the investigation process has its benefits. This ensures consistency in the way the process is carried out. It also helps to ensure all factors are considered, therefore identifying as many causal factors as possible.

Additionally a formalised approach makes sure that suitable and appropriate corrective measures are identified – as well those that will prevent a reoccurrence - and are properly promulgated and followed up.

## Starting the Investigation

Quite often the first decision to be made is whether or not an investigation is needed and if so, to what depth.

## Which Incidents to Investigate

The need for an investigation may be determined by the seriousness of the consequences or, in the case of a near-miss, the potential consequences.

### Definition of a near-miss

An incident or a potentially hazardous situation that had no actual consequences but:

- could have reasonably had serious consequences; or
- where the consequences were minor but could reasonably have been much greater

The reporting of near-misses by ships' crews has long been a challenge. Think of how this can be encouraged in your organisation.

The type of incident that most commonly initiates an investigation is a personal injury occurring on board the vessel. This applies not only to crew members but to supernumeraries, visitors, stevedores, pilots etc.

There may be circumstances where illnesses should be investigated. These can include instances of food poisoning or even where contagious viruses have affected a number of crew and passengers. The investigations will look at how these could be prevented and, in the case of viruses, contained to prevent spreading.

Pollution incidents and spills should be investigated due to the environmental damage consequences, which can clearly be huge.

Admiralty related incidents and damage to property should also be subject to investigation. These include collisions and damage to fixed and floating objects along with near-miss events.

But is there a need to investigate every incident and near miss? Determining the level of seriousness or potential seriousness of the consequences is quite subjective. Care must be taken not to disregard incidents on this basis. Conversely, the bar to trigger an investigation should not be so low that resources are then overstretched and time and effort is spent on more trivial incidents.

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When deciding where to focus efforts, it is also worth considering the Pareto principle which suggests that 20% of sources cause 80% of the incidents. Therefore the key is to concentrate more on the 20%. See the United States Coastguard webpages on 'Risk-Based Decision Making Guidelines' at <https://www.uscg.mil/hq/cg5/cg5211/risk.asp>

A further disadvantage of carrying out too many investigations and analysing what might be considered trivial, is that it can generate too many recommendations, too frequent changes and quite possibly be prone to knee jerk reactions. All of these can generate confusion on board the vessel and may well impact morale.

## Preparing the Investigation

An investigation should be initiated as soon as possible following an incident.

However, common sense must prevail if a serious casualty has occurred and emergency actions remain in progress. The investigation should not impinge on the casualty management and detract the attention of the crew.

But even if the investigation cannot commence immediately, the vessel's crew can start the process by ensuring evidence is preserved and this is addressed later in this briefing.

Any physical inspection of the scene of the casualty should only be conducted if safe to do so. If the scene is unsafe then measures must be taken before allowing access.

## Control Access

Related to this is the control of third parties and visitors on the vessel. An incident may attract a number of interested parties who may request access to the scene. Such parties include representatives from port authorities and surveyors instructed by cargo interests and/or charterers.

It is important to establish the identity of the other attending parties and their instructing principals. Exchanging business cards is often a useful exercise. The Master should exercise great caution when faced with requests for documentation from visitors and is well advised to seek the advice from the P&I club.

## An Open Mind

Entering the investigation with an open mind is essential. Be objective and do not just accept the crew's or any other parties' versions of events at face value. An honest and realistic analysis can only be carried out with objective and unbiased information.



*Take care not to pre-judge*

## Be Sensitive

The investigation should take into account any sensitive issues and this requires good judgment from the attending investigator. The incident under review may have resulted in serious injuries or fatalities to persons very close to the people you are trying to extract information from, and their possible distress must be considered.

## Collection and Preservation of Evidence

The extent and type of evidence required is dependent on the type of incident.

A comprehensive instruction on this can be found in North's loss prevention guide *The Mariner's Role in Collecting Evidence Handbook* which is available for download from the Member's Area of the North website.

The simple process on managing evidence following an incident is

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## Collect

Gather physical, documentary and electronic evidence and witness statements

## Preserve

Ensure evidence remains protected, secure and a chain of custody exists

## Record

Maintain a record of the items of evidence

Remember that the opportunities to collect information, evidence and any other material from the vessel might be limited. This is particularly pertinent if trying to gain access to evidence belonging to another party.

Some examples of important evidence are listed below. But this list is not exhaustive and may not be relevant to all scenarios. For claims management purposes, the P&I claims handler might provide recommendations on what evidence should be gathered and this may also prove useful to the company's own investigation. The master should also take guidance from any attending experts or the P&I and/or H&M appointed surveyors.

## Documentary Evidence

This type of evidence traditionally meant paper documents. But electronic versions of these documents have become more prevalent.

In most incidents, regardless of nature, the following information may be gathered:

- Ship's particulars and crew list at time of incident.
- Date and time of the incident.
- Location on board where the incident occurred.
- Weather and sea conditions at time of incident.
- Crew work rotas and records of the hours of rest for the relevant preceding period of time.
- How long the crew have been on board.
- On board incident or accident report form.
- Details of vessel's voyage (where from/to).

- Geographical position in which the accident occurred.
- Ship's drawings and plans as appropriate.
- On board deck and engine logs as appropriate.
- Sketches made by the crew, such as layout, positioning of personnel at time of incident etc.
- Any relevant checklists (completed or otherwise) as required by the safety management system.
- Relevant extracts from the vessel's safety management system, such as work procedures.
- Equipment and system planned maintenance records as appropriate.
- Relevant equipment and system operating and maintenance manuals.
- Rough logs and notebooks – any notes related to work are not private documents.
- Details of any mitigating action taken by the crew or any other parties.
- Details of any medical treatment administered – what, when and by whom.
- Witness statements.

Other evidence will depend on the type of incident. For example, the evidence needed in an investigation into a collision incident will also include the charts that were in use and an analysis of the voyage plan.

Likewise, a cargo related incident may require copies of shipper's declarations and carriage instructions to be studied.



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## Taking Witness Statements

There are two types of evidence with regard to statements and it is important to differentiate between the interviewees' opinions and facts:

### Factual evidence and opinion evidence

*Factual evidence* relates to what actually was seen or done at time of the incident

*Opinion evidence* concerns what people think happened.

Statements should be taken as soon as possible after the event. There are three main reasons for this:

- Memories fade. The ability to accurately recollect what happened fades with time.
- Collaboration. People's versions of events can change after they have had the opportunity to discuss it with either their superiors or fellow crew. There can be a tendency to amend their version to match others either subconsciously effect or through coercion.
- Legal value. Contemporaneous evidence carries more weight in a court of law. For example, a court may hold a statement made at time of the incident in higher regard than a statement made a week later.

When asking the crew to write their own written statements, consider providing them with a template in the Q&A format. This prompts information from the witness and reduces the risk of important facts being omitted.

An investigator will have their own techniques when extracting statements. Some key aspects to consider are



It is often worthwhile asking the crew what they think caused the incident and what may have prevented it. Their opinions may not be based on a well-informed and detailed root cause analysis, but it could provide useful insights into the safety management of the vessel and maturity of the organisational safety culture.

## On Board Incident Report Form

A very important item of documentary evidence is the incident or accident report form which is completed by the vessel's master or safety officer.

Many of the points raised in the above section on witness statements equally apply to the on board report form. It must contain factual information and any opinion must be clearly identified as such. They should be carried out as soon as possible following the incident as they not only act as valuable contemporaneous evidence but they can dictate how the situation is subsequently managed.

An example of this is when the shore-based vessel managers or the P&I club receive a scant, inaccurate or illegible on board incident report form. This can lead to an underestimation of the seriousness of the incident and a subsequent failure to properly investigate or follow up.

A poor standard of on board incident reporting is a common failing observed by North. Its value as evidence is undermined and therefore makes it difficult to rely on in claim settlements or in litigation. Furthermore, poor report standards can discredit otherwise good evidence.

It is therefore vital that the incident report forms generated on board the vessels are used with the following in mind:

- They are sufficiently detailed and completed as fully as possible.
- They are legible.
- Avoid poor use of language, abbreviations and acronyms which might lead to misinterpretation.
- Do not use incident report forms for political gain or trying to force a point - stick to facts and the issue in hand.

The report forms should be reviewed by shore management upon receipt and any discrepancies addressed immediately. It is difficult to get clarification on

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information written several months earlier when the crew member who wrote it is no longer on board.

Similarly with witness statement forms, templates for on board incident reporting should be used to prompt the information from the person writing the report.

## Electronic Evidence

This concerns data from electronic or recording devices and systems.

- Voyage Data Recorder (VDR): Consider the appropriateness of saving and downloading the VDR, remembering that the data on some units is only stored for as little as 24 hours.

See our loss prevention publications on VDRs here:

<http://www.nepia.com/media/222798/NORTH-Hot-Spots-VDR.PDF>

<http://www.nepia.com/media/245619/LP-Briefing-VDR-March-2015.PDF>

- Photographs and videos: Make a note of what the photograph is showing. Take high resolution photos of damaged items, particularly in way of areas of failure. This will help any further expert analysis on the nature of failure, such as identifying material fatigue or defective welding.
- ECDIS data.
- Details of any vessel traffic services (VTS) involvement
- AIS data to show position of vessel and any other nearby vessels.
- Any available CCTV footage of the incident from cameras on board the vessel or requests to receive footage from the port's CCTV system.

## Physical Evidence

It is important to collect any relevant damaged material as it may be needed for further examination. It is even more important to retain this evidence if a failed piece of equipment led to the casualty.

Examples of physical evidence include:

- Damaged parts and equipment.
- Damaged tools.

- Debris.

## Preservation and Recording

Good quality evidence is vital, not only for incident investigation but also for any subsequent claim or litigation. Evidence is therefore valuable so it must be treated as such. Be aware that there is a risk of evidence becoming devalued through being:

- Tampered.
- Lost.
- Concealed.
- Degraded.

Where possible and if safe to do so, preserve the scene and evidence as soon as possible. Bear in mind that in the event of a very serious incident, port state officials and local police may be on board and exercise control of the scene.

Samples and items of physical evidence can take many different forms. But in all cases they must be treated with care and properly documented. If possible, bag, label and seal. Evidence of all types should be stored in a secure location.

Items of physical evidence that are prone to degradation should be suitably protected. A typical example being samples of failed metal components – they must be stored in a dry environment as any exposure to moisture might degrade the sample and any subsequent laboratory analysis or testing will not be accurate.

To ensure the locations of the items of evidence are known at all times, a system of chain of custody should be established. As each party takes responsibility for the evidence – such as an agent, surveyor or courier – it should be recorded and signed. This is particularly pertinent when sending the VDR memory card from the vessel to the ship manager's office. There have been occasions where the memory card has gone missing in transit.

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It is good practice to maintain a log of the evidence in order to have a record of what was collected, seal numbers and their movements.



## Data Analysis and Causation

An ability to analyse the collected data and then determine the cause(s) of an incident is where the skill and expertise of the investigator comes to the forefront. Despite this process being quite subjective in nature, this hugely influences the effectiveness of the process as well as affecting the outcome of any associated claim or litigation.

An analysis is only as good as the information collected. The old adage of 'garbage in - garbage out' holds true. The importance of the quality of evidence as discussed in the previous sections must not be underestimated.

There is no right way to analyse but the key is to dig deep enough to identify the root causes. A common mistake is to identify what is known as the 'immediate' or 'apparent' cause and go no further.

Determining the immediate cause requires the least depth of study and does not extend to identifying the underlying contributory causes or root causes to the problem. Essentially it is the most probable cause for an incident based on readily available information.

However, determining the root cause(s) of the incident requires a more in-depth analysis and the identifying of causal factors.

The first step of any root cause analysis is to identify the causal factors. These causal factors may be structural or equipment defects, human errors and external factors that contributed to an incident. Or they may have allowed the severity of the incident to be worse than it could have been. There are usually several causal factors in an incident.

The analysis of the incident should consider if there were any breaches of rules or deviation from the vessel or company policy and procedures. Check compliance with statutory legislation and Class rules.

## Root Cause Analysis Methods

There are a number of methods of root cause analysis that are commonly used. Probably the most simple is the 'Five Whys' method.

There are plenty of sources on the internet where you can learn about the Five Whys method, but the basic technique is to identify the problem or the causal factor and ask why it happened. This should identify one or more sub-events and then the process is repeated for each – asking why did it happen? Repeating this process four or five times should then lead to the root causes.

Other recognised methods are *Causal Factor Charting* method and *Fault Tree Analysis* method.

For more detailed information, see our loss prevention briefing on Root Cause Analysis which can be downloaded at:

<http://www.nepia.com/media/631126/LP-Briefing-Ships-Root-Cause-Analysis-July-2015.PDF>

## Identifying Causal Factors

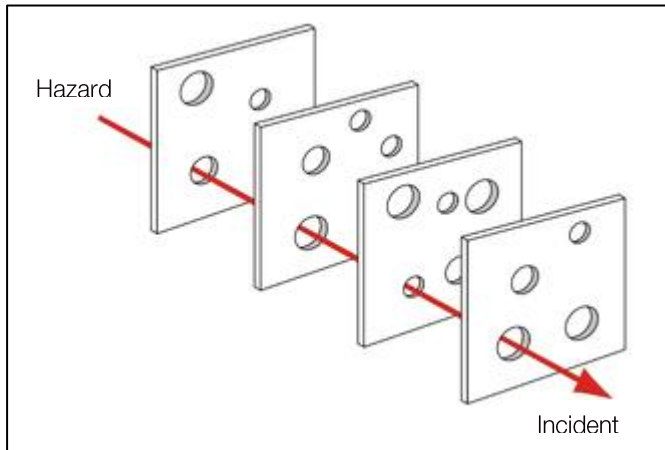
The events leading to an incident are rarely simple. It is quite usual for a number of preconditions to exist or minor events to occur and converge.

The Swiss cheese analogy is often used. Consider slices of Swiss cheese where each slice represents a barrier to preventing an incident and each hole represents a

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weakness – the incident only occurs when the holes line up.

Of course addressing one hole would have prevented the incident, but to prevent similar types of incidents from occurring it needs all holes to be identified and plugged.



## The Swiss cheese analogy

Causal factors can be broadly categorised as follows and each will be discussed in turn.

- Design.
- Structural or material failure.
- The human element (which has numerous sub-categories).
- External factors.

It will become evident that factors can overlap and impact each other.

## Design

If a piece of equipment, component or system fails, a question that can be asked is “did it perform to desired standard?” In other words, was it fit for purpose and of a suitable design for its duty?

This should not be confused with *defective* equipment, which will be addressed next.

## Structural or Material Failure

If a component has failed, it should first be determined if it failed prematurely or if it had reached the end of its expected life. In both cases the question is “why?”

Possible causal factors that lead to a premature failure include defects in fabrication or construction, malfunction of associated equipment, overloading during operation, improper use or lack of maintenance.

If the failed part has reached the end of its expected life, the investigation will need to consider why this was allowed to happen and identify any failings in preventative maintenance.

## The Human Element

In the vast majority of incidents, there is human involvement. In some cases it is clear that someone made a mistake that either led or contributed to the incident – human error. In some cases the outcome was influenced by someone violating a procedure.

## Human Error

Errors by people can be considered to comprise:

Incorrect decision	Incorrect action	Lack of action
•Did the person make the wrong decision?	•Was the decision correct but it wasn't carried out properly?	•Did someone fail to do something they were meant to do?

It is wholly inadequate to state the root cause of an incident as simply ‘human error’. It is a hugely complex area of study, but efforts must be made to understand why these errors were made.

Human performance - and therefore human error - is influenced by a number of different factors. All of these factors must be considered when establishing the root and contributory causes.

The following are examples of influencing factors and each might be considered when carrying out an investigation. There are many others that could apply and the below list is not exhaustive.



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## People Factors

- Skills, competence and training of crew.
- Familiarity with the vessel and its equipment.
- Personality, behaviour, relationship with others.
- Physical and medical fitness.
- Fatigue and stress.

## Ship Factors

- Design of vessel, its systems and equipment including vessel characteristics and idiosyncrasies.
- Safe condition of vessel and its equipment.
- Functioning safety equipment, guards and interlocks.
- Tools and spares to properly maintain vessel.

## Environment

- Weather and sea conditions .
- Traffic density.
- Port and berthing facilities.

## Management On Board

- Manning levels.
- Supervision and management of crew.
- Planning of work, risk assessment and allocation of jobs.
- Job role responsibilities and accountability.
- Emergency preparedness and response.
- Safety management system procedures and their enforcement.
- Communication and relationships between senior officers and crew.
- Language barriers and cultural differences.
- Fatigue management.

## Shore Management

- Understanding the realities of what actually happens on board.
- Oversight of ship staff.
- Communications between ship and shore.
- Communications between shore based departments affecting ship operation.
- Support to vessel and its crew.
- Suitable and workable policies and procedures.
- Safety culture starting from the top.
- Vessel scheduling and itineraries.

## Working and Living Conditions

- Ergonomics and user friendliness: human-machinery interface.
- Safe movement and access around vessel.
- Living standards - including hygiene and quality of food.
- Quality of rest.

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## Violating Procedures

Incidents and accidents can occur because someone violated a procedure. The root cause is not that someone didn't follow the rules. It is important to understand why they acted in the way they did.

People break the rules or take short cuts for a number of reasons. These reasons can range from the ignorant to the well intentioned to the reckless. The problem can only be addressed if the reasons for the violation are understood.



### *Unsafe working: But why?*

There have been numerous studies in this field which span across different industries. This is not a problem that is confined to the maritime industry.

One particular study into the reasons why people violate procedures was developed by Hudson (*Shell "Hearts and Minds" Project, 2004*) and some of the findings are briefly outlined here:

Unintentional "I didn't know"	<ul style="list-style-type: none"><li>•Not aware of procedure.</li><li>•Misunderstood the procedure.</li></ul>
Routine "Everyone does it"	<ul style="list-style-type: none"><li>•Common practice.</li><li>•Automatic behaviour.</li></ul>
Situational "The procedure is wrong"	<ul style="list-style-type: none"><li>•Cannot do the job without violating procedure.</li><li>•Procedure not workable.</li></ul>
Organisational Optimising "I thought it would help the company"	<ul style="list-style-type: none"><li>•Thinking its in best interests of company to violate procedure or take short cut.</li></ul>
Personal Optimising "It makes my life easier"	<ul style="list-style-type: none"><li>•Taking a short cut makes life easier.</li><li>•Complacency or boredom.</li></ul>
Reckless	<ul style="list-style-type: none"><li>•Reckless or malicious behaviour.</li></ul>
Exceptional	<ul style="list-style-type: none"><li>•Rare and unusual circumstances.</li><li>•Not previously identified.</li></ul>

The action required to remedy these violations can range from training to the revision of procedures to disciplinary action.

## External Factors

External influences can be regarded as causal factors in an incident. These influences can be negative and place additional pressure on the crew. They can affect their ability to perform as well as having a detrimental effect on their decision-making abilities.

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A crew member's judgement when carrying out a task might be affected by some newly-introduced regulation. Or they may be under pressure from a third party to hurry a task. Port operations can put significant pressure on crew and increase their levels of fatigue and stress. Visitors, inspectors and surveyors demanding the crew's time and attention can take its toll.

## Recommendations and Preventative Actions

After identifying the root and contributory causes of an incident, the next step is to consider how to prevent it and similar instances from happening again. Think about each causal factor and how it could have been prevented. The holes in the slices of Swiss cheese are effectively being filled in and it might be the case that an extra slice of cheese is needed!

Once agreed, the recommendations should be distributed across the full company fleet so everyone can learn from the incident. It is essential that all crew, operations staff and superintendents receive the information. The investigation may initiate a revision of the vessel's policy and procedures, which may need to be rolled out fleet-wide. It may address training needs on a company-wide scale.

There must be a system of follow-up and closing-out to ensure the recommendations are implemented, understood and in force. Timescales should be stated according to the urgency. The process must produce change.

## Using the Data to Identify Trends

A lot of time, effort and expertise can go into an incident investigation. It therefore makes sense to make the best use of the collected data. Consider using the information gained from investigations to identify trends or common factors. This will help direct any future safety and loss prevention initiatives.

For example the data could be used to measure:

- Trends in certain types of incident.
- Trends related to a certain type of task.
- Incidents involving specific ranks.
- Incidents by crew nationality or mix of nationalities.
- Influence of crew member trip length.
- Effect of particular trading routes.
- Seasonal influences.
- Measure of safety climate and maturity of overall safety culture.

## Legal Status and Disclosure

Incident investigation reports and the collected evidence may be discoverable in a court of law. It must be highlighted that ISM documents do not carry any legal privilege.

A general rule of thumb is not to write anything in a report that you would not be prepared to stand up and say in a court of law or arbitration. This ultimately requires that any opinions formed and included in the report are based on fact and that the investigator can support these opinions.

