

MARINE CASUALTY INVESTIGATION
Investigators' In-the-field Job Aid
MAIIF/IMO

Introduction to the Job Aid

This Job Aid's primary function is to provide in-the-field guidance for new investigators in the performance of their duties. It provides a comprehensive bullet point check list but there is no expectation that investigators will need to complete every step for every case as each incident is unique in its investigative requirements.







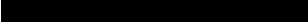
The guidance is extracted from, or based upon, information contained in these three principal source documents:

1. The Marine Accident Investigators' International Forum's (MAIIF's) Investigation Manual. (available at www.maiif.org) (MIM)
2. IMO Res. MSC.255(84) The Code of the International Standards and Recommended Practices for a Safety Investigation into a Marine Casualty or Marine Incident (CIC)
3. IMO Res. A.1075(28) Guidelines to assist Investigators in the Implementation of the Casualty Investigation Code (IG)

New safety investigators should be familiar with the contents of these three documents before going into the field. This Job Aid acts as an aide memoire of the necessary actions and considerations at each stage of the investigation. If there is any doubt about what is required the appropriate source document, which is referenced in the text as MIM, CIC or IG, should be consulted.

The Job Aid covers the investigatory stages up to and including the field phase. The source documents should be referred to for detailed guidance on the later investigatory stages of analysis, reporting and the formation of safety recommendations.

The Job Aid covers the stages in chronological order and its sections are colour coded to make it easy to use in the field.

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2 Job Aid - Actions on Notification

2.1 Gather information

Gather information to be able to classify the accident, assess its significance and decide on appropriate response.

2.1.1 Potential sources of information

- Flag State(s) and coastal States involved (contact details available through the IMO);
- 24-hour contacts for the investigating body in each Member State (GISIS or MAIIF website);
- National authorities involved, e.g. maritime Administration, coastguard, port authorities, police (inc. VTS), and other emergency services;
- Ship and company (contact details from Sea-web, SiReNaC, EQUASIS);
- VDR, ECDIS, GPS information resources, e.g. MAIIF/MAIB VDR Resource;
- AIS information sources, e.g. AISLive, SafeSeaNet;
- Environmental/hydrology conditions – National Meteorological Offices;
- Marine casualty information database(s), e.g. GISIS, EMCIP or national database;
- IMO Codes/Conventions/Regulations;
- Nautical publications, e.g. almanacs, charts, tidal data, pilot books;
- Media – monitor any media coverage of accident and possibly record

ACTIONS ON NOTIFICATION

2.1.2 Typical information required

- Source of notification;
- Time and date of notification;
- Time and date of marine casualty or incident;
- The name of the ship(s), ship type, and its flag State;
- Name and contact details of owners and operators, the ship(s), the shipping company and other points of contact as may be applicable;
- Name and contact details of ship agents, if applicable;
- The IMO or ship number;
- The nature of the marine casualty;
- The location of the marine casualty, including latitude and longitude;
- The number of any seriously injured, missing or deceased persons;
- Consequences of the casualty to individuals, property and the environment;
- A brief description of the casualty event(s);
- The identification of any other ship or structure involved;
- Each ship's condition and intended movements;
- Contact details of anyone with information about the casualty;
- Details of VDR/SVDR, where fitted, and if the VDR data has been saved;
- The weather conditions on site;
- Contact information for the competent Authority of any Substantially Interested State, and their investigation body if applicable;
- Contact information and action taken by local first responders;
- Contact information for cargo details and location, e.g. loading company.

ACTIONS ON NOTIFICATION

2.2 Consider level of inquiry

Is casualty a Very Serious Casualty (Definition CI Code 2.22)?

- YES
 - Marine Safety Investigation to be conducted
- NO
 - Decide on level of investigation and or appropriate response– consider:
 - The seriousness of the marine casualty or incident;
 - The type of ship and/or cargo involved;
 - The potential safety value that may be gained by conducting an investigation;
 - The public profile of the casualty or incident;
 - Whether the casualty or incident is part of an identifiable trend, e.g. from GISIS database analysis;
 - The potential (as opposed to actual) consequences of the casualty or incident;
 - The extent of resources available and projected to be available in the event of conflicting priorities, including the extent of any investigation backlog;
 - Any risks associated with not investigating;
 - Serious injuries occurring to crew and/or passengers and/or third parties;
 - The pollution of environmentally sensitive areas;
 - Ships subject to significant structural damage;
 - The disruption, or potential disruption, of major port operations or other activities;
 - Whether another administration will be investigating.

Decide:

- **Marine Safety Investigation;**
- **More information needed (Preliminary Assessment); or,**
- **No investigation necessary (MIM 1.5)**

ACTIONS ON NOTIFICATION

2.3 Notify others

Notify other Substantially Interested States (SISs)(Definition CI Code 2.20) and Interested Parties (IPs) (definition CI Code 2.7)

2.3.1 SISs

The flag State (s) of the vessel(s) involved and/or the coastal State has an obligation to notify other SiSs (CI Code Ch. 5) with as much of the following information as is available:

- flag State(s) of the ship(s);
- IMO/identification number(s);
- nature of the marine casualty;
- location of the marine casualty;
- date and time of casualty;
- number of seriously injured or deceased persons (and nationalities);
- consequences of the marine casualty to people, property and/or environment;

THEN: Discuss and decide which State will be the Marine Safety Investigating State (CIC Ch.7)

2.3.2 Interested parties

If safety investigation is to be conducted inform the master, owner and agent of the ship(s) involved (CI Code Ch.20) as soon as practicable of:

- the casualty or incident under investigation;
- the time and place at which the investigation will commence;
- the name and contact details of the investigation authority;
- the relevant details of the underpinning legislation;
- their rights and obligations;
- the rights and obligations of the investigating State(s);

Early and regular contact with the Next of Kin is recommended (MIM 2.1.9). Good practice to establish a single point of contact with NoK.

Identify other interested parties and notify them if appropriate (MIM 1.6.4), for example:

- Flag and port State regulators, surveyors, enforcers;
- Police or other judicial authority;
- Search and Rescue/emergency response authorities;
- Port authority;
- P&I Club surveyors and lawyers;

ACTIONS ON NOTIFICATION

- Classification Society;
- Lawyers representing cargo interests;
- Lawyers representing individual crew members and salvors;
- Industry representatives, e.g. fishing;
- Equipment manufacturers;
- Maritime training centres and organizations;
- Seafarers or other maritime unions

2.3.3 Superiors – press office – media

Ensure superior officers are aware of the actions being taken with respect to the safety investigation and consider whether a press release would be beneficial. (MIM 2.1.8) :

A typical press release might contain:

- What happened;
- Where it happened;
- When it happened;
- What the immediate consequences were;
- What can still be expected;
- Launch of an investigation;
- Time and location of any press conference.

3 Job Aid - Preparing to Go on Site

3.1 Forming the Investigation Team

If resources allow it is always better to have at least two investigators in the team. To decide on the make-up of the team consider:

- Resources available
- Size and relative importance of investigation
- Necessary speed of response
- Complexities of investigation including:
 - Number of ships involved
 - Number of witnesses/interviewees involved
 - Difficulties associated with site, location
 - Number of locations (interviewees, ships)
 - Different aspects of investigation (deck, engine, stability)
- Need for specialist expertise (human factors, naval architecture, interpretation, technical analysis, recorder (VDR) specialists)
- Media interest – the possible need for dedicated media liaison

3.2 Evidence Preservation

3.2.1 Preserve the Site (MIM 1.7)

If possible and practicable, bearing in mind possible SAR and pollution prevention activities, the condition of the investigation site should be preserved until the arrival of the investigating team. Contact other interested parties to request assistance. Consider:

- The master and crew of the ship(s);
- The ship manager/owner/agent;
- Maritime administration inspectors/surveyors;
- Local police or fire service personnel;
- Harbour authority representatives;
- Coastguard and rescue authorities;
- Salvors.

3.2.2 Preserve the Evidence (MIM 1.7)

Identify perishable evidence and take steps to ensure that it is preserved.

Consider, in particular:

3.2.3 Electronic

- Voyage Data Recorders (MIM 1.7.2)
 - Identify from ship owners or from ship's crew, type and model of VDR;
 - Use MAIIF/MAIB online VDR web resource;
 - Gain advice from VDR manufacturer;
 - **Instruct master to take appropriate steps to save data;**
 - Consider saving VDR data from witness ships.
- Electronic Chart Display and Information System (ECDIS ;
 - Instruct master to take appropriate action to preserve data;
- ECS if fitted/used
- GPS Plotter
- CCTV cameras (on board and ashore);
- VTS radar and VHF recordings;
- Coastguard radar, VHF and AIS recordings.

3.2.4 Human

- Contact shipowner/manager, agent or master to ensure witnesses/interviewees remain available.

3.2.5 Documentary

- Contact ship to ensure charts, logbooks and other records remain unaltered.

3.2.6 Photographs

- Photographs accident site/scene by shipboard staff/others

3.3 Health & Safety Risk Assessment (MIM 1.3.7.1, 2.3; IG 5.3.1.2)

Consider, and if necessary mitigate, foreseeable risks facing the investigation team, including:

- Travel to location/site
 - Security considerations
 - Driver fatigue
 - Vaccinations
 - Sunscreen
 - Warm/Cold weather clothing
- Access to site/ship
 - Ship at sea
 - Boat travel
 - Helicopter travel
 - Ship in port
 - Ladders
 - Tides
 - On ship
 - Ladders
 - Lighting
 - Enclosed space entry
 - Aloft or overside access if required
- Physical hazards
 - Condition of ship/accident site
 - Stability
 - Fire damage
 - Structural damage
 - Engine room – lighting, floor plates, noise
 - Condition of cargo
 - Hazardous cargo
 - Stability of cargo
- Chemical hazards
 - Substances hazardous to health
- Bio hazards/pathogens
 - Blood
 - Other body fluids
 - Other
- Radiological hazards
- Psychological hazards

PREPARING TO GO ON SITE

- Bodies
- Contact with grieving people

3.4 Equip the Team

Ensure investigation team has correct PPE and investigation equipment:

3.4.1 PPE

Consider:

- high-visibility and protective waterproof jacket;
- steel toe-capped, non-slip working boots;
- safety helmet with fitted ear protectors;
- safety goggles/glasses;
- high-visibility vest;
- automatic inflatable lifejacket;
- working gloves;
- overalls (reusable and disposable types);
- dust mask;
- latex type gloves for forensic evidence collection;
- waterproof trousers;

3.4.2 Investigation Equipment

Consider:

- safety torch;
- first aid/medical kit;
- mobile telephone;
- VDR downloading equipment;
- chart or map of area
- digital camera with video function;
- steel tape measure; laser measuring device
- digital voice recorder;
- laptop computer;
- measuring and sampling equipment - sample containers;
- spare batteries and other equipment accessories;
- note book and pen/pencil;
- oxygen /HS2/CO2 analyser with in-date test certification
- personal escape hood, to enable evacuation from confined space
- a basic tool kit should be considered when physical evidence removal is expected
- Evidence tags (numbered and/or bar coded)

- Forms – receipt for evidence taken

3.5 Logistics

Consider:

- Travel documentation - passports
- Tickets
- Visas
- Obligatory vaccinations
- Foreign exchange
- Accommodation
- Emergency contact information
- Hire car/local transport arrangements in port/place
- Road/City maps
- Establishing a rendezvous/base

4 Job Aid – Arriving on Site/ Site Management

4.1 H&S Dynamic Risk assessment (MIM 2.3; IG 5.3.3)

At accident site review risk assessments and take mitigating action as necessary, including:

- Access to site/ship
 - Ship at sea
 - Boat travel
 - Helicopter travel
 - Ship in port
 - Ladders
 - Tides
 - On ship
 - Ladders
 - Lighting
 - Enclosed space entry
 - Aloft or overside access if required
- Physical hazards
 - Condition of ship/accident site
 - Stability
 - Fire damage
 - Structural damage
 - Engine room – lighting, floor plates
 - Condition of cargo
 - Hazardous cargo
 - Stability of cargo
- Chemical hazards
 - Substances hazardous to health
- Bio hazards/pathogens
 - Blood
 - Other body fluids
 - Other
- Radiological hazards
- Psychological hazards
 - Bodies
 - Contact with grieving people
- Establish 'buddy' system – look after each other

4.2 Meeting Key People – Coordinating/Cooperating (IG 5.3.2)

There can be many different stakeholders involved in the aftermath of a marine casualty or incident, each with their own legitimate interests and responsibilities. Coordination at the casualty site is vital to make sure that the evidence collection is successful. To this end:

If boarding a working ship FIRST explain your role and requirements to the Master and seek his/her assistance as necessary.

Arrange a meeting with representatives from other substantially interested

States (SISs), to discuss (IG 5.4):

- The sharing of knowledge
- Developing an investigation plan
- Delegation of investigation tasks
- Identification of additional help from specialists
- Legal powers

Identify other key stakeholders and arrange a coordination meeting to explain

(MIM 2.1.7):

- Objectives
- Extent of Cooperation
- Legal powers
- Procedure and priority for interviews
- Procedure and priority for evidence collection
- Arrangements for updating on progress

4.3 Initial Site Survey (MIM 2.2.3, IG 5.6)

Walk through accident scene/site and:

- Ask for photographs taken earlier by shipboard staff/others
- Photograph scene
- Make written and voice notes
- Make sketches and diagrams
- Note positions of controls and switches
- Note position and use of emergency equipment
- Note extent of damage
- Establish what has changed since time of accident

ARRIVING ON SITE/SITE MANAGEMENT

4.4 Dealing with the media

If you are asked for information/interview.

TAKE CONTROL

- Introduce yourself.
- Ask for their name, phone number, outlet and deadline.
- Ask how you can help them and what type of information they need.
- If they want an interview, ask if it is taped, live, on site or in studio.

SET LIMITS AND NEGOTIATE

- Tell the media what you can talk about and explain the parameters of your expertise.
- Tell the media up front how much time you will have to speak with them.
- Propose an interview time and location that is convenient for you and your schedule.
- Negotiate if your proposal does not work for the journalist.
- Do not agree to speak off the record—there is no such thing.

KEEP INTERVIEWS SIMPLE

- Tell them if you are investigating.
- Explain your job and your role in the investigation.
- Explain the mandate of the investigating organization.
- Explain the standard investigative process.
- Tell them the facts about the accident.
- Tell them you cannot speculate about the causes of the accident at this stage.
- Tell them you are gathering the facts.
- Explain that you will need to analyze the facts before you will know what happened.

BE YOURSELF

- Use plain language, no jargon.
- Speak slowly.
- Explain technical terms if used.
- Be courteous and accessible

PRESERVE THE INTEGRITY OF THE INVESTIGATING ORGANIZATION

- Protect the privacy rights of individuals.
- Protect confidential information (for example, other government organizations, operators, manufacturers).

ARRIVING ON SITE/SITE MANAGEMENT

- Never talk about matters that are before the courts.

5 Job Aid – Evidence Collection

5.1 General Aide Memoire - SHELL

When collecting evidence for a human factors investigation the use of the acronym SHELL is recommended to ensure that all factors that might have affected human performance are examined. (Annex 1 and MIM 3.1.4)

Use SHELL - Consider:

- Software(The information and support systems guiding people)
 - checklists,
 - manuals,
 - publications,
 - procedures,
 - regulatory requirements,
 - training,
 - education,
 - charts.
- Hardware (The ships, facilities, machinery, cargo, equipment, and material people work with)
 - Control station design
 - Navigational instruments
 - Bridge design
 - Ship design
 - Tools and equipment being used
 - Displays
 - Machinery being operated
 - Alarms
- Environment (The internal and external environment and the safety environment or culture in which the people were working)
 - External environment
 - Wind
 - Cloud cover
 - Precipitation
 - Visibility
 - Sea conditions
 - Ice

EVIDENCE COLLECTION

- Internal environment
 - Temperature
 - Ventilation
 - Lighting
 - Noise
 - Vibration
- Safety environment or culture
- Liveware (The people involved and their interaction with each other)
 - The key people - their physical and mental capability to do the work they were tasked to do
 - Physical fitness, height, reach, weight, age
 - General health, fatigue, stress, alcohol, drugs
 - Knowledge, training, aptitude, attitude, personality
 - Interpersonal conflicts, financial problems, family problems.
 - The other people that the key people were interacting with
 - Communication, cultural and language differences
 - Pilot/master interaction
 - Bridge resource management
 - Supervision
 - Task assignment
 - Bridge engine room interaction
 - Crew interactions
 - Shore management

5.2 Evidence Collection - Human

5.2.1 Fair Treatment (MIM 2.1.10)

When collecting evidence from the people involved in the accident or from those who have information for the investigation, remember:

- Guidelines on the Fair Treatment of Seafarers (Res A.987(24))
 - Respect basic human rights
 - Investigate expeditiously
 - Allow seafarer repatriation as soon as possible
- Casualty Investigation Code (Res MSC.255(84))
 - Inform seafarer on nature and basis of investigation
 - Give access to legal advice

5.2.2 Identify Witnesses/Interviewees (MIM 3.5.2)

Identify:

- Key witnesses (those who played an active role in accident)
- Eye witnesses (those that saw something)
- Other crew and company personnel who can supply background information
- Port or Rescue service personnel
- Equipment designers/manufacturers
- Others

5.2.3 Plan interviews (MIM 3.5.1, 3.5.2)

Consider:

- Order of interviews (who first)
- A location for the interviews
- Preparing the location, seating, writing table, refreshments
- Ensuring that there is little or no disturbance
- Who will conduct interview and the 'team' size
- The roles of the interviewers
- Collecting relevant background and documentary information before the interviews
- Broad topic areas to be discussed with each witness/interviewee (See Annex 2)
- Is an interpreter required? (MIM 3.5.7, 3.5.8)
- Be aware of possible cultural differences

5.2.4 Conduct Interviews (MIM 3.5.4)

Remember:

- Develop a rapport from the start
 - Introduce yourself as a seafarer etc.
 - Be polite
 - Behave in a natural manner
 - Keep interruption to minimum
 - Develop a friendly conversation
 - Display sincere interest
 - Frequently summarise the information being given
- Respond to the particular needs of the interviewee
- Ask permission (if necessary) to use audio recorder
- Use cognitive interview techniques for cooperative eyewitnesses (MIM 3.5.6) to help them remember more details.
 - Start with free recall of events
 - Recreate the context
 - Picture the scene
 - Reverse order recall
- Do use:
 - Open questions
 - Specific questions to obtain detailed information
 - Closed questions to clarify a particular point
 - Indirect questions to obtain personal information
- Do not use:

EVIDENCE COLLECTION

- Leading questions
- Hypothetical questions
- Remain impartial – do not judge the interviewee

A detailed list of topic areas to be raised and information to be gained in different accident scenarios is included in **Annex 2**

5.3 Evidence Collection – Physical (MIM 2.4.2)

Consider:

- Equipment
- Tools
- Materials
- Details of structural damage
- Pre- and post-accident positions of accident-related elements
- Scattered debris
- Patterns, parts, and properties of physical items associated with the accident.
- Fluids

Remember:

- Sketch and map position of debris, equipment, injured persons etc
- Photograph physical evidence in situ
- Survey and inspect physical evidence before removing it
- Document and log removal of evidence

5.4 Evidence Collection – Documentary

Consider:

There are numerous documents kept aboard a ship which may be valuable in determining the facts surrounding an incident. The investigators should consider examining the following shipboard documents (when applicable):

- Articles of Agreement
- Bar records – daily purchases – voyage receipts, etc.
- Bell Books (Bridge and Engine-room)
- Bridge Logbook (other than the official logbook)
- Captain's Night Orders
- Captain's Standing Orders
- Cargo Orders Book (like the Captain's Night Orders but issued by the Chief Mate regarding cargo operations)
- Course recorder
- Compass/gyro error log
- Crew list and crew Merchant Mariners' Credentials, including state pilots' licences.
- Crew qualifications
- Current certificates
- Charts and record of chart corrections
- Chief Engineer's Standing Orders
- Deck Logbook
- Declaration of Inspection
- Echo Sounder Chart;
- Engine-room Log Book

EVIDENCE COLLECTION

- Engine telegraph logger
- Instruction manuals, drawings
- ISM Code certification
- ISM Documentation including: (MIM 2.4.3)
 - Familiarization training (ISM Code 6.3);
 - Training in support of the SMS to be identified and provided (ISM Code 6.5);
 - Information and language of ISM Code (ISM Code 6.6);
 - Plans, instructions and check lists for the safety of the ship and pollution prevention (ISM Code 7.0);
 - Emergency preparedness (ISM Code 8.0);
 - Reporting non-conforming incidents (ISM Code 9.1);
 - Corrective action (ISM Code 9.2);
 - Maintenance (ISM Code 10.1);
 - Critical equipment (ISM Code 10.3);
 - Documentation (ISM Code 11.0);
 - Record of internal audits (ISM Code 12.3).
- Maintenance manuals
- Maintenance record
- Master-Pilot conference card (typically held by the pilot)
- Notes kept by deck officers regarding cargo operations, etc., and by oilers regarding their rounds
- Oil Record Books for cargo and bunker.
- Oil Transfer Procedures
- Passenger list
- Personal logbooks (typically for deck and engine officers only)
- Pilot notes, trip sheets, and voyage/passage/pilotage plans
- Publications (nautical and others)

EVIDENCE COLLECTION

- Port log, and log abstract
- Radio Log
- Ship's statutory certificates/any conditions of class
- Ship's register
- Ship Reporting Records
- Ship Response Plans, garbage plans, etc.
- Ship Manoeuvring Characteristics
- Statement of facts/reports of accident/incident
- Voyage/passage plan
- Weather Log/printouts

Remember:

- Photograph documents using digital camera
- If removing documents ensure evidence log and evidential trail are maintained (MIM 2.4.7)
- Where possible obtain electronic (digital) versions of documents (e.g. SMS procedures and PMS records)

5.5 Evidence Collection – Electronic

Consider:

- Voyage Data Recorder (MIM 2.4.4)
 - Ensure VDR data has been saved
 - Retrieve the data – seek guidance if necessary from:
 - MAIB/MAIIF web resource (MAIIF members)
 - VDR manufacturer/service agent

Consider also:

- Other electronic evidence; (MIM 2.4.6)
 - Electronic Chart Display and Information Systems (ECDIS);
 - Electronic charting systems;
 - GPS devices;
 - AIS transponders;
 - Radars;
 - Engine management systems;
 - Fire protection systems;
 - Communications systems;
 - Security (CCTV) cameras;
 - Electronic log books;
 - Planned maintenance and safety management system records.
 - Personal computers
 - Cargo loading/stowage computers
 - Ship's stability computers
 - Alarm systems

EVIDENCE COLLECTION

Remember:

- The safety investigator has custody of the VDR data but the ship owner 'owns' it (MSC/Circ. 1024). Copy data and supply copy to ship owner.
- Log all actions taken in interrogating, downloading, copying and retrieving electronic evidence to provide full evidential trail.
- If you don't understand the computers/instrumentation seek specialist help.

6 Preliminary Analysis (MIM 4.2.5, IG 5.11)

Evidence needs to be analysed as it is collected to find gaps and to ensure that all aspects of interest are covered.

6.1 Stage 1 - Sequence of events (MIM 4.3.1)

Start to compile a time line of events (MIM 4.2.5.3, IG 2.1) from the moment the first information is received. Build on it throughout the evidence gathering phase.

Consider:

- Initial reports (inc. coastguard reports)
- VDR,
- GPS
- ECDIS or ECS
- AIS
- CCTV
- Course recorders
- Engine monitoring systems/logs
- Human evidence from interviews
- Log books
- VTS and CG VHF and radar recordings
-

Remember:

- The times used must all be on same time base
- Each event describes a single discrete happening
- Describe event precisely
- Give each event a date and time
- Identify gaps in the events and seek more evidence to fill them
- The event lines describes “WHAT” happened

6.2 Stage 2 - Identify 'accident events' (MIM 4.2.5.3, IG 2.1)

To discover 'HOW' a casualty occurred.

Consider:

- Applying systematic approach (MIM 4.3.2, IG 5.11)
- Each event in turn asking question - Is this BOTH significant and inappropriate?

Remember:

- 'Accident events' are those events in the sequence of events that were critical in the lead up to the casualty
- An accident event needs to be inappropriate in the context of what was happening and what was known at the precise time of the event in question.
- Accurately identifying the 'accident events' is the single most important stage in the analysis process

6.3 Stage 3 - Analyse 'accident events' (MIM 4.3.3)

To discover "WHY" the accident events occurred.

Consider:

- For each 'accident event' asking
 - 'Why?' the event occurred
 - Which risk controls or safety barriers failed to work?
 - What should have been in place to stop the event occurring?

Remember:

- You should analysis in depth asking the questions though several layers of responsibility to uncover:
 - Human an technical failure mechanisms
 - Operational contributing factors
 - Management and organizational contributing factors

7 Annex 1

7.1 SHELL

Software, Hardware, Environment & Liveware

Software: The information and support systems guiding people. Software elements include checklists, manuals, publications, procedures, regulatory requirements, training, education, maps, and charts.

Hardware: The ships, facilities, machinery, cargo, equipment, and material people work with. Hardware elements include all machinery, gear, electronics, switches, controls, and displays.

Environment: The internal and marine environment in which people work. Environment elements include the internal environment such as workplace environment, room temperature, ventilation, lighting, pitching and yawing, and the marine environment such as sea state, wind, ice, precipitation, and visibility.

Liveware: The people themselves. Liveware elements include all of the people involved in the accident both directly and indirectly.

The SHEL model is typically depicted graphically to display not only the four categories or components of the maritime transportation system, but also the relationships or "interfaces" between the elements and the people (liveware) at the heart of the model.

In this diagram:
S is Software
H is Hardware
E is Environment
L is Liveware



The rough edges between the components in the SHEL diagram are symbolic of the fact that the **mismatch** between an individual and these components is important. These possible mismatches warrant special attention by the marine investigator because mismatches in the system may point out safety deficiencies. Examples of mismatches between a person and other components include:

- **Person to Person (liveware-liveware) Mismatches:** Mismatches between people and other people include voice communications, working language, phraseology, speech rate, readback/hearback, briefings, personal interactions, crew coordination, and non-verbal cues such as hand signals.
- **Person to Policy & Procedures (liveware-software) Mismatches:** Mismatches between liveware and software include problems in the transfer of information between support systems and the person. Outdated publications, for instance, generate a mismatch by giving the person incorrect information.
- **Person to Equipment & Gear (liveware-hardware) Mismatches:** Mismatches between live and hardware include problems in the physical and mental interaction of people and machines. Design limitations, instrument/control design and location, instrument controls and readability, seat design, proper guards and protections and other ergonomic issues are instances of these mismatches.
- **Person to Environment (liveware-environment) Mismatches:** Mismatches between people and environment are facts that affect human performance. For example temperature, humidity, illumination or glare, ambient noise, vibration, air quality, external visibility, pitch and yaw each have an effect on a person's ability to perform his or her task optimally.

8 Annex 2

Interview - Areas to be examined and information to be gained

8.1 INFORMATION FOR EVERY CASUALTY

[Note: Select only what's relevant]

8.1.1 General information

- Casualty type
- Date and local time of casualty
- Position/Location of casualty – Latitude and Longitude, bearing and distance from a known point or river mile marker reference
- Ship(s) involved
- Consequences
- Weather at time of casualty
- Visibility
- Sea area – offshore, coastal, port approaches, harbour
- Sea conditions
- Tidal/current conditions
- Water depth
- Aids to navigation used
- Failure of aids to navigation
- Vessel Traffic Service used

8.1.2 Ship related information

- Name of ship
- Previous name(s)
- Nationality (Flag)
- Previous nationality(s) (Flag(s))
- Documentation Number (IMO Number, State Number)
- Home port/port of registry
- Ship type/service
- Call sign
- Gross tonnage
- Deadweight

INTERVIEW TOPICS

- Length overall
- Beam/breadth (moulded/extreme)
- Drafts – Fore, aft, midships
 - Leaving port
 - At time of casualty (best estimate)
 - After casualty (best estimate)
- List/heel
- Propulsion type and particulars
- Hull construction
- Hull material
- Classification society
- Previous Class Society
- Registered shipowner
- Ship manager/operator
- Date of contract/keel laid/delivery
- Date of major conversion
- Building yard
- Hull number
- Port at which voyage commenced and port at which it was to have ended, with dates
- Details of cargo
- Last port and date of departure
- Port bound for at time of occurrence
- Any incident during the voyage that may have a material bearing on the incident, or unusual occurrence, whether or not it appears to be relevant to the incident
- Plan view of ship's layout including cargo spaces, slop tanks, bunker/fuel lube oil tanks (diagrams from IOPP Certificate)
- Details of cargo, bunkers, fresh water and ballast and consumption
- Any deficiencies highlighted in Port State Control inspections
- Any conditions of class

8.1.3 Particulars of people involved in incident

- Full name
- Age
- Details of injury (if any)
- Description of accident
- Person supervising activity
- First aid or other action on board
- Capacity on board

- Certificate of Competency/Licence
 - Grade
 - Date of issue
 - Issuing country/authority
 - Expiration Date
 - Time Document Held
- Age
- Height
- Weight
- Sex
- Restrictions/Limitations/Disabilities
- Nation of Origin
- Native Language
- Other Certificates of Competency held

8.1.4 Particulars of sea state, weather and tide

- Direction and force of wind
- Direction and state of sea and swell
- Atmospheric conditions and visibility
- State and height of tide
- Direction and strength of tidal and other currents, bearing in mind local conditions

8.1.5 Particulars of the incident

- Type of incident
- Date, time and place of incident
- Details of incident and of the events leading up to it and following it
- Details of the performance of relevant equipment with special regard to any malfunction
- Persons on bridge
- Persons in engine-room
- Whereabouts of the master and chief engineer
- Mode of steering (auto or manual)
- Extracts from all relevant ship and, if applicable, shore documents including details of entries in official, bridge, scrap/rough and engine-room log books, data log printout, computer printouts, course and engine speed recorder, radar log, etc.

- Details of communications made between ship and radio stations, SAR centres and control centres, etc., with transcript of tape recordings where available
- Details of any injuries/fatalities
- Voyage data recorder information (if fitted) for analysis
- Details of cargo operations

8.2 SHIPBOARD ISSUES (IG APPENDIX)

8.2.1 Training and experience

- Position or rank held.
- Certificate held; length of time the certificate has been held; where trained.
- Experience in the position; both on this ship and over career.
- Length of time on this contract and overall on board the ship.
- Experience on other ships; both with this company and other companies.
- Details of other relevant training

8.2.2 Shipboard organizational structure and processes

- The management/department structure on board the ship.
- The individual's position within the on-board structure; who they work for, who they work with, who they report to and who they assign duties to.
- Normal day-to-day responsibilities, tasks/watches and duties.
- Description of any interaction with personnel ashore.

8.2.3 Nature of Tasks

- Specifics of the task(s) being undertaken at the time of the occurrence, including location.
- Differences between the task at that time and normal operations.
- Description of the social dynamics of the working environment (e.g. alone/pair/team).
- Understanding of the task.
- Familiarity with the task; last time it was performed, etc.
- Available discretion relating to how the task was to be accomplished.
- Training provided for the task; what was the training.
- Procedures, documents and guidance for the task.
- Equipment used for the task; reliability, previous failures, problems and

were the crew familiar with it.

- Physical environment; heat, humidity, noise, confined space, exposure to chemicals, etc.
- Workload and/or effort required for the task:
 - To what extent was it within the crew's capability at the time.
 - Were there any tasks that were not done because of the workload.
 - Physical effort involved; pushing, pulling, lifting, etc.
 - Mental effort involved; thinking, deciding, calculating, remembering, looking, searching, etc.
 - Time pressure involved; adequacy of time allocated to the task.
 - Use of scaling questions may assist here (e.g. "on a scale of 1 to 10, where 1 is very easy and 10 is extremely difficult, how (physically) difficult was this task ...").

8.2.4 Activities prior to occurrence

- Actions and/or activities before coming on watch or reporting for duty.
- Individual's role in the operation being conducted by the ship at the time of the occurrence.
- Individual's location on board at the time of the occurrence.
- What was being observed immediately prior to the occurrence; what was seen, heard, felt, smelled, and thought about.

8.2.5 Work period/rest period/recreation pattern

- Description of normal duty schedule (e.g. day worker or watchkeeper).
- Description of duty schedule on the day of the occurrence; on the day before and during the week before the occurrence.
- Length of time awake and/or on duty at the time of the occurrence.
- Overtime worked on the day of the occurrence; on the day before and during the week before the occurrence.
- Usual sleep/rest routine (what time asleep and awake).
- Sleep/rest routine in the three days (72 hours minimum) leading up to the occurrence:
 - 72-hour history of time to bed/time to sleep/duty times/nap times.
 - If there is an indication of reduced sleep beyond 72 hours, collect sleep information beyond 72 hours (as a guide, collect information back to two good nights' rest prior to the occurrence).
 - Quality of sleep; disturbances, light sleep, waking, how

- refreshed when waking.
- Time of day when sleep is taken (impact on quality). ○ Last extended period of off-duty time.

8.2.6 Living conditions and shipboard environment

- Description of the adequacy of personal facilities; individual, shared or communal; noisy, cramped, vibrations, temperature, ship's motion, etc.
- Availability and consumption of alcohol and/or non-prescribed medications.

8.2.7 Physical health

- Symptoms of illness experienced within the 72 hours before the occurrence.
- Medications and other substances taken (prescribed, not prescribed).
- Description of the last meal consumed prior to the occurrence; what and when.
- Description of existence and regularity of exercise routine.
- Details of any recent medical examinations, illnesses or injuries.
- Details of any regular or irregular medication, both prescribed and not prescribed.
- Description of quality of vision (e.g. corrective lenses).
- Description of quality of hearing (e.g. hearing aids).
- Name and contact details of personal physician.

8.2.8 Mental Health

- Length of time spent away from family and loved ones
- Extreme emotions at any time in the days before the occurrence; e.g. feelings of extreme sadness, anger, worry, fear (use scaling questions (1 to 10) to determine level).
- Important and/or difficult personal decisions made recently; e.g. financial or family worries.
- Recent work performance; any concerns from others.
- Stress and/or difficult situations whilst on board and how these were being managed.
- Difficulties with concentration.
- Any mental health issues recently and/or in the past.
- Medications taken (prescribed, not prescribed).

8.2.9 Working relationships

- Friendships and/or support from other crew members.
- Conflicts and/or clashes with other crew members or supervisors.
- Trust in other crew members.
- Language barriers interfering with work performance.
- Clarity of roles and responsibilities with other crew members.

8.2.10 Employment conditions

- Contractual arrangements.
- Complaints or industrial action and systems for resolution of these.
- Recent changes to employment conditions.

8.2.11 Safety policy

- Awareness of the company's safety policy.
- Ship's procedures for dealing with safety issues; methods of reporting and addressing safety concerns.
- Safety training; type, nature and frequency.
- Emergency drills; type, nature and frequency.
- Personal protective equipment (PPE) provided.
- Records and/or knowledge of personal accidents or injuries prior to the occurrence.
- Review and correction of non-conformities, deficiencies.

8.2.12 Staffing levels

- Sufficiency of staffing/crewing levels on board.
- Appropriate allocation of crew members to duties.
- Changes to normal staffing/crewing levels.

8.2.13 Standing orders

- Master's standing orders; for all or part of the crew.
- How are the orders communicated.
- Are the orders in accordance with the company policies.

8.2.14 Level of automation and reliability of equipment

- Complexity of machinery and automated systems.
- Training provided for systems.
- Competency of crew in using the systems.
- Reliability of systems; any earlier failures.
- Maintenance of systems.
- Are the systems integrated with each other and with the task requirements.
- Backup systems

8.2.15 Ship design, motion/cargo characteristics

- Ship design, motion or cargo characteristics; any features which interfere with human performance (e.g. obstructed watchkeeper vision).

8.3 SHORESIDE MANAGEMENT ISSUES (IG APPENDIX)

8.3.1 Management policies and procedures

- Existence of and opinion about the effectiveness of the safety management system, including auditing, analysis, reporting and investigation of the occurrence and Plan-Do-Check-Act cycle.
- Existence of and opinion about the effectiveness of risk assessment and management policies and procedures relating to ships, personnel and the environment.
- Existence of and opinion about the effectiveness of the role of the Designated Person (DP).
-

8.3.2 Scheduling of work and rest periods

- The company's work schedule, relief policy and risk management policy on fatigue.
- Adherence to these policies.
- Recent changes to these policies.
- The company's policies and practices for determining staffing/crewing levels on board the ship.
- The effectiveness of these policies and practices.

8.3.3 Assignment of duties

- The company's policies for determining watchkeeping practices and other duties on board the ship.
- The actual watchkeeping practices.

8.3.4 Shore-ship-shore support and communications

- Means and level of support for the ship's master in conduct of operations.
- The master's reporting requirements.

8.3.5 Voyage planning and port call schedules

- Policies, procedures and guidelines provided to the master to enable voyage planning.
- Actual practices for voyage planning.

8.3.6 Recreational facilities

- The company's policies and practices for the provision of welfare and recreational services on board.

8.3.7 Contractual and/or industrial arrangements and agreements

- Contractual arrangements for all crew members.
- Complaints or industrial action in the last year.

8.3.8 National/international requirements

- Appropriateness of the applicable international conventions and flag State regulations.
- Effectiveness of the flag State's implementation of the requirements and recommendations of the applicable international conventions.
- Compliance with the requirements and recommendations of the applicable international conventions and flag State regulations.

8.4 NAVIGATION ACCIDENTS

Aspects for particular consideration for [collisions and near misses] are in square brackets and for (groundings and contacts/allisions) are in round brackets. The rest are applicable to all navigation accidents:

INTERVIEW TOPICS

- Memory from VDR, ECDIS, ECS, GPS, ARPA, course recorders, engine data log.
- Navigation equipment: draw a plan or photo main consoles. What alarms could be set and what were actually set?
- Was navigation equipment working properly, when was it last checked, manuals?
- Familiarity of watchkeepers with the bridge equipment, training received.
- What was the OOW's experience of navigating in the area?
- Was chart in use corrected and up-to-date, were sufficient paper charts carried?
- Navigation methods being used, e.g. how were fixes obtained, what was the fixing interval, how was the ship's track monitored?
- Steering mode, manual follow up/non-follow up, autopilot normal/river pilot, rudder limits/weather helm set.
- Radars/ARPA in use, scale used, mode of display, EBL/VRM/parallel indexing used, alarm set, when was the radar index error last checked?
- GPS employed, correct datum in use?
- Passage plan- comprehensive? Was it used, who compiled and who approved it?
- Correct nautical publications carried?
- Company and Master's Standing orders and those for the conduct of navigation.
- Was the helm/rudder indicator used?
- Was the echo sounder used, alarms set, depth records kept?
- What was the gyro error, when was it last checked, were repeaters aligned?
- Magnetic compass deviation card posted up/available?
- What navigation lights and shapes were displayed?
- What were the watchkeeping arrangements?
- Content and standard of master/pilot briefing and liaison.
- Content and standard of handover between watchkeepers.
- Was information on squat and manoeuvrability available?
- Blind arcs/ranges for both visual lookout and ship's radar.
- Were clearing lines set and how?
- Was a watch alarm fitted, was it used, what was interval?
- Was the ship's whistle/horn operating correctly, manual and automatic modes?
- Propulsion information: shaft direction, rpm, pitch gauge.

INTERVIEW TOPICS

- [Position of collision/near miss]. (Grounding/contact).
- [When and how was other ship first detected? E.g. position, course, speed, true bearing, relative bearing, range].
- [Courses, headings, speeds, and sound signals from first sighting]. (Height of tide).
- [Radio communications between the two ships].
- [Monitoring of other ship, was a radar plot kept, acquired on ARPA?]
- (Draught of ship, forward, aft and amidships, last fix before grounding/contact).
- Weather, sea conditions, visibility, current and tidal flow.
- Weather forecasts obtained e.g. Navtex; obtain hindcast from Met. Office.
- Who was on the bridge, who had the con, where and what was he doing?
- Were the watchkeepers carrying out other tasks, distracted or fatigued?
- Was there a dedicated lookout?
- Lighting conditions and noise on the bridge.
- Machinery or equipment failure.
- General alarm sounded/broadcast on P/A system.
- [Compliance with collision regulations].
- State of watertight and weathertight doors.
- Point and angle of impact, sketches and photographs.
- [Chart of area showing position of collision/near miss]. (Grounding/contact)
- Engine movement book or computer readout of engine data log.
- [Post-collision action taken, degree of damage and repair, internal soundings].
- (Ship's draught, soundings taken around ship after grounding/contact).
- Extent of pollution, measures taken to minimise.
- [Paint deposit samples where it is not clear who collided with whom].
- (If applicable anchor details, length and scope of cable, holding performance).
- Information from pilot's PPU (if relevant)
- How did planned route differ from the actual route?
- Were other vessels involved?

8.5 FIRES AND EXPLOSIONS

The following evidence should be collected in the case of a fire or an explosion. However, it should be recognised that fire investigation is a specialist topic in itself for which additional training is required or specialist contractor assistance is recommended:

- Outfit of fire-fighting systems and appliances, fire plan.
- Fire-fighting appliances and systems properly serviced and maintained (PMS records, safety record book, certification etc.).
- Structural fire protection, e.g. insulation, fire doors, dampers, cable glands.
- Containment used, use of fire doors and hatches, boundary cooling.
- Sprinklers and gas drenching systems used.
- Instructions posted for fixed firefighting systems.
- Portable fire appliances used, e.g. fire hoses and extinguishers.
- Emergency fire pump use.
- Fire detection system, units activated, alarms given/noticed.
- Organisation and procedures for fire emergency control.
- Fire drills practised and logged.
- Seat of fire, source of ignition, material initially ignited.
- Spread of fire and smoke; was flashover involved?
- Means of escape.
- General alarm sounded, crew mustering, broadcast on P/A system.
- Deployment of fire parties.
- Fire dampers and fuel quick closing valves, shut down arrangements for fans and fuel pumps.
- Shore side fire brigade involvement.
- Hot work involved, permit to work procedure followed.
- Dangerous goods involved.
- Stability considerations with respect to fire-fighting water's free surface
- PMS/maintenance records of tests (QCVs, fixed systems, other equipment etc).

8.6 CARGO SHIFT INCIDENTS

The following is applicable to cases in which bulk cargo has shifted:

- Port of loading, arrival date, departure date.
- Was cargo stowed in accordance with IMO Code of Practice for the Safe Loading and Unloading of Bulk Carriers?

INTERVIEW TOPICS

- Loading start and finish time and when ship left port, crew supervision of loading.
- Cargo stockpiled before loading, condition of stockpiles, wet base, weather before and during loading.
- Damp cargoes, moisture content, flow moisture point, transportable moisture limit, drainage to the bilges during voyage.
- Method of loading e.g. belt conveyor, grabs, pneumatic conveying.
- How was the cargo trimmed? E.g. rotating nozzle, deflector plate.
- Number and dimensions of holds, cargo amount in each hold.
- Shape of loaded cargo, approximate depths and slope angles.
- Anything different about this shipment or how it was loaded.
- Stability condition before sailing, conditions calculated while on passage.
- Weather, sea conditions, speed of ship.
- Heel angle before shift, list angle after shift.
- Structural or other damage as a result of shift.
- Remedial action e.g. ballasting, change of heading.
- Did list cause problems with:
 - Running of main engine or generators?
 - Downflooding through ventilation pipes into fuel tanks?
 - Valves in vent heads preventing downflooding?
- Cargo samples if applicable.
- Roles and responsibilities for safe loading.
- Wave direction, wave height, encounter period.
- Weather condition (precipitation) at berth.
- Rolling period while on passage.
- Measurement method of moisture content, survey report.
- Stowage plan.
- Details of the shipper and consignee.

8.7 FLOODING

- Source of flooding, failure of hull, deck and superstructure plating or planking, sea water cooling systems, scuppers, windows, stern or rudder glands?
- How was flooding first detected, what action was taken?
- Any unusual ship motion before flooding discovered?
- What was the extent of flooding?
- State of watertight and weathertight doors and hatches.
- How was flooding limited by bulkheads, decks, doors and hatches?

- Condition of closing appliances, especially the seals.
- Freeing ports adequate?
- Downflooding arrangements. Any used?
- Bilge alarms, fixed bilge pumps, portable pumps.
- Stop cocks and non-return valves in pipe systems.
- Stability condition before and after flooding.
- Did floodwater cause significant hogging, sagging, list or loll?
- Did hogging or sagging cause structural damage?
- Did head of floodwater cause damage to e.g. bulkheads, decks?
- Cargo damage.
- Effect on propulsion machinery and electrical supply.
- Damage control measures, e.g. wood bungs and wedges, cement boxes, pipe clamps.
- Fishing vessel specifics:
 - Did bilge alarm and pumps meet requirements of relevant regulations/code?
 - Testing regime and maintenance of bilge alarm system.
 - Extended spindles employed on sea inlets?
 - Unauthorized modifications to vessel

8.8 FOUNDERING

Events leading up to the foundering:

- Voyage plan, course and speed.
- Stability condition before foundering.
- Stability performance, obtain stability book, last inclining experiment, computer models if available.
- Weather, sea and visibility conditions.
- Radio communications with coastguard, VTS, other ships.
- How long afloat after initial accident?
- How did the ship sink? E.g. by bow, stern or capsize.
- Location of wreck and water depth.
- Salvage intentions?
- Fishing vessel specifics:
 - Type of fishing e.g. beam trawling, stern trawling, potting, dredging.
 - Recent changes to fishing gear.
 - Was vessel required to meet stability standard?
 - Sea bottom at wreck position, e.g. sand, mud, rock, wrecks nearby.

- Details of equipment/gear on deck
- Maintenance condition and size of freeing ports/scuppers

8.9 LIFESAVING APPLIANCES AND EVACUATION

- Required outfit of lifesaving appliances carried.
- Were lifesaving appliances properly fitted and in date for service etc.?
- Organization and procedures for drills and emergencies.
- Boat drills, including evacuation and man overboard, practised and logged?
- Liferafts correctly secured with Hydrostatic Release Unit?
- SOLAS type approved liferaft, or other recognised body?
- Distress signals card and SOLAS manual.

8.10 STRUCTURAL/MACHINERY/EQUIPMENT FAILURE

- Correct operating procedure used?
- Machinery/equipment maintained and serviced in accordance with the manufacturer's instructions (see Manuals), maintenance and servicing records, experienced and qualified staff.
- Genuine replacement parts used or parts of correct specification.
- Recent repairs, onboard or ashore.
- ISM - any non-conformity reports on failed components.
- Design flaw, material defect, manufacturing or assembly fault.
- Operating within environmental tolerance, e.g. temperature, humidity.
- Item suitable for marine use, equipment designed for intended environment.
- Fatigue failure, indicated by beach marks, repeated loading cycles below the maximum stress.
- Fatigue life exceeded, number of cycles greater than assumed for design.
- Material overstressed, indicated by tearing or buckling, e.g. ultimate tensile stress exceeded, excessive shear force or bending moment.
- Components subject to wear, foreign material present, oil samples, magnetic plug residue samples, fresh water samples.
- Impact damage or abused in some other way.
- Retention of failed specimens.
- Previous failures and repairs.
- Vibration noticed prior to failure.

- Non-destructive testing, information available?
- Heavy weather damage. Obtain weather hindcast and wave information, photos of weather conditions at the time.
- Ship motions, e.g. pitching, rolling and slamming.
- Action taken to reduce motions, e.g. course change.

8.11 SHIP LOST OR MISSING

- Ship history from, e.g. owners, agents, stevedores, pilots, surveyors.
- Date and time of departure from last port.
- Voyage plan, estimated time and date of arrival at next port.
- Type of cargo, where and how stowed and secured.
- Any communications e.g. radio and mobile telephone calls.
- Contact or sighting by other ships, (coastguard incident log).
- Weather, sea conditions, visibility, current and tidal flow.
- Reports of surveys, port state and general inspections.
- History of equipment failures or structural defects.
- Photographs of ship from, e.g. owners, previous crew, harbourmasters.
- Fishing vessel specifics:
 - Fishing habits of skipper; normal fishing grounds. Ask previous crew, harbourmaster, agent, crews of other fishing vessels.
 - Did any of the crew inform next of kin of their intentions?

8.12 ACCIDENTS INVOLVING ENCLOSED/CONFINED SPACES

Enclosed space incidents are not limited to those that result in asphyxiation or atmospheric poisoning. They can also include other types of incidents such as falls from height. Investigations of any accident that occurs inside an enclosed space should address the following:

- Any definition/list of enclosed/confined spaces held on board ship?
 - Where relevant, does it sufficiently identify all enclosed spaces based on the design/construction of the ship, including but not limited to enclosed ladder trunks, upper stool spaces, etc.?
 -
- What enclosed space related procedures are in place, e.g., entry, ventilation, atmosphere monitoring, etc.?
- Scope/content of pre-task hazards assessments for enclosed space entry

INTERVIEW TOPICS

- Is the adequacy of the entry/exit included?
- Lighting?
- Is the risk assessment that was conducted generic or was it specific to the entry/operation being conducted when the accident occurred?
- Did the risk assessment address any crew related issues, e.g., experience, fitness, etc.?
- Did the risk assessment address environmental factors inside the space, e.g., heat, humidity, etc.?
- What equipment is available on board (atmosphere meters, BA, extraction equipment) and was it maintained properly?
 - Is there adequate span gas available on board for checking the proper operation of the gas detection equipment?
 - Was the span gas within its expiration date?
 - Is there an adequate number of personal gas detectors on board and are they in good working order?
 - Does the equipment that was on board match the enclosed space entry procedures?
 - Was the equipment that was used the equipment required by the procedures?
- What measures/procedures are in place to prevent unauthorized entry? Were they in place at the time of the accident?
 - Particular issue is entry by third parties (stevedores, customs officials, etc.)- do the measures / procedures address this area?
 - Was entry into cargo holds addressed during pre-loading/discharge meeting with stevedores?
- Did the incident occur during a planned enclosed space entry?
 - If planned, were the established procedures followed?
 - If not, was the space being entered identified as an enclosed space in the established procedures and was it recognized as an enclosed space by the involved crew?
 - If identified as an enclosed space and the procedures were not followed:
 - What was the reasoning for why they were not followed?
 - Did any crewmembers attempt to “Stop the Job?”
 - Was there something unusual about the design/construction of the ship that presented a previously unidentified hazard?
- Rescue effort:
 - Were there any initial rescue attempts that did not follow the established enclosed space rescue procedures?

INTERVIEW TOPICS

- Were the enclosed space rescue procedures followed?
 - Was the rescue conducted by ship's crew, shore-based personnel, or both?
 - Were there any difficulties entering the space by crew wearing required equipment, e.g., BA set, and/or removing rescued persons?
 - Records and crew experience of enclosed space entry training and rescue drills:
 - How frequently were enclosed space entry training/drills conducted?
 - What is the content of the training and how is it conducted, e.g., computer based, in person training?
 - Does the Company have guidance for conducting rescue drills (use of equipment, scenarios, etc.)?
 - When was the most recent enclosed space entry training/rescue drill conducted?
 - Did any of the crew involved with the incident take part in the training?
 - When it was conducted?
 - What was the scenario?
 - If possible, obtain independent measurement of atmosphere before ventilation after the accident.
 - Who conducted the measurements? When were they conducted and where in the space were the measurements taken?
 - Investigators should not enter enclosed space until certified safe by a chemist or other competent authority as required by applicable national requirements.
 - Check boundaries and penetrations of compartment for source of contamination.
 - Consider whether weather and sea conditions were influential.
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