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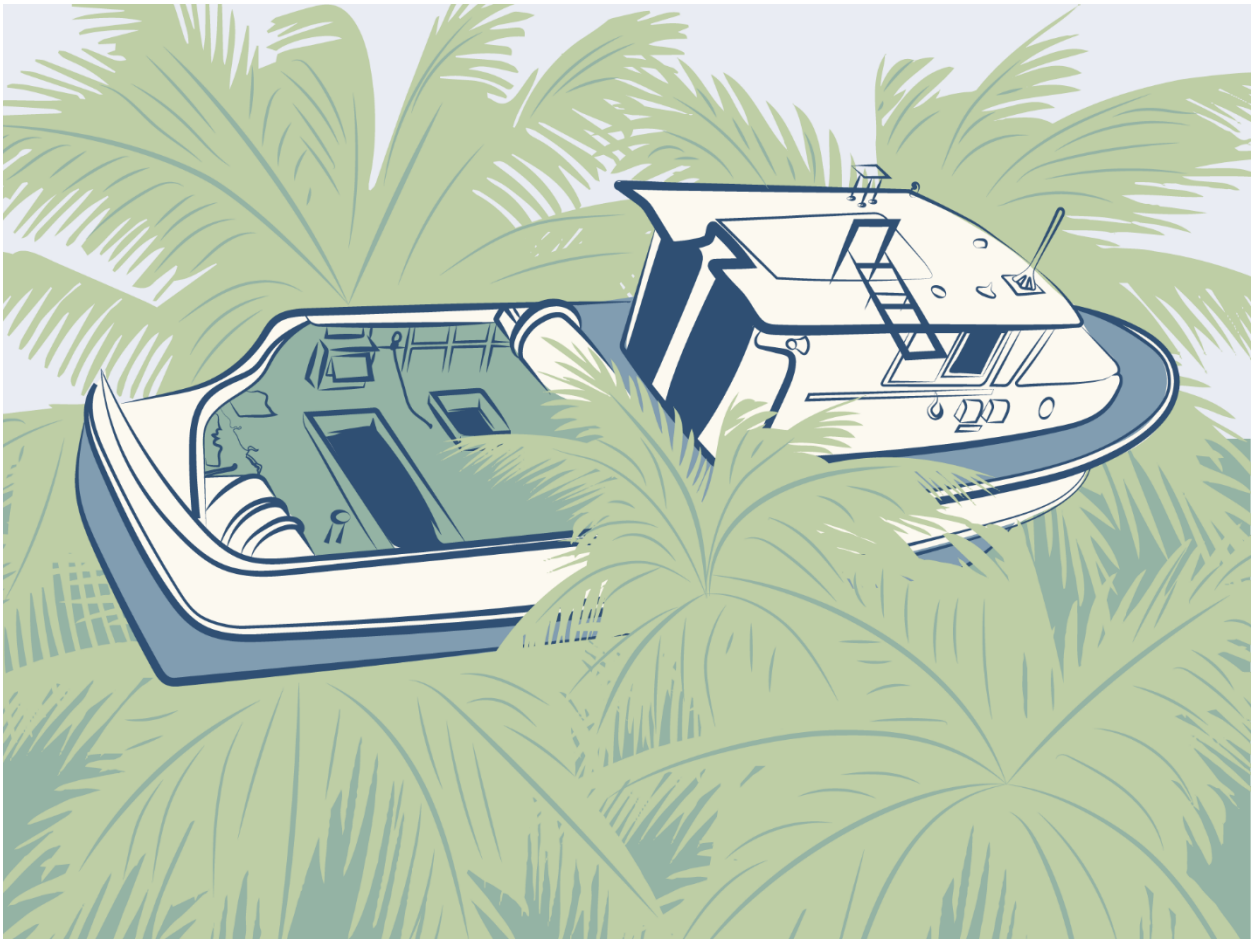
THE FISHERIES ACCIDENT MANAGEMENT PROCESS
GUIDELINES FOR COMPETENT AUTHORITIES



FISH safety foundation

Cover drawing by Zoe Brandizzi

THE FISHERIES ACCIDENT MANAGEMENT PROCESS
GUIDELINES FOR COMPETENT AUTHORITIES

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PREPARATION OF THIS DOCUMENT

This publication was prepared with assistance from the Norwegian Government funded FAO Trust fund project on Supporting member countries implement climate change adaptation measures in fisheries and aquaculture (GCP/GLO/959/NOR). This project aims to improve country capacity to develop and implement climate change adaptation plans and actions that promote socio-economic development with specific attention to poverty reduction and food security in the fishery and aquaculture sector. The project has activities in Saint Lucia, South Africa and The Philippines. Strengthening safety at sea of fisherfolk was identified during vulnerability assessments and national adaptation plan consultative development processes in Saint Lucia as a key area for adaptation.

In order to improve the safety in fishing operations and secure the livelihoods of small-scale fishers and their households in a situation of climate change it is important to know what type of accidents are happening in fisheries, how they happened, why they happened and what can be done to prevent those accidents reoccurring. When information on accidents is available, this can be used to provide targeted training to fishers, adjust management and safety regulations in fisheries, create awareness, design safer fishing vessels and promote safe fishing technologies and operations. The collection of accident information is an essential step to decrease the number of accidents and fatalities among fishers.

Under the International Maritime Organization (IMO) International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto and by the Protocol of 1997 (MARPOL) (IMO, 2021a) and the International Convention for the Safety of Life at Sea (SOLAS) (IMO, 2021b), 1974, a framework for accidents and casualty reporting has been established for merchant fleets. However, fishing vessels and particularly small-scale vessels are not targeted in the reporting systems. The IMO, FISH Safety Foundation (FSF), PEW Charitable Trusts, Lloyd's Register Foundation and FAO have started collaborating recently on fisheries accident reporting.

The guidelines presented in this circular were prepared by Eric Holliday of the FSF, with technical assistance from Raymon van Anrooy (FAO). The draft guidelines were presented and discussed at a Train - the - Trainer workshop on safety at sea for small-scale fishers in the Caribbean, which was attended by 30 professionals on safety at sea from seven Caribbean countries and was held in Saint Lucia in January 2020. The workshop received support from the GEF funded FAO Climate Change Adaptation in the Eastern Caribbean Fisheries project (CC4Fish).

Following the workshop, these guidelines were finalized for dissemination throughout the Caribbean region by the secretariat of the Western Central Atlantic Fishery Commission (WECAFC).

ABSTRACT

This circular describes the fisheries accident management process. It contains guidelines for national agencies (competent authorities) involved in fisheries accident investigations. It provides competent authorities and their investigators with a structured approach to meeting their legislative requirements to record, investigate, analyse, and report on accidents in the fishing sector. These guidelines are based on international standards, models and lessons learned from various countries where similar accident management processes are in use. The draft guidelines were discussed and finalized at a Train - the - Trainer workshop on safety at sea for small-scale fishers in the Caribbean, which was attended by 30 professionals on safety at sea and fisheries from seven Caribbean countries and was held in Castries, Saint Lucia in January 2020. The fisheries accident management process outlined may also be useful for other regions, which have similar safety challenges and opportunities for safety improvements in fisheries. These guidelines are intended to apply to a wide range of undesired events, such as accidents involving minor and serious injuries, fatalities, vessel damage, incidents involving damaged equipment and near misses.

CONTENTS

ACKNOWLEDGEMENTS

The authors hereby acknowledge the cooperation and valuable advice received from representatives of the fisheries and maritime safety agencies from Antigua and Barbuda, Dominica, Grenada, Saint Lucia, Saint Kitts and Nevis, Saint Vincent and the Grenadines and Trinidad and Tobago, in the preparation of these guidelines.

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INTRODUCTION

This circular covers all key aspects of the fisheries accident management process, including the provision of necessary systems and resources, response management, reporting, recommendation management and the learning of lessons, leading to continuous improvement.

The key elements of fisheries accident investigation are described in detail: receiving accident reports, evidence gathering, interviewing techniques, analysis of immediate and underlying causes and recommendations. The guidelines are built on an understanding of risk management and the integration of both human factors principles and a positive safety culture, with the aim of continuous improvement in the application and performance of safety management in fisheries. The guidelines emphasize the need for cooperation in the achievement of good accident investigation and improved safety management.

The guidelines are intended as general guidance for investigators from competent authorities.

What is an accident and why should it be investigated?

The term "accident" can be defined as an event when people are killed, seriously injured or disabled as well as events when the vessel is wrecked or damaged by collision, grounding or fire and other unintentional events causing substantial oil spill or environmental pollution.

An accident then is either a:

- fatality / missing at sea or serious injury, or
- vessel loss or damage

An “incident” usually refers to an unexpected event that did not cause injury or damage this time, but had the potential to do so. A "near miss" or a "dangerous occurrence" are also terms for events that could have caused harm, but did not.

Annex 1 contains a list of definitions applied in this circular.

Reasons to investigate a workplace accident include:

- most importantly, to find out the cause of accidents and to prevent similar accidents in the future;
- to fulfil any legal requirements;
- to determine the cost of an accident;
- to determine compliance with applicable safety regulations;

Incidents that involve no injury or property damage should still be investigated to determine the hazards that should be corrected. The same principles apply to a quick inquiry of a minor incident and to the more formal investigation of a serious event.

What is good accident investigation?

Good accident and incident investigation consistently and accurately identifies immediate and underlying causes after thorough analysis and produces objective and appropriate recommendations.

These should then be effectively implemented and the necessary lessons learned. This should lead to fewer accidents and continuous improvement, both within each fishers' activities and across the fishing industry as a whole.

Why look for the "root cause"?

An investigator who believes that accidents are caused by unsafe conditions would generally try to uncover those conditions as causes. On the other hand, one who believes that accidents are caused by unsafe acts will attempt to find any human errors that could be the causes. Therefore, it is necessary to examine the underlying factors in any chain of events that ended in an accident.

The important point is that even in the most seemingly straightforward accidents, seldom, if ever, is there only a single cause. For example, an "investigation" which concludes that an accident was due to human carelessness, and goes no further, fails to seek answers to several important questions such as:

- Was the crewmember distracted? If yes, why was the crewmember distracted?
- Was a safe work procedure being followed? If not, why not?
- Were safety devices in order? If not, why not?
- Was the crewmember trained? If not, why not?

An inquiry that answers these and related questions will probably reveal conditions that are more open to correction than attempts to prevent "carelessness".

Purpose of these guidelines

This circular aims to provide competent authorities and their investigators with a structured approach to meeting their legislative requirements to record, investigate, analyse, and report on accidents in the fishing sector in the Caribbean.

Throughout this circular, some specific regulatory guidance sections have been included, which could provide valuable advice for each step of the accident management process.

This circular has been modelled on the "Marine Guidance Note" MGN 458 (M+F) (MAIB, 2012), whereby the relevant sections used are shown in blue in this document. The guidelines were prepared with a selected group of Caribbean fisheries and safety experts and focus on improving the accident management process applied for the small-scale fisheries sector in the Caribbean small-island developing states (SIDS). Nevertheless, the process outlined should also be useful for other regions, which have similar challenges and opportunities as outlined in these guidelines.

SCOPE AND USE

These guidelines are intended to apply to a wide range of undesired events – including the following:

- vessel damage;
- fatalities / lost at sea;
- accidents involving minor and serious injuries;
- piracy;
- incidents involving equipment and assets;
- near misses (sometimes known as close calls or near hits);
- health exposures (e.g. noise, poison and fish allergies); and
- accidental release of substances causing harm and/or environmental impact.

The guidelines support a stepwise fisheries accident management process through which an investigator would be able to:

- **collect** evidence relating to the accident;
- **check** validity of the evidence;
- **select** evidence relevant to the investigation objective;
- **analyse** evidence **without** making assumptions;
- **collate** examine and compare information;
- **determine** causes based on findings;
- **record** complete all sections of the report format; and
- **improve** the system ensure recommended improvements happen.

PROCESS STEPS

Steps in the fisheries accident management process

There are 5 steps in the process following an accident/fatality:

REPORTING

RECORDING

INVESTIGATION

ANALYSIS

REPORT AND RECOMMENDATIONS

Guidance will be provided for each of these steps in this circular.

STEP 1: REPORTING ACCIDENTS AND FATALITIES

As soon as possible after an accident has occurred, and the crisis is over (for example injured party attended to or vessel rescued), there are at least two reporting requirements to comply with by the affected person(s):

- Internal (to the family and employer);
- External to the relevant government authorities (e.g. Fisheries Department, Maritime Safety agency, Coast Guard).

When an accident has occurred, either the vessel captain or owner must report the event to the relevant authorities as soon as possible. At present, most authorities have a paper-based reporting platform only, but this is changing rapidly.

It is worth noting that reporting may be supported at grass roots level, via voluntary staff, and active local fishermen or dedicated coordinating representatives from the local fishing communities.

A tiered approach

A system for reporting accidents at sea should follow a three-tier approach at the local, national and regional levels:

- **Local accident scene**: A detailed Accident Report Form* (as per **Annex 2**) is used to reflect all essential details such as date, time, type, cause, nautical location, meteorological conditions, identity of crafts and vessels involved, distress reporting and action taken, and human and material loss, among other circumstantial details. This information is manually completed in a standard reporting form, which is then submitted directly to the competent authority, or via a pre-determined coordinator (for instance a fishing industry organization focal person).

- **National level**: The information is documented and automatically analysed using electronically automated Excel programming (or similar) to reflect monthly accident types, causes and totals, as well as human and material equipment and other losses for the country concerned. This information is compiled and analysed for submission to the regional level on bi-monthly basis.

- **Regional level**: On a quarterly basis accident reports are documented, analysed and disseminated to cover each of the countries within a regional safety or fisheries framework.

***Note*:** Captains / vessel owners / affected persons will fill out Parts 1 to 6 on the Accident Report Form and then submit it to the competent authority. If the decision is made to investigate the accident further, the competent authority's investigator will investigate and record the outcomes in Parts 7 to 10.

***Specific regulatory guidance*:**
Reporting requirements to be provided by the captain / vessel owner

The **competent authority** undertakes to record all accidents reported, and to investigate serious accidents as required by relevant IMO international accident investigation requirements under SOLAS regulation XI-1/6 – as supplemented by the provisions of the *Code of the International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident (Casualty Investigation Code)* adopted by resolution MSC.255(84).

Accidents must be reported by the quickest means available and should contain the information set out in the Accident Report Form (see **Annex 2)**. If reports are received that contain gaps, then the investigator is to contact the reporter and ask for the missing information.

When an accident occurs, the captain must send a report to the **competent authority** as soon as is practicable following the accident.

Alternatively, the vessel owner must send a report to the **competent authority** as soon as is practicable following the accident if the owner has ascertained that the report has not been made by the captain.

The captain/ vessel owner must, so far as is reasonably practical, ensure that the circumstances of every accident are examined. A single report giving the findings of such an examination, stating any measures taken or proposed to prevent a recurrence, must be provided to the **competent authority** as soon as is practicable, irrespective of any investigation that may be conducted by any national authority.

The captain/ vessel owner must also, so far as is reasonably practical, ensure that the circumstances of every serious injury (as defined) are examined.

Marine incidents should also be reported to the **competent authority**. Marine incidents include 'near misses', stemming from failure of procedures in shipboard operations, material defects, fatigue and human failures. Many incidents occur which do not cause injury or damage, but have the potential to be hazardous or could have serious consequences.

When making reports, whether on an Accident Report Form (ARF) or in narrative, the content of the descriptive text is particularly important. Lessons can be learned from the positive as well as negative aspects. Details of actions taken to minimise the effects of the accident or, in the case of a marine incident, to prevent it developing into an accident, are particularly helpful. A description of actions taken or recommendations made to prevent a recurrence are also of value. Much is gained from the information provided by those most closely involved in the event at the time it occurred.

The **competent authority** Accident Report Form (ARF) can be used to provide an initial report of any accident; it can also be used for reporting serious injuries. Copies of the ARF may be downloaded from the **competent authority** website or obtained directly from the **competent authority**.

STEP 2: RECORDING

Once the accident/fatality has been reported, there needs to be a system of recording the relevant information. Comprehensive information will be needed for the investigation and analysis stages of the process.

Important aspects to consider when developing the recording system requirements are:

- Who is managing it?
- What resources are available?
- Is there a central storage for this?
- Is there a back-up system (e.g. in the cloud)?
- Can the user and data entered be verified?
- What measures are in place to ensure privacy and confidentiality?

The importance of a central (lead) agency

In order for the system of collection, recording, analysis, and utilization of sea accident data for small fishing vessels to work effectively and efficiently, the following points are important:

- Each nation must appoint a single competent authority (for example a Maritime Safety Agency, Coastguard or Fisheries Department) to act as the lead agency for implementing and maintaining sea accident management programmes. This could help eliminate some of the difficulties in coordinating the efforts among a number of agencies in collecting, recording and analysing sea accident data.

- There must be an open exchange and sharing of (non-confidential) data among the relevant stakeholders (including the marine safety agency, Coastguard, Navy, Police Department, Fisheries Department, insurance companies, fishing industry, fishing communities, and so on).

- The database must be monitored and corrected on a regular basis to ensure the validity of the data (e.g. correcting for people reported as lost at sea, but who turn up months later). The individuals responsible for collecting, recording, analysing and distributing sea accident data should be made aware of the importance of their work.

- Stakeholders should be made aware of the benefits from the analysis of the sea accident data. Their support is critical to the success of any fisheries safety initiative.

STEP 3: ACCIDENT INVESTIGATION

Overview

The primary purpose of an investigation is to ascertain the cause(s) of an accident to determine if remedial measures should be taken to prevent the future occurrence of a similar accident. Investigations are to be seen as a primary means of safety promotion and not as a means to determine liability per se.

The information obtained from investigations can be used to measure the effectiveness of the safety management system, as well as to monitor existing policies, adequacy of existing regulations, and the operational practices on board of fishing vessels.

It is important to note however, that investigations *may* lead to legal action and prosecution if national laws are broken.

***Note:** as indicated earlier, captains / vessel owners / affected persons will fill out parts 1 to 6 on the Accident Report Form and then submit it to the competent authority. If the decision is made to investigate the accident further, the competent authority's investigator will investigate and record the outcomes in parts 7 to 10.

The following guidance is provided for the competent authority accident investigators.

Specific regulatory guidance: Investigations

All serious accidents (as defined) will be investigated by the **competent authority**.

The **competent authority** may also investigate an accident on behalf of another flag state if requested. In some cases, the vessel's own investigation will be sufficient, but the **competent authority** may seek further details if necessary.

Before deciding whether to carry out any form of investigation, the **competent authority** may seek to obtain such information as he/she considers necessary concerning the accident, and any remedial action taken. The vessel captain/owner mentioned above, or any other person holding such information shall provide it to the **competent authority** to the best of their ability and knowledge.

If the **competent authority** decides that an investigation will be carried out, it will be undertaken by inspector(s) at a time and place, and in such a manner, as appears appropriate.

Where the **competent authority** has received a report referred to above, it must decide whether or not a safety investigation should be carried out and shall publish details of that decision as soon as is reasonably practical. Public notice that an investigation has started may be given in such a manner as the **competent authority** considers most suitable.

A preliminary assessment may be carried out to obtain further details to see if the accident meets the criteria to warrant further investigation. When a preliminary assessment is complete, the **competent authority** will decide whether it is appropriate to conduct further investigation leading to a published report.

Where an inspector is appointed to carry out an investigation, his/her powers are extensive. Subject to these powers, the inspector has wide discretion as to how he/she carries out the investigation. If possible, much of it will take place on board the vessel involved. He/she may wish to visit the owner(s) and speak with all crew on board at the time of the accident. He/she may also prohibit, pending investigation, access to or interference with anything involved in the accident under investigation.

In particular, the captain / vessel owner mentioned above should ensure that all charts, logbooks, voyage data, crew list and other recorded information relating to period preceding, during and after an accident, and all other documents, which might reasonably be considered pertinent to a reportable accident, are kept intact. No alterations should be made to recordings or entries, and any equipment associated or involved in an accident should remain undisturbed until:

- published notification is received from the **competent authority** that no safety investigation is to take place or that the investigation has been completed; or
- the **competent authority** or an inspector carrying out the investigation gives written notification that particular evidence is no longer required.

The **competent authority** may consider it necessary for the collection or preservation of evidence in connection with any safety investigation, including a preliminary assessment relating to the accident, that the captain/ vessel owner ensures that the vessel is accessible to any inspector engaged in the investigation at all times. The vessel must remain accessible until the process of collecting or preserving evidence has been completed.

If this power were to be used, the **competent authority** would likely request written assurance that access to the vessel, crew, and any evidence be granted at the nearest port, and that the evidence would not be disturbed during the voyage. If this written assurance were not granted, then the **competent authority** could use their discretion in applying the power described above. Should a vessel be required to remain in a local port, then the vessel could be moved to a suitable anchorage to ensure that the availability of berths is not affected.

If this power were to be used, the **competent authority** would not unreasonably require a vessel to remain in port any longer than is necessary. Evidence will be collected or preserved as quickly as possible and with the minimum amount of delay to the vessel.

Investigation process

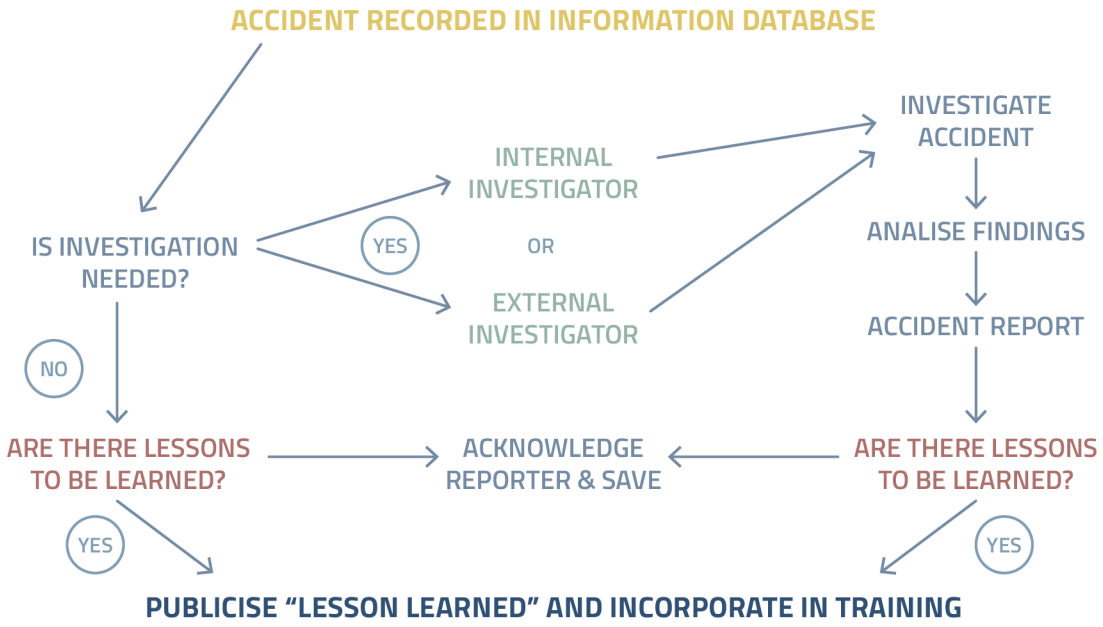

Figure 1: Investigation, analysis and learning

As indicated in Figure 1 above, the accident report from the captain / vessel owner will be recorded in the competent authority's information database. Subsequently a decision has to be taken by the competent authority as to whether the event recorded requires further investigation. This decision will be based on the facts reported, as well as considerations of the potential outcome of the accident.

Whether or not an official investigation is undertaken, the lessons learned from the event should be shared with the industry, and further be included in future fishing safety training.

Consideration needs to be given as to who the investigator will be. If available, a suitably qualified and experience in-house investigator will undertake this investigation. If not available, an external party will need to be contracted.

The investigator must fully investigate the event using a structured step-by-step approach to gather and sort information, analyse the causes, develop recommendations, and provide a comprehensive report.

It should be noted that those responsible for accident investigation require in-depth training and solid methodologies to work towards (for detailed inspector qualification guidance see appendix 3 in FAO, 2015). By identifying accident causation factors, common problems can be identified. This can lead to a need to amend the legislation, fisheries and safety management practices and may trigger a culture change in the fishing industry. Investigators require an understanding of why people make mistakes in order to consider why accidents happen. Everyone, regardless of knowledge, experience or training can commit errors. However, human errors can be a result from understandable, predictable aspects of the environment in which the work takes place.

Developing an understanding of human error will help investigators comprehend better the range of underlying causes that can contribute to unsafe acts. This will enable investigators to develop more robust recommendations for managing and mitigating the likelihood of similar accidents repeating in the future.

Information which should be collected in the first instance (FAO, 2015) include:

1. vessel-related factors, such as:

    - vessel and equipment (for example: poor vessel design and construction, vessel stability issues, inadequate crew space and facilities, dangerous winches or line/net hauling systems, lacking medical/first-aid supplies, poor vessel or engine maintenance, lack of quality shipyards, unsuitable or fire prone electrical systems);
    - operational factors, including vessel management, and the availability and use of equipment for navigation, such as Global Positioning Systems [GPS], Automatic Identification System [AIS] Automatic and Electronic Chart Display & Information Systems [ECDIS]; and
    - access to communication, such as very high frequency [VHF] radios, shortwave, mobile and satellite phones, satellite/VHF distress system, Vessel Monitoring Systems [VMS], and the emergency position-indicating radio beacon [EPIRB];

2. general factors, such as:

    - human element (including navigational errors, fatigue, stress, lack of training, risk-taking behaviour, drug abuse, lack of a safety culture and language barriers);
    - equally, the human element also applies to shore-based maritime and port traffic controllers, vessel repairers and surveyors;

- fisheries management regime in place (such as short fishing seasons that trigger a race to fish, fishing fleet overcapacity, high costs of fishing licenses or quota, and excessive competition between vessels or fleets);
- regulatory measures (such as unclear, inappropriate or out-of-date regulations, or gaps or contradictions among applicable regulations, in particular regarding registration and fishing vessel authorization procedures);
- enforcement measures (e.g. possible lack of trained human resources at the coast guard or port authorities, inadequate surveillance vessels for offshore monitoring, control and surveillance [MCS]); and
- lack of financial resources and/or inadequate sanctions;

3. natural environmental factors, such as:

   - fog, poor visibility, winds, high seas (surges and waves), storms, hurricanes, lightning tempests and tsunamis.

See also **Annex 3** (accident causation framework for questions) for an additional questioning framework for investigators.

Part of the investigation process will involve interviewing witnesses and others. Given the importance of this part of the process, the following guidance is provided:

Specific regulatory guidance: Interviewing procedures

The inspector can require any person who may be able to help the investigation attend an interview, answer questions, and sign a declaration of the truth of their answers.

An inspector may record a witness interview of any person who is assisting a safety investigation carried out in accordance with the National Regulations/Act in any manner that the **competent authority** considers reasonable.

A solicitor or other professional legal adviser acting solely on behalf of the person being interviewed may not be excluded from an interview. Any other person allowed or nominated to be present at an interview by an interviewee, may be excluded from being present by the inspector. To use this power, both the inspector and the **competent authority** must have substantial reason to believe that the presence of the nominated person would hamper the investigation.

If this power would be used, the interviewee can then nominate another person to be present. At the request of the person being interviewed, the interview would be suspended until the second nominated person is present.

The issue of disclosure of records is just as important. Investigators are to note the following:

Specific regulatory guidance: Disclosure of records

During the course of a safety investigation the **competent authority** may collect contemporaneous evidence. This may include charts, log books, crew lists, voyage plans, recorded information relating to the period proceeding, during and after an accident, recorded or retained, including information from a voyage data recorder, electronic monitoring system (e.g. observer cameras) or a video recorder; and all

documents or other records which might reasonably be considered pertinent to the accident. This evidence remains the property of the owner and copies will be taken wherever possible.

Unless a Court determines otherwise, the names, addresses and any other details of anyone who has given evidence to an inspector shall not be disclosed.

Any independent technical analysis commissioned by the **competent authority** and opinions expressed in such analysis may be made publicly available if the **competent authority** considers it appropriate to do so.

Copies of information obtained from voyage data recorder or from other recording systems, pertinent to the accident, may be provided at the discretion of the **competent authority** to the police or other official authorities.

Certain documents or records shall not be made available for purposes other than the investigation unless a court determines otherwise. These include any declarations taken by an inspector or supplied to him/her during the course of investigation; any notes or recordings of any interviews; medical or confidential information regarding persons involved in an accident; any Accident Report Form (ARF), copies of a draft report, or a report which is not the final report of the investigation; all correspondence received by the **competent authority** from parties involved in a safety investigation; evidence from voyage data recording devices; all communications between persons involved in the operation of the investigated vessel and inspector's notes and opinions. However, a person who has given evidence to the **competent authority** may disclose his/her own declaration, if he/she so wishes.

If any part of a report is based on information obtained pursuant to an inspector's powers under the appropriate act, the report shall be inadmissible in any judicial proceedings, unless a Court determines otherwise.

The restrictions laid out above relate to the handling of records by the **competent authority** and other government parties involved. Without prejudice to other legal or contractual arrangements, owners and operators of the vessels involved may disclose voyage data recorder data and correspondence between persons involved in an accident, while those persons themselves may disclose their own correspondence, medical or address information without reference to a court and without the threat of legal consequence for doing so.

STEP 4: CAUSATION ANALYSIS

Competent authority responsibilities

The competent authority will also be responsible for the analysis of the information received. This agency will need to set up a long-term system of collection, storage and analysis of data on safety at sea (see step 2). It is critically important that an environment is established to facilitate the harmonious exchange of this information between all the agencies responsible for safety at sea. This exchange could be made through regular meetings between agencies coordinated by the competent authority. It is common practice to formalize the collaboration between national agencies through a Memorandum of Understanding (MoU) and joint work plan. Moreover, it is valuable to establish under the umbrella of the competent authority, a statistical unit with trained officers in database management, analysis and reporting, computing and communication systems.

At the regional level, competent authorities of the countries should be prepared to regularly provide fisheries accident information to a regional structure, such as a regional fisheries management body (RFMO) or an appropriate regional organization concerned with maritime accidents and incidents, where further aggregation and analysis would be undertaken if deemed necessary. Should such a regional initiative be established, there would be a need for standardization of data and agreement on a data sharing protocol.

The investigation will determine the direct and indirect contributing factors to injuries, fatalities and vessel damages before, during and after the event. Thereafter, the results should be analysed in light of the appropriate national legislation and international conventions to which the country is a party (such as IMO SOLAS Convention, the IMO Cape Town Agreement and ILO Work in Fishing Convention [C188]).

The causation analysis process should be structured though, and there are a number of models/ frameworks to use for this task. The James Reason "Swiss Cheese" causation model (figure 2) is a useful tool for causation analysis purposes. Investigators should be fully trained in applying this model, and other modern analyses methods (Petursdottir *et al*., 2001)

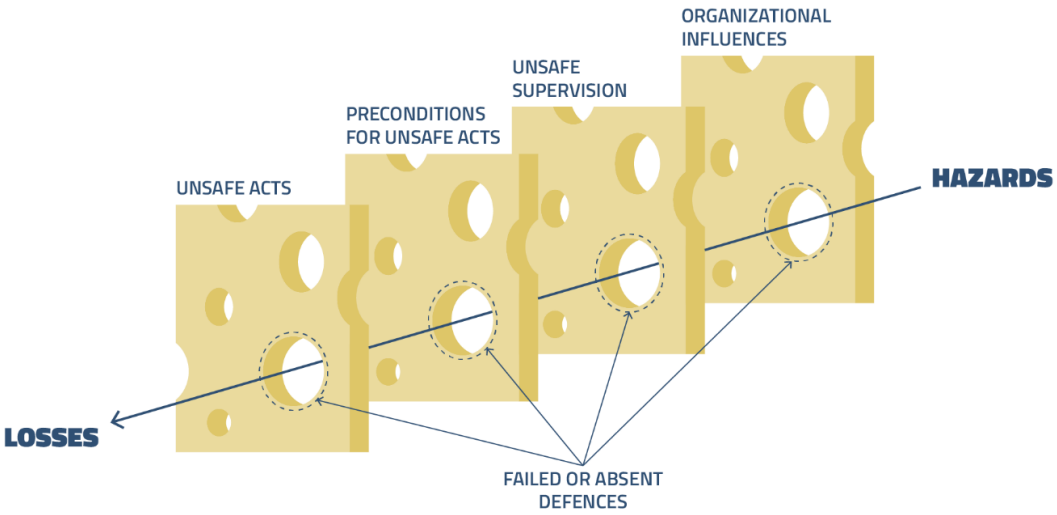

Figure 2: Swiss Cheese causation model

See **Annex 4** for a comprehensive overview of the Swiss Cheese causation model.

Causation analysis: Multiple causation theory

The sequence of events leading up to the accident may have happened over a long time frame and this needs to be considered during the investigation. All accidents will have a triggering event often called the active failure. This failure is normally the last one in the sequence of events leading to the accident. It is often associated with what the people did or did not do (human failure) at that particular time. The time period required for a human failure to manifest its adverse effects is usually very short.

Other events will have happened to allow the active failure to take place and these may have occurred over a long period of time. They will certainly include a series of changes and errors. These changes and errors may include such things as: process, procedure, substance, equipment, decisions made, emotions, illness, design, normalization, routinization, lack of training, modification, vessels and the working environment.

The important thing to remember is that the accident is a **sequence of events**. An event is something which happened in the period being investigated, such as:

- making a decision to do something;
- failure of a piece of equipment; and
- a change in conditions, such as a gust of wind.

Root cause analysis

Accidents, however serious, are generally symptoms of a larger problem within a system. Though accidents generally stem from various causal factors, correcting the symptoms of a problem does often little to prevent the possibility of a similar or more severe accident to occur again. To identify and "treat" the true ailment in a system, the root causes of an accident must be identified. The investigator will be tasked with finding the root cause(s) of the accident.

A "root cause" is a causal factor that, if corrected, would prevent recurrence of the accident. Root causes involve both local problems (localized) or problems within the entire system (systemic) that allow or create deficiencies that cause or could cause unwanted occurrences. Root cause analysis is a systematic process that uses the facts and previously performed analyses to determine the underlying reasons for the accident. In accident investigations, finding root causes is prerequisite to the development and implementation of corrective and preventive measures.

The aim of the root cause analysis is to identify and address only those causes that can be controlled within the system being investigated. (This would exclude events or effects that cannot be reasonably anticipated or controlled, such as storms, hurricanes, and other natural disasters). Root cause analysis is any methodology that identifies the causal factors, including management systems deficiencies, which, if corrected, would prevent recurrence of the accident. Simply stated, the root cause is the underlying reason that answers the investigators' question, "Why?".

The root cause analysis does not only apply to a specific accident or incident occurrence. The analysis is intended to produce lessons learned that can have generic implications for a broad group of fishing vessels or vessel operations.

There may be more than one root cause of a particular accident, but probably not more than three or four. If more are thought to exist at the conclusion of the analysis, the investigator should re-examine the list of causal factors to determine which causes can be further combined to reflect more fundamental (root) causes.

To initiate a root cause analysis, the facts surrounding the accident must be known. The facts must be analysed using analytic methods to prepare an initial list of causal factors. It is useful to develop a rather exhaustive list of causal factors prior to the application of root cause analysis to ensure that final root causes are accurate and comprehensive.

To acquire needed information, investigators should examine the evidence collected from the accident scene, witness statements, interviews, and relevant documentation to determine what additional information will be needed for the particular root cause technique they are performing.

Once the initial investigation has been completed, the accident investigator should have a broad understanding of the accident's events and conditions, along with a fairly extensive list of suspected causal factors. A root cause analysis is then performed to define the list of causal factors and categorize each according to its significance and impact on the accident.

Root cause analysis can be performed using computerized or manual techniques, as long as a systematic process for identifying root causes is used.

STEP 5: REPORT AND RECOMMENDATIONS

Overview

Once the root cause(s) have been identified, the process can move to the next phase – that of reporting.

Detailed investigation reports of specific accident cases may display important lessons learned and provide recommendations of general importance to the sector. Statistical analysis of aggregated accident reports may reveal common safety weaknesses.

It is important that the accident management process includes routines for dissemination of all types of conclusive lessons from accidents and recommendations to all concerned stakeholders, but also to a broader public in order to strengthen safety awareness. Regular publications, information workshops, and awareness campaigns are examples of alternative or complementary options of important information feedback from the system.

It is also essential to encourage two-way communication where, for example, conclusions and recommendations made by the captain, vessels' owner, the crew or the accident rapporteurs are collected and carefully considered.

Recommendations

Maintain a monitoring system for the corrective actions to ensure they are done and lead to the desired outcomes. Corrective actions are to be assigned to someone to implement within a specific time frame. In other words what, who, and when should be applied.

Recommendations can be considered to apply at three levels and the likely effectiveness of these should be considered, along with the potential costs:

- Eliminate the deficiency to prevent repetition of an accident from the same cause (for example replace timely a part of an engine or navigation equipment to minimize problems at sea).

- Accept that there is a risk that an accident may happen, but adjust the system to reduce the likelihood of recurrence of the accident (for example apply more restrictive operating conditions, such as not departing from port if waves height or wind force is above a certain threshold, or requiring basic safety training of crew before going to sea).

- Accept the difficulty in eliminating and controlling the risk that an accident may happen and focus on reducing the consequences (for example use of protective equipment, such as life jackets, shoe wear and helmets).

These are, in effect, filling some of the holes in the Swiss Cheese model.

The recommendation should be written clearly, and indicate which of the above is intended e.g.:

> *'In order to prevent future similar accidents company X needs to...'*

Recommendations are generally advisory rather than mandatory in nature, but they will be issued within a framework that expects action to be taken. The investigation will have been productive to the extent that the real causes of unsafe acts and conditions are accurately identified, evaluated and corrected. The

number of recommendations is not important. Their quality, relevance and practicability in addressing the causes of the event and the unsafe acts and conditions that preceded it are important.

One systematic model for achieving this is the use of 'SMART' recommendations. There is some variation about what these letters stand for but the following is generally accepted:

Letter	Meaning	Brief explanation
S	Specific	A clear description of what is required and who is responsible is necessary for any action to take place. Each recommendation should only address one issue.
M	Measurable	If it can be measured then its level of implementation can be reviewed.
A	Attainable	If it is not attainable it should not be recommended.
R	Relevant	It should relate to the circumstances of the accident and how to prevent recurrence.
T	Time-bound	Timescales for stages and completion will allow monitoring of progress

Table 1: The five SMART (Specific, Measurable, Attainable, Relevant, and Time-Bound) criteria for application in formulating recommendations.

Any recommendation should aim at making demonstrable improvement

When formulating recommendations consideration should also be given to:

- Will it be effective in reducing or eliminating the identified risk?
- Is it objective and balanced and free of judgmental and emotive language?
- Is it practical?
- Are potential improvements proportional to the effort needed for the required change?
- Will it be acceptable to those who will be affected by implementation?
- Will it be sustainable over time?
- Does it introduce new risks in another area, e.g. increased maintenance in a high-risk environment?
- Is it based on firm evidence and therefore not counter factual?
- Have there been similar events? This may suggest urgent action.
- Where there are multiple implementers to be involved is the lead agency made clear?
- Where reviews or research are recommended is it clear how the outputs should be used to improve safety?

If a range of recommendations will be made, then prioritizing of these recommendations may be appropriate, e.g. via the timescale or the monitoring process.

Never make public recommendations about disciplining a person or persons who may have been at fault. This would not only be counter to the real purpose of the investigation, but it would jeopardize the chances for a free flow of information in future accident investigations.

In the unlikely event that you have not been able to determine the causes of an accident with any certainty, you probably still have uncovered safety weaknesses in the particular operation. In such cases, it is appropriate that recommendations be made to correct these weaknesses.

See Annex 5 for an example of an Accident Report.

Specific regulatory guidance: Recommendations

Recommendations can be made as a result of one or more investigations, whether completed or not, by the **competent authority**. If only a preliminary assessment has been conducted they will be in the form of a letter from the **competent authority**. If a full investigation has been conducted, the recommendation(s) would be included in the final report. Recommendations are addressed to those stakeholders (such as captain, vessel owner and/or crew) considered best fitted to implement them.

Any person to whom a recommendation is addressed should take the recommendation into consideration. The persons addressed should be requested to send full details of any measures that are being or will be taken by them to implement the recommendation and, if appropriate, include a timetable for implementation. Notice should be given to the **competent authority** if at any time the information provided needs to be modified.

Moreover, any person to whom a recommendation is addressed should, after taking the recommendation into consideration, provide a full explanation to the **competent authority** as to why the recommendation is not implemented, if that is the case.

The **competent authority** shall, annually or at such intervals as they see fit, make information received in response to recommendations publicly available. If a person has failed to comply with a recommendation addressed to him/her, he/she will be allowed a further opportunity to provide an explanation before the information is published.

Also note the following:

Specific regulatory guidance: Reports of investigations

The **competent authority** may, at its discretion and to promulgate any lessons learned, publish collective short reports of accidents that have not been the subject of a full investigation and published report.

Reports of full investigations will be made publicly available in the shortest time possible and in such a manner as the **competent authority** deems fit. The report shall set out conclusions relating to the facts of the accident, or where the facts cannot be clearly established, an analysis and professional judgement to determine the probable facts; and recommendations for future safety improvements. These reports will be published on the **competent authority** website.

Provision is made for any person likely to be affected by a report to see the draft report and to comment on the facts and analysis therein, before it is finalized and made publicly available.
The **competent authority** will consider explanations relating to the facts and analysis contained in the report that may be made to the Authority by or on behalf of the persons served with such notice.

Recommendations may also include penalties:

Specific regulatory guidance: Penalties

The **competent authority** may lay down penalties to apply for breaches of the requirements to meet safety regulations in the fishing industry, as it commonly does in other maritime sectors. Offences may include for instance a failure to report an accident or serious injury; not providing information as required; falsely claiming to have additional information or new evidence, or a failure to preserve evidence. In addition, penalties for obstructing an inspector or otherwise impeding his/her investigation are commonly laid down in the Act.

Outcomes of the accident management process

The accident investigation report and its recommendations will the immediate output of the accident management process. However, an important outcome of the accident investigation process is the learning from the lessons gained from the accidents and incidents in fisheries. Publicizing and disseminating the outcomes of an investigation are important. In addition, there are a number of measures possible in order to improve safety in fisheries in general. Possible safety measures may address various organizational, technical, operational and managerial aspects. The following list provides examples of common measures that are taken following the outcomes of accident investigations:

- awareness campaigns to promote a safety culture in fishing communities;
- technical training and education of vessel captains and crew (for instance on navigation, vessel stability, engine repair and maintenance, communication);
- basic safety training of fishing vessel captains and crew;
- introduction of new/more stringent regulations on vessel standards and equipment;
- enhancement of inspections of technical standards (such as vessel seaworthiness), vessel equipment, and safety gears;
- introduction of penalties and sanctions for violation of safety regulations;
- fishery management measures, introduction of quotas, seasonal restrictions;
- economic incentives such as subsidized life-saving appliances and safety gear, or safety training courses;
- introduction of compulsory fishing vessel insurance and life/accident insurance schemes for crew as prerequisite for vessel registration or commercial fishing licenses;
- introduction of compulsory third-party liability insurance for owners of fishing vessels;
- improvements to the registry of licensed commercial fishers, and issuance of fishers identity cards;
- introduction of formal labour contracts and associated social protection scheme coverage for captains and crew of fishing vessels;
- improvement of early warning systems and communication of weather forecasts to fishers;
- routines and techniques for vessel monitoring (such as VMS introduction) and notification of planned fishing voyages to the port or fisheries authorities; and
- improvements to Search and Rescue (SAR) capacities.

It is important that the **competent authority**, along with other key agencies, demonstrates that there can be positive overall results for the fishing industry arising from the accidents and their investigations.

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ANNEX 1: DEFINITIONS

For the purpose of this circular the following FAO definitions have been used:

Fishing
Searching for, attracting, locating, catching, taking or harvesting fish or any activity which can reasonably be expected to result in the attracting, locating, catching, taking or harvesting of fish.

Vessel
Any vessel, equipped to be used for, or intended to be used for, fishing or fishing-related activities.

Fishing-related activities
Any operation in support of, or in preparation for, fishing, including the landing, packaging, processing, transhipping or transporting of fish that have not been previously landed at a port, as well as the provision of personnel, fuel, gear and other supplies at sea. (FAO, 2016)

Specific definitions: safety-related (FAO, 2016; FAO, 2009)

Accidents
Accident means any occurrence on board a vessel or involving a vessel whereby:

a) there is loss of life or major injury to any person on board, or any person is lost or falls overboard from the vessel or one of its boats;
b) a vessel:
    (i) causes any loss of life, major injury or material damage;
    (ii) is lost or presumed to be lost;
    (iii) is abandoned;
    (iv) is materially damaged by fire, explosion, weather or other cause;
    (v) goes aground;
    (vi) is in collision;
    (vii) is disabled; or
    (viii) causes significant harm to the environment.
c) **any** of the following occur:
    (i) a collapse or bursting of any pressure vessel, pipeline or valve;
    (ii) a collapse or failure of any lifting equipment, access equipment, hatch-cover, staging or boatswain's chair or any associated load-bearing parts;
    (iii) a collapse of cargo, unintended movement of cargo or ballast sufficient to cause a list, or loss of cargo overboard;
    (iv) a snagging of fishing gear, which results in the vessel heeling to a dangerous angle;
    (v) a contact by a person with loose asbestos fibre, except when full protective clothing is worn; or
    (vi) the escape of any harmful substance or agent, if the occurrence, taking into account its circumstances, might have been liable to cause serious injury or to cause damage to the health of any person.

Major injury

Means:

a) any fracture, other than to a finger, thumb or toe;
b) any loss of a limb or part of a limb;
c) dislocation of the shoulder, hip, knee or spine;
d) loss of sight, whether temporary or permanent;
e) penetrating injury to the eye; or
f) any other injury:
    (i) leading to hypothermia or to unconsciousness; or
    (ii) requiring resuscitation, or requiring admittance to a hospital or other medical facility as an inpatient for more than 24 hours.

Serious injury

Any injury, other than a major injury, to a person employed or carried on a vessel, which occurs on board or during access, which results in incapacity for more than three consecutive days, excluding the day of the accident, or as a result of which the person concerned is put ashore and the vessel sails without that person, unless the incapacity is known or advised to be of three consecutive days or less, excluding the day of the accident.

Incidents

A sequence of events and/or conditions that could have resulted in loss. This loss was prevented only by a fortuitous break in the chain of events and/or conditions. The potential loss could be human injury, environmental damage, or negative business impact (e.g. repair or replacement costs, fishing opportunity lost, etc.). Sometimes referred to as a "near-miss".
A marine incident is a procedure, practice or condition that a reasonable person would consider, if not corrected, to have the potential to lead to a marine casualty.

Near miss

A sequence of events and/or conditions that could have resulted in loss. This loss was prevented only by a fortuitous break in the chain of events and/or conditions. The potential loss could be human injury, vessel or equipment damage, environmental damage, or negative business impact (e.g. repair or replacement costs, scheduling delays, contract violations, loss of reputation, etc.).

Vessel loss or damage

The vessel:

- is lost or assumed to be lost;
- is abandoned;
- is significantly damaged*;
- has grounded or been involved in a collision or any other occurrence that incapacitates the vessel.

* A vessel is considered significantly damaged if the damage affects the structural integrity, performance or operation of the vessel and this necessitates a major repair or replacement of one or more important parts, or if the damage leads to technical loss of vessel.

Also, an accident involving fire, explosion, collision, contact, heavy weather damage, hull cracking, or suspected hull defect, etc., resulting in:

- immobilization of main engines, extensive accommodation damage, severe structural damage, such as penetration of the hull under water, etc., rendering the ship unfit to proceed;
- pollution; or
- a breakdown that necessitates towage or shore assistance.

ANNEX 2: ACCIDENT REPORT FORM

Part 1: Event information

Date of accident: .....

Time of accident: .....

Position/location of vessel if known (GPS/latitude/longitude):

.....

Weather conditions (sea/wind):

.....

Visibility (poor/fair/good): .....

Type of accident:

☐ Sinking	☐ Capsize	☐ Collision
☐ Grounding	☐ Fire/explosion	☐ Engine failure
☐ Vessel disabled	☐ Piracy	☐ Vessel Missing
☐ Personal injury	☐ Lost overboard	☐ Hit by lightning

☐ Other (provide details): .....

Part 2: Vessel information

Name of vessel: .....

Registration number/identification marks/colour:

.....

Port of registry/flag State: .....

Home port: .....

Type of fishing: .....

Type of vessel:

	☐ Multi day	☐ One day inboard engine
	☐ One day outboard engine	☐ Traditional (no engine)

Engine horsepower: .....

Vessel Material (wood/steel/fibreglass/etc.): .....

Vessel length: ..... Tonnage: .....

Captain's name: .....

Captain's contact details: .....

Owner's name: .....

Owner's contact details: .....

Part 3: Injury information

Name of injured person: .....

Age of injured person: .....

Nationality: .....

Severity of injury:

- ☐ Near miss
- ☐ Minor/first aid
- ☐ Serious injury
- ☐ Missing
- ☐ Drowning
- ☐ Fatal*

**For fatality, indicate where the individual passed away —at sea, in hospital, etc.:*

.....

Type of injury:

- ☐ Abrasions/cuts
- ☐ Twists/fracture
- ☐ Burns/chemicals
- ☐ Amputation
- ☐ Electric shock
- ☐ Suffocation
- ☐ Fish-related (provide details):
- ☐ Other (provide details):

.....

Body part affected:

☐ Head	☐ Eyes	☐ Neck
☐ Shoulder	☐ Back	☐ Abdomen
☐ Internal	☐ Arms	☐ Hands
☐ Fingers	☐ Groin	☐ Legs
☐ Knees	☐ Feet	☐ Toes

Illness :

☐ Diarrhea	☐ Constipation/cramps
☐ Food poisoning	☐ Flu/fever
☐ Sore eyes	☐ Hayfever/allergies
☐ Skin rash/blisters	☐ Headache/earache
☐ Nausea	☐ Infection
☐ Bladder/urinary	☐ Dehydration
☐ Sun stroke/sunburn	☐ Decompression illness
☐ Seizure	☐ Mental trauma
☐ Other (provide details):	

Part 4: Additional information

Please provide any additional information which may be relevant / important in this case.

.....

.....

Part 5: Additional information

This section is for outlining actions taken at the time of the event/accident/response/rescue.

.....

.....

Part 6: Reporter details

Name of reporter: .....

Contact details: .....

Date of report: .....

Post-investigation Report form

Part 7: General safety equipment on board

Which of the following mandatory and/or recommended safety devices/equipment were on board at the time of the accident?

Life jackets	☐yes ☐no	Quantity:	Comments: .....
Life rings/buoys	☐yes ☐no	Quantity:	Comments: .....
Life raft	☐yes ☐no	Quantity:	Comments: .....
Flares (parachutes/smoke)	☐yes ☐no	Quantity:	Comments: .....
Flag/signs	☐yes ☐no	Quantity:	Comments: .....
EPIRB	☐yes ☐no	Quantity:	Comments: .....
Reflecting mirror	☐yes ☐no	Quantity:	Comments: .....
Spare outboard engine	☐yes ☐no	Quantity:	Comments: .....
Spare parts (plugs, etc.)	☐yes ☐no	Quantity:	Comments: .....
Basic tools	☐yes ☐no	Quantity:	Comments: .....
Anchor and rope	☐yes ☐no	Quantity:	Comments: .....
Spare fuel	☐yes ☐no	Quantity:	Comments: .....
Sail	☐yes ☐no	Quantity:	Comments: .....
Sea anchor and line	☐yes ☐no	Quantity:	Comments: .....
Spare oars	☐yes ☐no	Quantity:	Comments: .....
Fire extinguishers/pump	☐yes ☐no	Quantity:	Comments: .....
Fire blankets	☐yes ☐no	Quantity:	Comments: .....
First aid kit	☐yes ☐no	Quantity:	Comments: .....
VHF, mobile phone	☐yes ☐no	Quantity:	Comments: .....
GPS/plotter	☐yes ☐no	Quantity:	Comments: .....
Compass/radar	☐yes ☐no	Quantity:	Comments: .....
Food/water	☐yes ☐no	Quantity:	Comments: .....
Bucket/bailer	☐yes ☐no	Quantity:	Comments: .....

Part 8: Accident causation factors

This section is for findings after an investigation – which has used a structured causation analysis methodology – has taken place (by a qualified investigator).

Technical factors:	☐ Inadequate guarding/unguarding	☐ Defective tools, equipment or gear
	☐ Hazardous working conditions	☐ Insufficient illumination, ventilation
	☐ Rudder/engine failure	☐ Lack of personal protective equipment (PPE)
	☐ Unsafe design or construction	☐ Inadequate warnings/signs/ instructions
	☐ Extreme weather	☐ Procedures not in place/ inadequate
	☐ Vessel out of fuel	☐ Vessel overloaded
	☐ Gear/rope in propeller	☐ Inadequate life supporting equipment
Human factors:	☐ Failure to wear lifejacket/PPE	☐ Under the influence of alcohol/drugs
	☐ Fatigued/stressed	☐ Disregarding safety practices
	☐ Operating without authority	☐ Operating recklessly
	☐ Disabling safety devices	☐ Disobeying orders
	☐ Human error	☐ Lack of knowledge
	☐ Lack of skill	☐ Inexperience
	☐ Navigation error	☐ Lack of safety buddy system
	☐ Working alone	

Part 9: Recommendations

This section is for outlining actions taken at the time of the event/accident/response/rescue.

.....

.....

Part 10: Reporter details

Name of investigator: .....

Agency/authority: .....

Contact details: .....

Date of final report: .....

Signature of accepting officer and date:

.....

ANNEX 3: ACCIDENT CAUSATION FRAMEWORK FOR QUESTIONS

The simple causation framework shown in Figure 3 attempts to illustrate that the causes of any accident can be grouped into five categories - task, material, environment, personnel, and management (CCOHS, 2021). When this framework is used, possible causes in each category should be investigated. Each category is examined more closely below.

Remember that these are *sample* questions only: no attempt has been made to develop a comprehensive checklist.

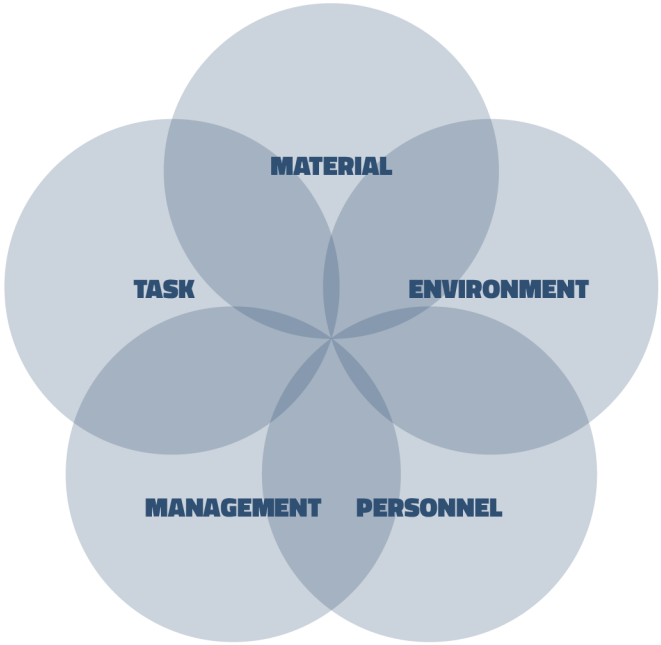

Figure 3: Accident causation framework

Task

Here the actual work procedure being used at the time of the accident is explored. Members of the accident investigation team will look for answers to questions such as:

- Was the process/task new?
- Was a safe work procedure used?
- Had conditions changed to make the normal procedure unsafe?
- Were the appropriate tools and materials available?
- If "yes", were they used?
- Were safety devices working properly?
- If "yes," was it working properly?
- Was lockout used when necessary?
- Was safety equipment/device used?
- Did the task/process require the employee to work beyond the employee's physical capabilities?

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

Material/equipment

To seek out possible causes resulting from the equipment and materials used, investigators might ask:

- Was there an equipment failure/malfunction?
- What caused it to fail/malfunction?
- Was the machinery poorly designed?
- Were hazardous substances involved?
- Were they clearly identified?
- Was it stored and handled properly?
- Was a less hazardous alternative substance possible and available?
- Was the raw material substandard in some way?
- Should personal protective equipment (PPE) have been used?
- Was the PPE used?
- Were users of PPE properly trained?
- Was necessary equipment/material available?
- Could a safer work method have been used with other equipment?

Again, each time the answer reveals an unsafe condition, the investigator must ask **why** this situation was allowed to exist.

Environment

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

- What was/were the weather/indoor conditions like?
- Was it too hot, too cold?
- Was poor housekeeping/materials management a problem?
- Was it slippery?
- Was poor environmental design (ergonomics, violence) a problem?
- Was the work area/equipment of adequate/appropriate dimensions and appropriately designed?
- Was the level of lighting inadequate?
- Was glare a problem?
- Was it noisy?
- Were toxic or hazardous gases, dusts, fumes or mists present?
- Was it stuffy? Poorly ventilated?

Personnel

The physical and mental condition of those individuals directly involved in the event must be explored. The purpose for investigating the accident is **not** to establish blame against someone but the inquiry will not be complete unless personal characteristics are considered. Some factors will remain essentially constant while others may vary from day to day:

- Was the person experienced in the task being done?
- Had adequate training been given?
- Did the person follow accepted safe work procedures?
- Was the person physically/mentally capable of doing the work?
- Was the person tired?
- How many shifts/hours had the person worked?
- Is the person a shift worker? If "yes," what was the person's rotation at the time of the incident?
- Was the person in good health?
- Has the person had a recent/previous injury?
- Was the person under stress (work or personal)?
- Were the tasks beyond the person's physical/mental capabilities?
- Did the person/third party make a driving error?
- Did the person use the provided safety equipment/devices?

Management

Management holds the legal responsibility for the safety of the workplace and therefore the role of supervisors and higher management and the role or presence of management systems must always be considered in an accident investigation. Failures of management systems are often found to be direct or indirect factors in accidents. Ask questions such as:

- Had same/similar hazard(s) been identified that may have contributed to the accident/incident?
- If "yes," had procedures been developed to overcome them?
- Were safety rules communicated to and understood by all employees?
- Were written procedures and orientation available?
- Were they being enforced?
- Were written safe work procedures developed?
- Was training offered in safe work procedures?
- Was training offered in hazard identification/assessment/control?
- Were regular inspections conducted?
- Were unsafe conditions corrected without delay?
- Was there adequate supervision?
- Had hazards been previously identified?
- Had procedures been developed to overcome them?
- Was regular maintenance done?
- Was lack of maintenance staff a problem?
- Was adequate supervision given?
- Was adequate staffing available?
- Were safety specifications lacking for purchasing equipment/supplies?

- Were the end users of equipment/supplies consulted for input prior to making decision for purchasing particular equipment/supplies?
- Was workload excessive?
- Was there a well-being check procedure for the worker if working alone?
- Had the worker been informed of the nature and the extent of the risk of violence?

This framework for conducting accident investigations provides a guide for uncovering the possible causes and reduces the likelihood of looking at facts in isolation. Some investigators may prefer to place some of the sample questions in different categories; however, the categories are not important, as long as each pertinent question is asked. Obviously, there is considerable overlap between categories; this reflects the situation in real life. The above sample questions do not make up a complete checklist, but are examples only.

ANNEX 4: THE REASON MODEL OF ACCIDENT CAUSATION

A useful way to conceptualize why accidents occur and to emphasize the complexity of accident causation is illustrated by what is known as "Reason's model". This model, developed by Dr James Reason of the University of Manchester, United Kingdom of Great Britain and Northern Ireland, looks beyond the immediate circumstances of the accident and looks at the preconditions at the time of the occurrence. This is a useful tool in identifying who should take what actions to prevent and mitigate the effect of future accidents.

The Reason model of accident causation is accepted as an industry standard and has been recommended by various organizations for use in investigating the role of management policies and procedures in accidents and incidents.

The Reason model is a general model that traces the root causes of different accidents to organizational errors (latent failures) arising in the upper levels of any organization (Reason, 1995). Reason and other researchers contend that explanations of accidents based solely upon individual operator performance are now accepted to be inadequate as models of the accident generating process. Such processes in modern large-scale technological systems involve a complex of multiple interacting factors that are distant in time and proximity within the organization from the immediate circumstance of an accident.

In the model (figure 4), the first layer (**defences**) represents defences that should mitigate the results of the unsafe act. The second layer (**unsafe acts**) and third layer (**preconditions**), include such conditions as fatigue, stress, operating practices, etc. The fourth layer (**line management**) includes such aspects as training, maintenance, etc. The fifth layer depicts all high-level **decision-makers** such as regulators, owners, designers, manufacturers, trade unions, etc. Dr Reason suggests that these decision-makers frequently make "fallible" decisions and these resulting latent defects stay dormant waiting for someone to commit an unsafe act, and thereby trigger a potential accident scenario. If the system's defences function as intended, the results of the unsafe act are caught and the effects are limited. If the defences do not function, the accident could prove tragic.

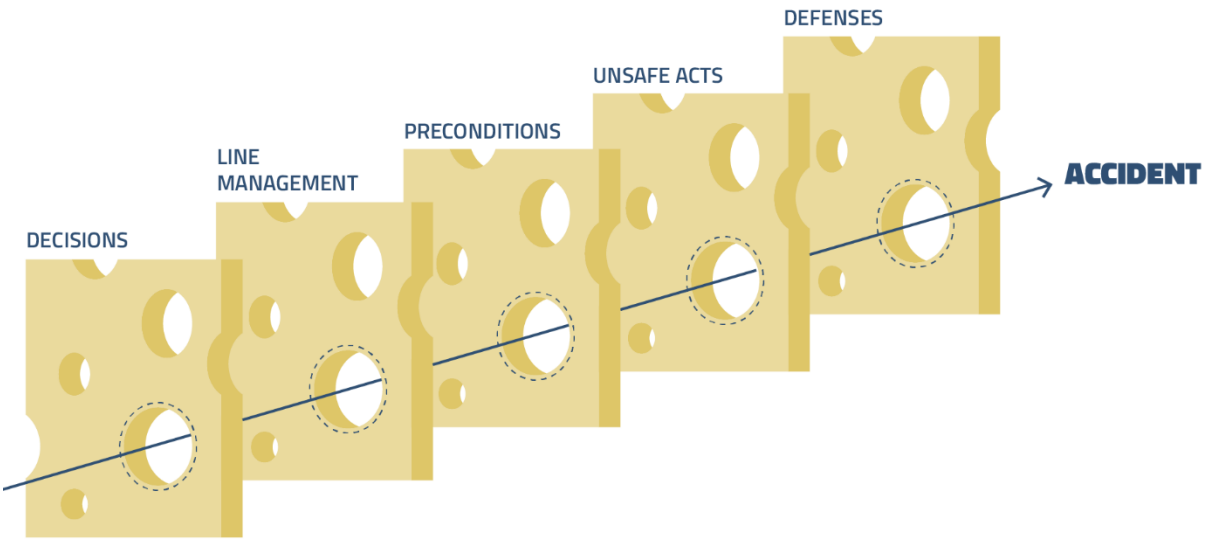

Figure 4: Swiss cheese model

The model shows the importance of reducing or eliminating safety deficiencies. This can be represented as a reduction in the number or size of the holes, thus reducing the probability of an accident. Reason's model is particularly useful in illustrating how an accident can have a number of causes.
James Reason hypothesizes that most accidents can be traced to one or more of four levels of failure: Organizational influences, unsafe supervision, preconditions for unsafe acts, and the unsafe acts themselves. In this model, an organization's defences against failure are modeled as a series of barriers, with individual weaknesses in individual parts of the system, and are continually varying in size and position. The system as a whole produces failures when all individual barrier weaknesses align, permitting "a trajectory of accident opportunity", so that a hazard passes through all of the holes in all of the defences, leading to a failure.

The model includes, in the causal sequence of human failures that leads to an accident or an error, both **active failures** and **latent failures**. The former concept of active failures encompasses the unsafe acts that can be directly linked to an accident, such as (in the case of aircraft accidents) pilot errors. The latter concept of latent failures is particularly useful in the process of accident investigation, since it encourages the study of contributory factors in the system that may have lain dormant for a long time (days, weeks, or months) until they finally contributed to the accident. Latent failures span the first three levels of failure in Reason's model. Preconditions for unsafe acts include fatigued operators or improper communications practices. Unsafe supervision encompasses such things as, for example, two inexperienced pilots being paired together and sent on a flight into known adverse weather at night. Continuing with the aviation example, organizational influences encompass such things as reduction in expenditure on pilot training in times of financial austerity.

The same analyses and models apply in the field of healthcare for example. Here a latent failure could be the similar packaging of two different prescription drugs that are then stored close to each other in a pharmacy. Such a failure would be a contributory factor in the administration of the wrong drug to a patient.

Reason noted that human error was implicated in the causes of most accidents. However, unsafe acts, just as much as their occasional bad outcomes, are consequences rather than causes. As a result, the Reason model is based on the underlying systems structure, and is intended to discover the errors and deficiencies that led to the operators being placed in a situation causing an accident. The Reason model contends that one cannot simply focus on an individual’s behaviour; to eliminate problems, one has to look into the indirect underlying factors and causes which may be the root of a problem.

Reason developed this model after he studied a number of major disasters from around the world such as the Bhopal Gas tragedy, the Challenger, Chernobyl, etc. According to the model an accident sequence begins with improper organizational processes (i.e. decisions concerned with planning, scheduling, designing, and maintaining, etc.) The latent failures so created become precursors for the active failures (high workload, faulty equipment, time pressure, fatigue, low morale, etc.).

The model is popularly referred to as the “Swiss Cheese” model of accident causation. Simply visualizing the different defence layers as slices of Swiss cheese helps here. Each slice is different – generally containing big and/or small holes in random positions. The holes can be seen here as deficiencies in whatever system is being examined. And each slice will be different.

The Reason Model in practice

The following is a hypothetical example, drawn up by the International Labour Office (ILO, 1999), of how Reason's model might be used to describe an accident on a trawler leading to the loss of a fisherman's arm: (1) the regulations in a given country do not require new entrants to fishing to receive any safety training (**decision**); (2) the owner does not require this either (**decision**), neither does he require the Captain to conduct any training on board (**decision** or **line management**); (3) at sea, an experienced crew member becomes ill and the newcomer is asked to fill in, having spent very little time

on deck and having received little or no guidance (**line management**); (4) the vessel is operating in fairly rough conditions (**precondition**); (5) everyone is fatigued (**precondition**) and the newcomer ventures too close to the deck gear (**unsafe act**) and loses his balance due to an unanticipated motion of the vessel; (6) he falls into a winch not fitted with proper guards (a possible **defence**) and his arm is severed before there is time to stop the winch. The fisherman has lost an arm not only due to deck gear or inattentiveness but also to a series of mistakes by himself, the skipper, the owner and the regulator -- all the holes in the model were aligned.

The above example illustrates that measures to prevent accidents as well as to preserve the health of fishermen must be implemented at many levels. An additional consideration is how to reduce the severity of the consequences of an accident. In the scenario described above, there are latent conditions and immediate actions which can mitigate the severity of the accident. The fisherman whose arm is lost faces permanent disability or even death from bleeding, shock or other causes. The latent condition "lack of training in first aid" could result in a death; conversely, immediate action by a crewmate with proper first-aid training may save a life.

Another example could be that of a worker hurt on a machine. Here senior managers may have purchased unsafe machinery, supervisors may have pushed for faster turnaround, workers may not have received enough training with the new machinery, and the worker who suffered the accident got distracted three seconds prior to the accident.

This example illustrates key concepts in the model:

- **Active errors** are the proximal causes of the accident: the victim got distracted. If the worker hadn’t got distracted, he would have prevented the accident.

- **Latent errors** are contributory elements in the organization: senior managers purchased unsafe machinery, supervisors were pushing too much, and workers had not been trained. Had none of these latent errors occurred, the accident would have been prevented.

- **Windows of opportunity** refer to the opportunity for errors to contribute to the accident. Had the worker not got distracted, he would have prevented the accident… this time. Yet, the latent errors remain unresolved, waiting for their opportunity (thus a "window of opportunity") to strike.

- **Causation chain** refers to the alignment of all necessary windows of opportunity at all levels in the organization, thus leading to the occurrence of a particular accident. That is, the causes of most accidents can be traced back to "windows of opportunity" opened at all levels in the organization.

ANNEX 5: EXAMPLE: ACCIDENT INVESTIGATION REPORT

A good example of an accident investigation report is provided in the Transportation Safety Board of Canada report M16A0327 (TSB, 2017).

Summary

On 06 September 2016, at 1539 Newfoundland Daylight Time, the small open fishing vessel Pop's Pride, with 4 people on board, was reported overdue after it did not return to St. John's, Newfoundland and Labrador, from the fishing grounds off Cape Spear. Several vessels searched, and the bodies of 2 crew members were recovered. Both bodies were wearing personal flotation devices; however, the crew members' survivability had been reduced by the water temperature and the amount of time they had been in the water. The submerged vessel was recovered the following day. The other 2 crew members were not recovered and are presumed drowned.

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

The report "Table of Contents" is reproduced below for good practice guidance – noting that each individual report will be tailored to the particular circumstances of the event.

Accident investigation report: table of contents

This circular describes the fisheries accident management process. It contains guidelines for national agencies (competent authorities) involved in fisheries accident investigations. It provides competent authorities and their investigators with a structured approach to meeting their legislative requirements to record, investigate, analyse, and report on accidents in the fishing sector. These guidelines are based on international standards, models and lessons learned from various countries where similar accident management processes are in use. The draft guidelines were discussed and finalized at a Train - the - Trainer workshop on safety at sea for small-scale fishers in the Caribbean, which was attended by 30 professionals on safety at sea and fisheries from seven Caribbean countries and was held in Castries, Saint Lucia in January 2020. The fisheries accident management process outlined may also be useful for other regions, which have similar safety challenges and opportunities for safety improvements in fisheries. These guidelines are intended to apply to a wide range of undesired events, such as accidents involving minor and serious injuries, fatalities, vessel damage, incidents involving damaged equipment and near misses.

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