

2010

**UNIVERSITY OF  
STRATHCLYDE**

**Naval Architecture. & Marine  
Engineering.  
Human factors department**

**[M'AIDER]**

Analyses to identify the most critical dangerous/ emergency cases.

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## 2. Introduction

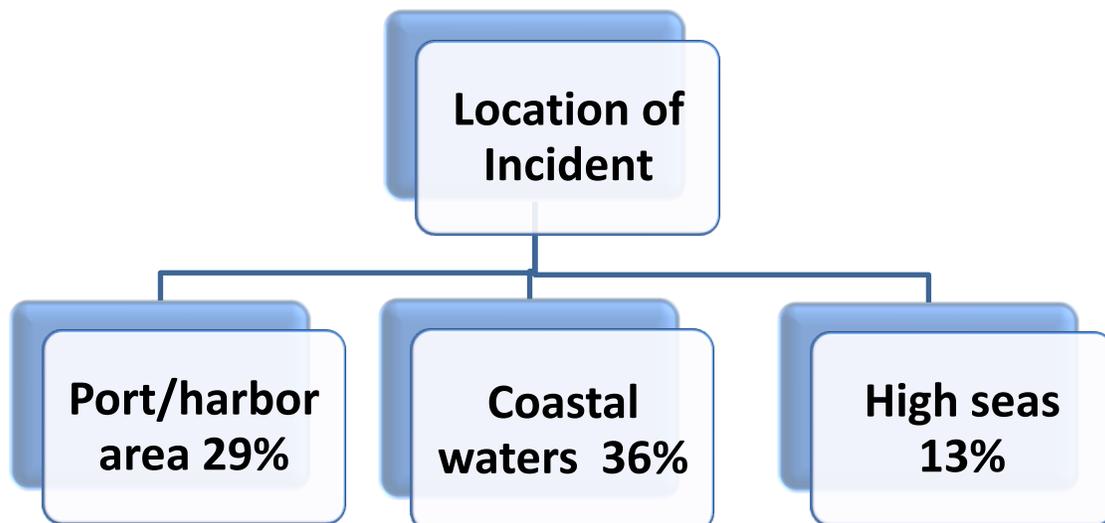
The main aim for the M'AIDER project is to improve safety at sea at ports by indentifying emergency situations known so far and create a knowledge-base of scenario's based on emergency situations for training of seafarers at officer level and higher ranks.

The Marine Accident and Investigation Branch (MAIB), department of Transport, granted their collaboration by sharing their database with us. The database contains information about all the incidents that has occurred in UK waters meaning; supplied for cases involving UK registered vessels and cases occurring in UK waters.

For using these details to generate statistics we limited the database to incidents involving UK flagged vessels only. All of these statistics are based on Incidents with UK registered vessels only between 01-01-1991 and 31-12-2009.

We carried out analyses to indentify the most critical dangerous/ emergency cases issues that can be used in developing scenarios to develop the training approach and content.

There are 12 main chapters and 1 chapter with the Human factors definitions explained. The 12 main chapters will have paragraphs with consists of analysis according to a flow diagram method.



### 3. Location of Incident

In this chapter the locations of incidents are studied for different types of ships.

**Location of Incident:** Identifies what type of waters the incident occurred.

**Frequency is the Count of Location of the Incident:** frequency of Incidents occurred in one of these locations.

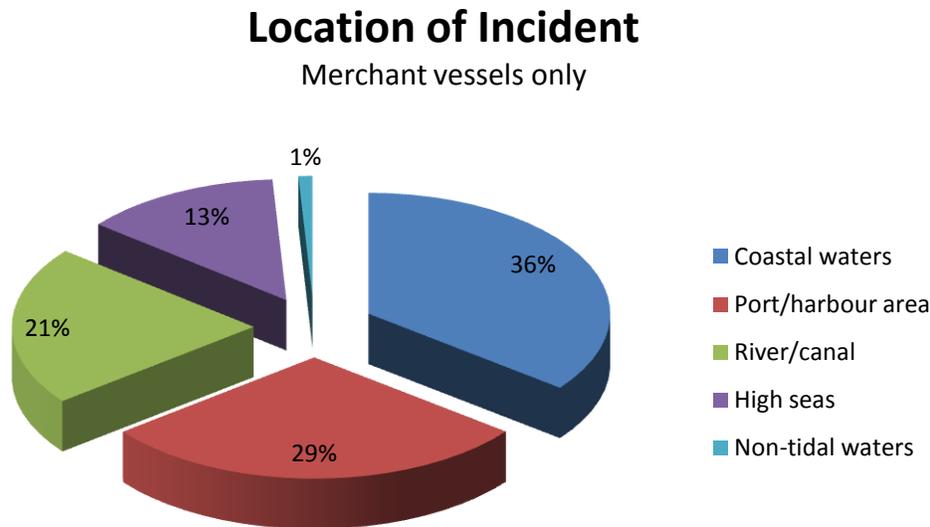
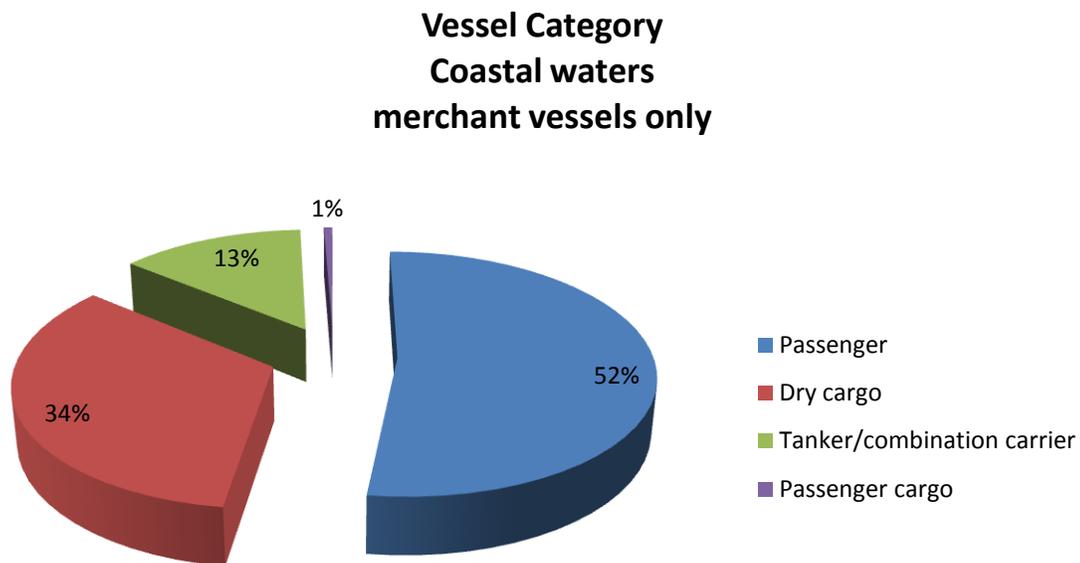


Figure 3-1 Location of incident

Vessel Nationality	Vessel Category	Location Of Accident	Count Of Location Of Accident
U.K.	Dry cargo	Coastal waters	323
U.K.	Dry cargo	High seas	259
U.K.	Dry cargo	Non-tidal waters	3
U.K.	Dry cargo	Port/harbour area	267
U.K.	Dry cargo	River/canal	199
U.K.	Dry cargo	Unknown	1
U.K.	Passenger	Coastal waters	500
U.K.	Passenger	High seas	49
U.K.	Passenger	Non-tidal waters	22
U.K.	Passenger	Port/harbour area	411
U.K.	Passenger	River/canal	321
U.K.	Passenger cargo	Coastal waters	6
U.K.	Passenger cargo	High seas	2
U.K.	Passenger cargo	Port/harbour area	7
U.K.	Passenger cargo	River/canal	2
U.K.	Tanker/combination carrier	Coastal waters	129
U.K.	Tanker/combination carrier	High seas	49
U.K.	Tanker/combination carrier	Port/harbour area	99
U.K.	Tanker/combination carrier	River/canal	53
	Total Merchant vessels	Coastal waters	958
		Port/harbour area	784
		River/canal	575
		High seas	359
		Non-tidal waters	25

## 4. Vessel category

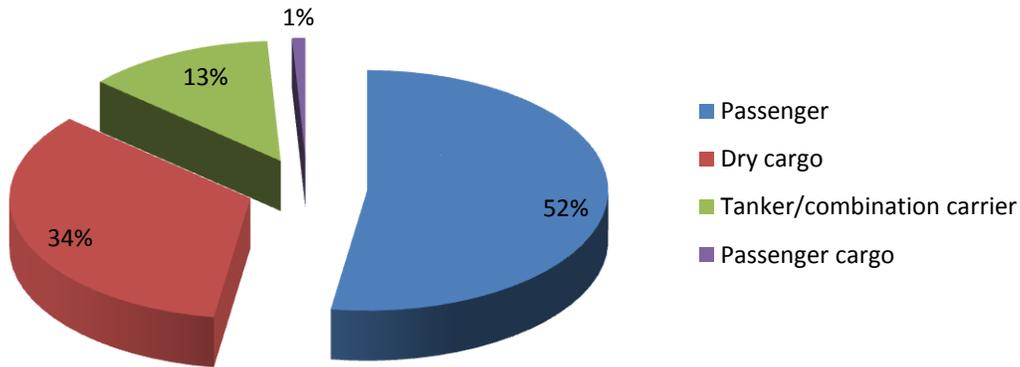
Statistics are based on incidents that **occurred** with Merchant Marine vessels in the locations: coastal waters, Port/harbor area,river/canal and high seas.



**Figure 4-1 Vessel category in coastal waters**

Location Of Accident	Vessel Category	Count Of Vessel Category
Coastal waters	Fish catching/processing	3256
Coastal waters	Other commercial	1051
Coastal waters	Pleasure craft (non-commercial)	951
Coastal waters	Other (non-commercial)	119
	<b>Merchant vessels</b>	
Coastal waters	<b>Passenger</b>	<b>500</b>
Coastal waters	<b>Dry cargo</b>	<b>323</b>
Coastal waters	<b>Tanker/combination carrier</b>	<b>129</b>
Coastal waters	<b>Passenger cargo</b>	<b>6</b>

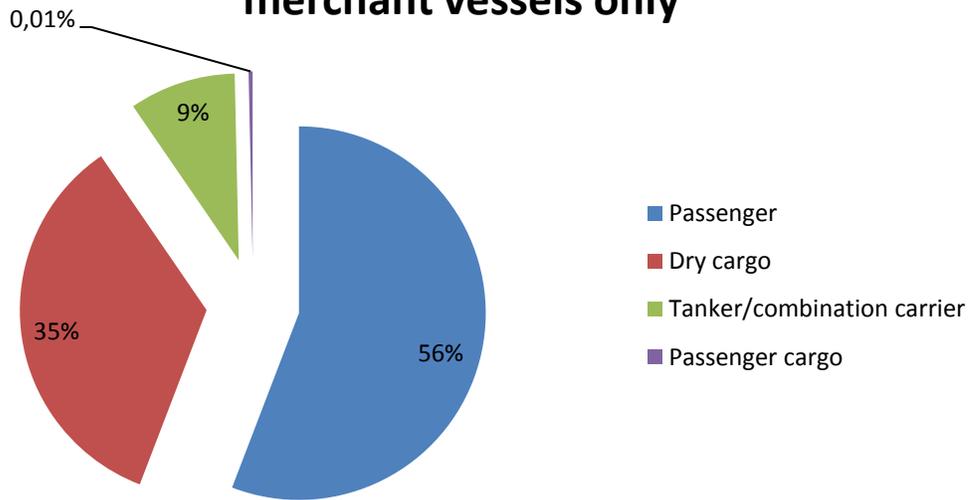
## Vessel Category in Port harbor area merchant vessels only



**Figure 4-2 vessel category in Port/harbor area**

Location Of Accident	Vessel Category	Frequency
Port/harbour area	Other commercial	716
Port/harbour area	Fish catching/processing	540
Port/harbour area	Pleasure craft (non-commercial)	313
Port/harbour area	Other (non-commercial)	68
	Merchant vessels	
Port/harbour area	Passenger	411
Port/harbour area	Dry cargo	267
Port/harbour area	Tanker/combination carrier	99
Port/harbour area	Passenger cargo	7

## Vessel Category in River / Canal merchant vessels only



**Figure 4-3 vessels category in river/canal**

Location Of Accident	Vessel Category	Frequency
River/canal	Other commercial	309
River/canal	Pleasure craft (non-commercial)	231
River/canal	Fish catching/processing	92
River/canal	Other (non-commercial)	30
River/canal	Other (non-commercial)	30
	<b>Merchant Vessels</b>	
River/canal	<b>Passenger</b>	<b>321</b>
River/canal	<b>Dry cargo</b>	<b>199</b>
River/canal	<b>Tanker/combination carrier</b>	<b>53</b>
River/canal	<b>Passenger cargo</b>	<b>2</b>

## Vessel Category in High Seas

Merchant vessels

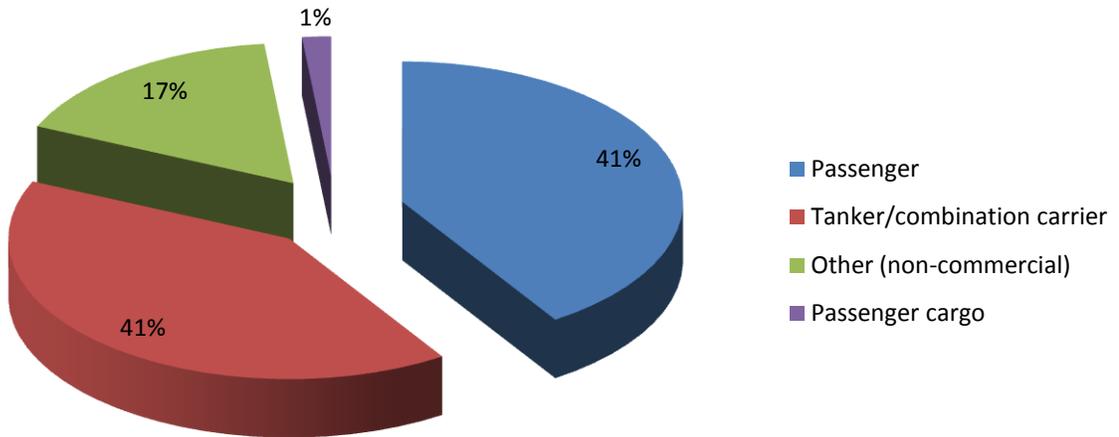


Figure 4-4 vessels category in High seas

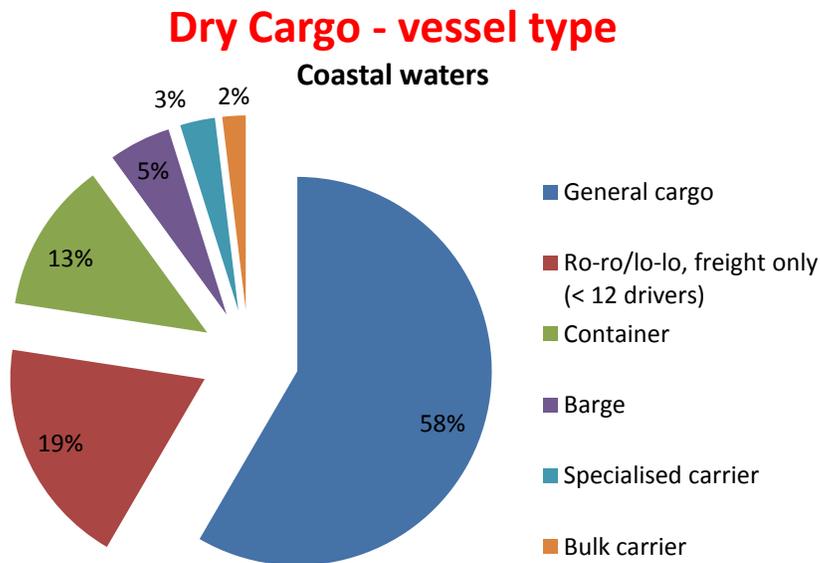
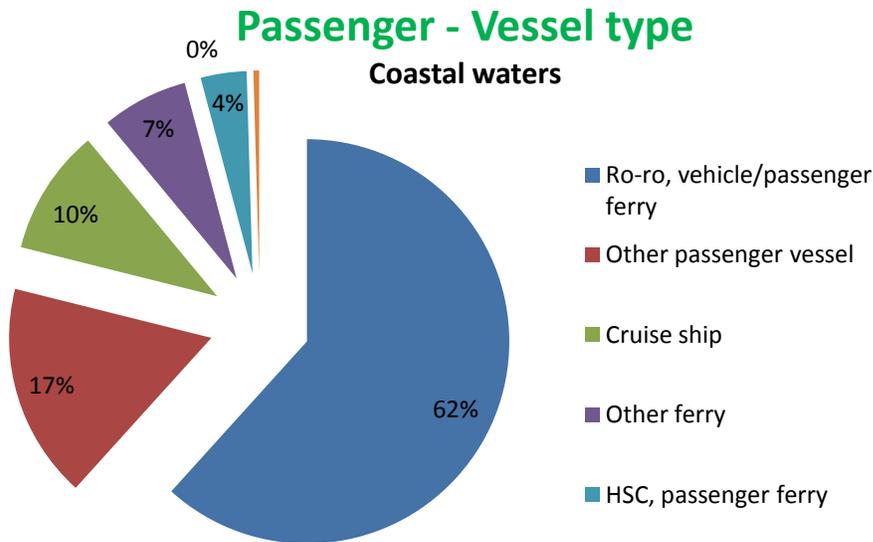
Location Of Accident	Vessel Category	Frequency
High seas	Fish catching/processing	818
High seas	Dry cargo	259
High seas	Other commercial	194
High seas	Pleasure craft (non-commercial)	124
High seas	Merchant vessels	
High seas	Passenger	49
High seas	Tanker/combination carrier	49
High seas	Other (non-commercial)	20
High seas	Passenger cargo	2

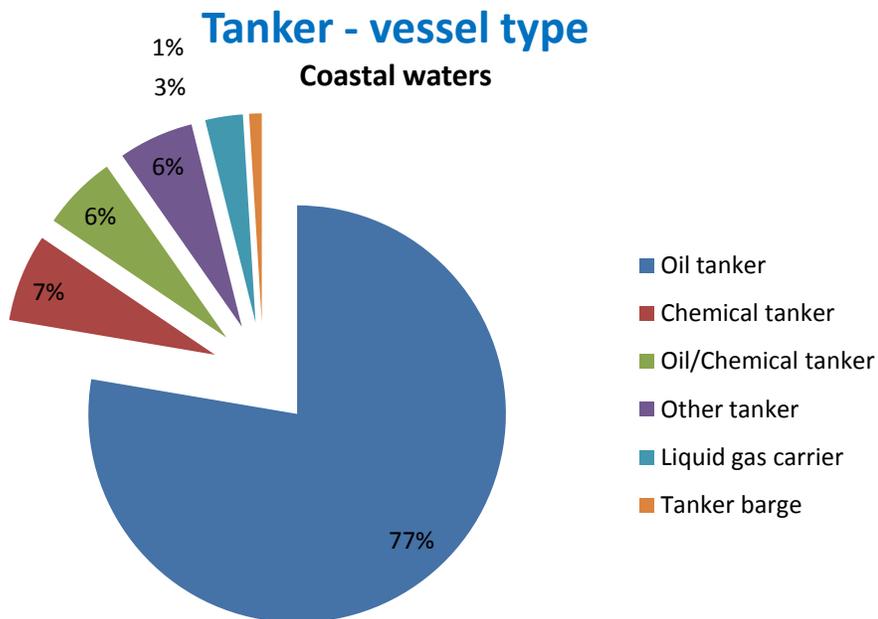
# 5. Vessel type specification

In this chapter we will analyse the specified vessels types and frequency of incidents occurred with a vessel from one of the vessel type categories

**Vessel category:** Identifies the category of the vessel

**Count of Vessel category:** frequency of Incidents occurred with a vessel from these categories.





**Figure 5-1 Vessel Type tanker specified in Coastal waters**

Location Of Accident	Vessel Category	Vessel Type	Frequency
Coastal waters	Dry cargo	General cargo	181
Coastal waters	Dry cargo	Ro-ro/lo-lo, freight only (< 12 drivers)	59
Coastal waters	Dry cargo	Container	39
Coastal waters	Dry cargo	Barge	16
Coastal waters	Dry cargo	Specialised carrier	9
Coastal waters	Dry cargo	Bulk carrier	6
Coastal waters	Passenger	Ro-ro, vehicle/passenger ferry	269
Coastal waters	Passenger	Other passenger vessel	75
Coastal waters	Passenger	Cruise ship	44
Coastal waters	Passenger	Other ferry	30
Coastal waters	Passenger	HSC, passenger ferry	16
Coastal waters	Passenger	HSC, vehicle/passenger ferry	2
Coastal waters	Passenger cargo	General cargo/ passenger	1
Coastal waters	Tanker/combination carrier	Oil tanker	80
Coastal waters	Tanker/combination carrier	Chemical tanker	7
Coastal waters	Tanker/combination carrier	Oil/Chemical tanker	6
Coastal waters	Tanker/combination carrier	Other tanker	6
Coastal waters	Tanker/combination carrier	Liquid gas carrier	3
Coastal waters	Tanker/combination carrier	Tanker barge	1

# 6. Incident Type

In this chapter we will study the Incident type and the frequency of an incident occurred

**Count of incident type:** frequency of incident type

**Grounding** means making involuntary contact with the ground, except for touching briefly so that no damage is caused.

**Hazardous Incident** means any event, other than an accident, associated with the operation of a ship which involves circumstances indicating that an accident nearly occurred.

**Collision** vessel hits another vessel that is floating freely or is anchored (as opposed to being tied up alongside)

**Contact** Vessel hits an object that is immobile and is not subject to the collision regulations e.g. buoy, post, dock (too hard), etc. Also, another ship if it is tied up alongside. Also floating logs, containers etc.

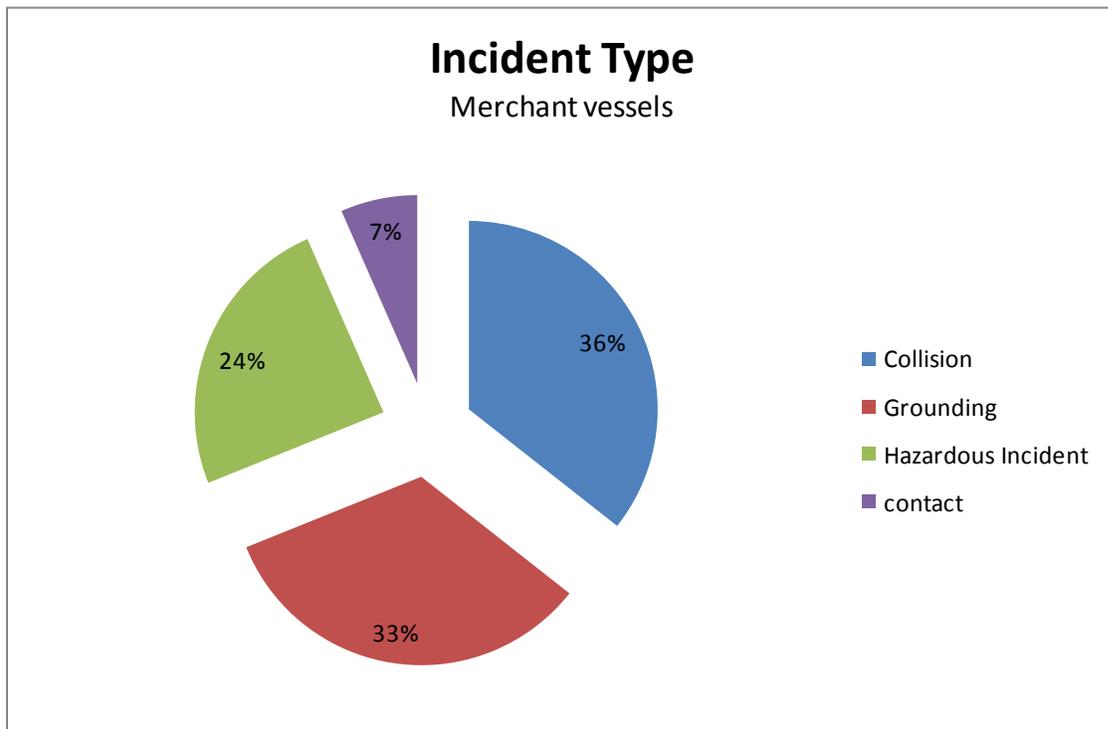


Figure 6-1 Incident Type

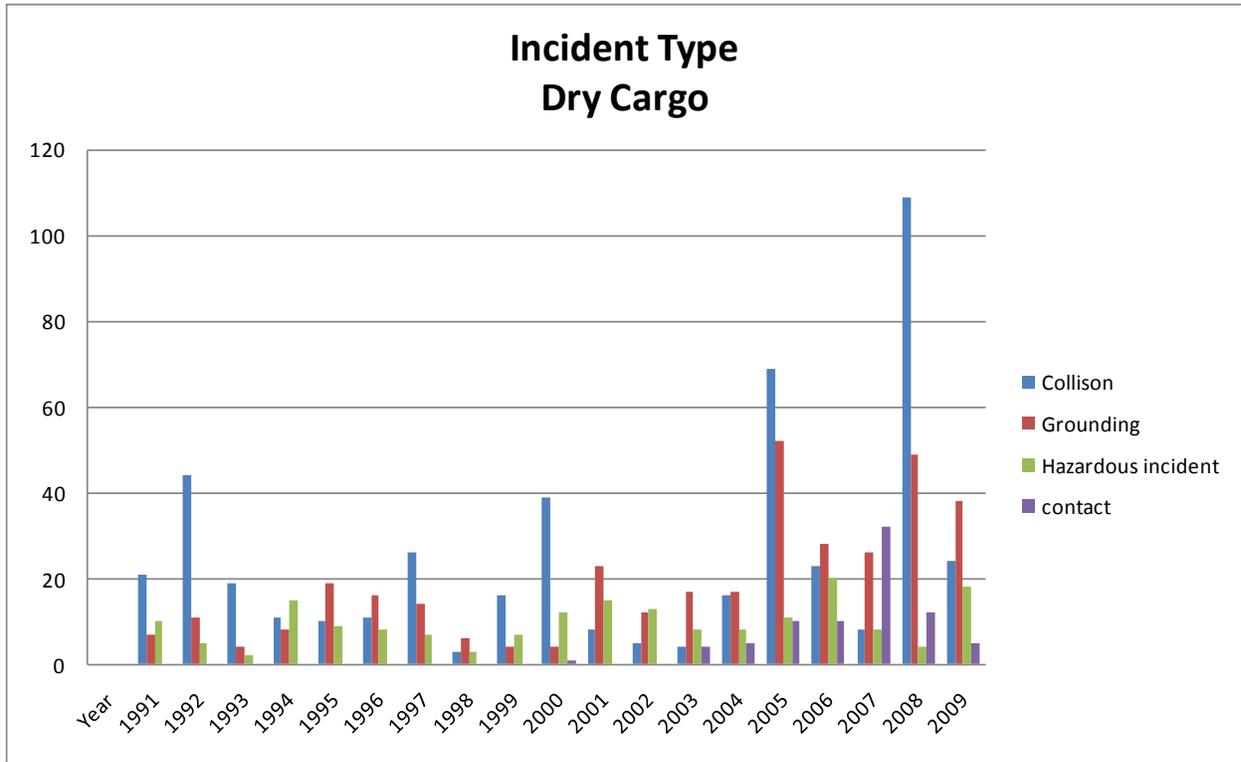


Figure 6-2 Frequency of incident type - Dry cargo

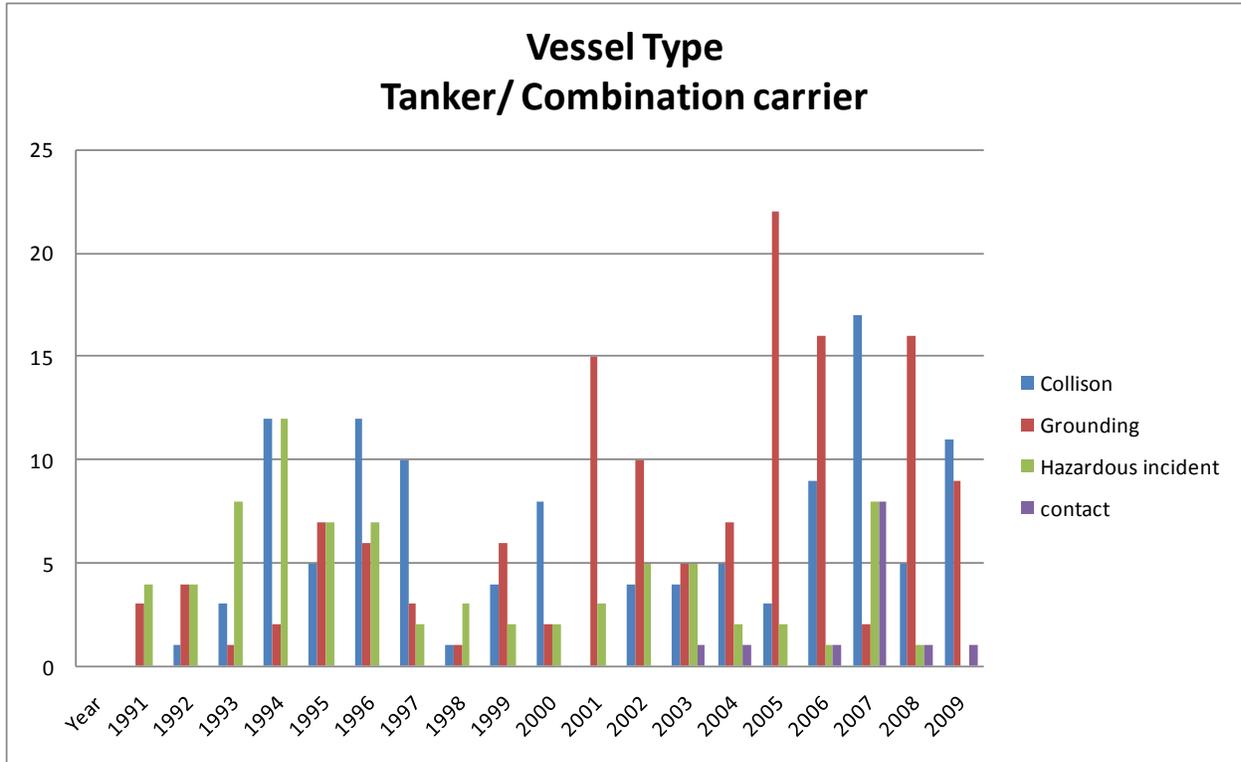
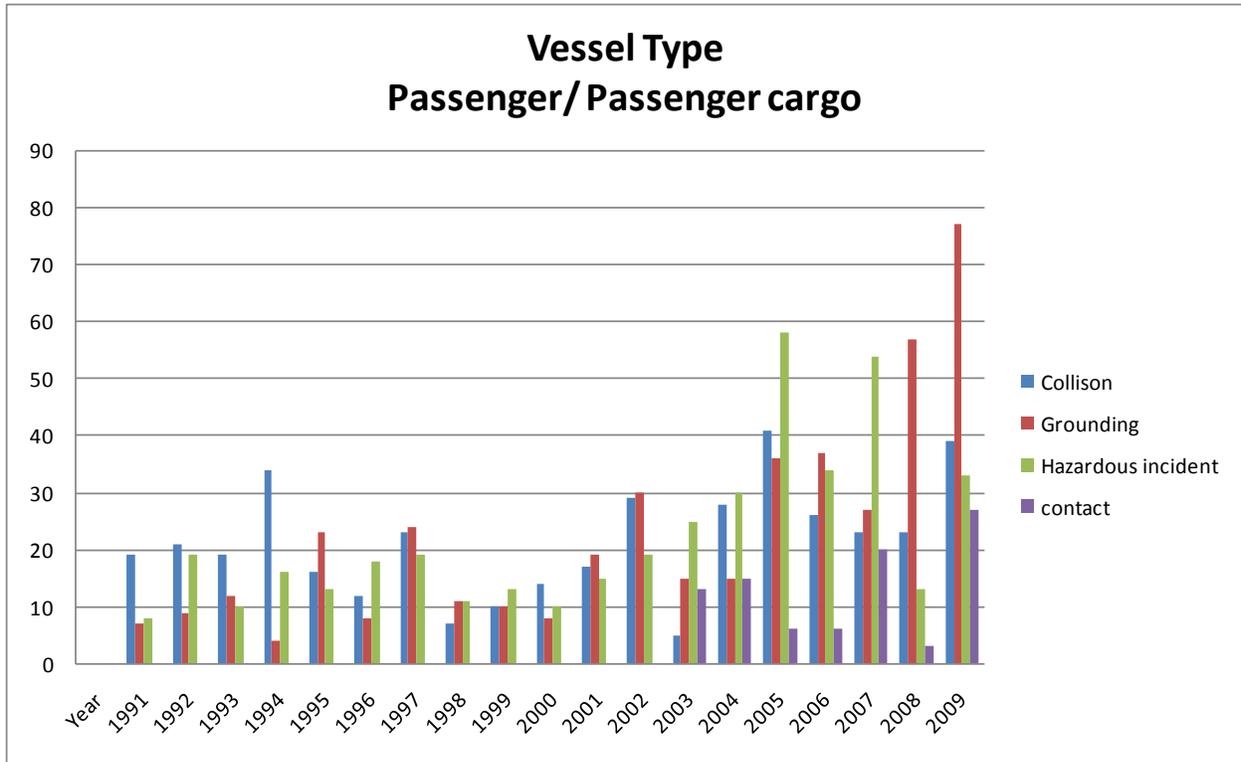


Figure 6-3 Frequency of Incident type – Tanker/Combination carrier



**Figure 6-4 Frequency of incident type- Passenger/Passenger cargo**

Incident type – Coastal waters

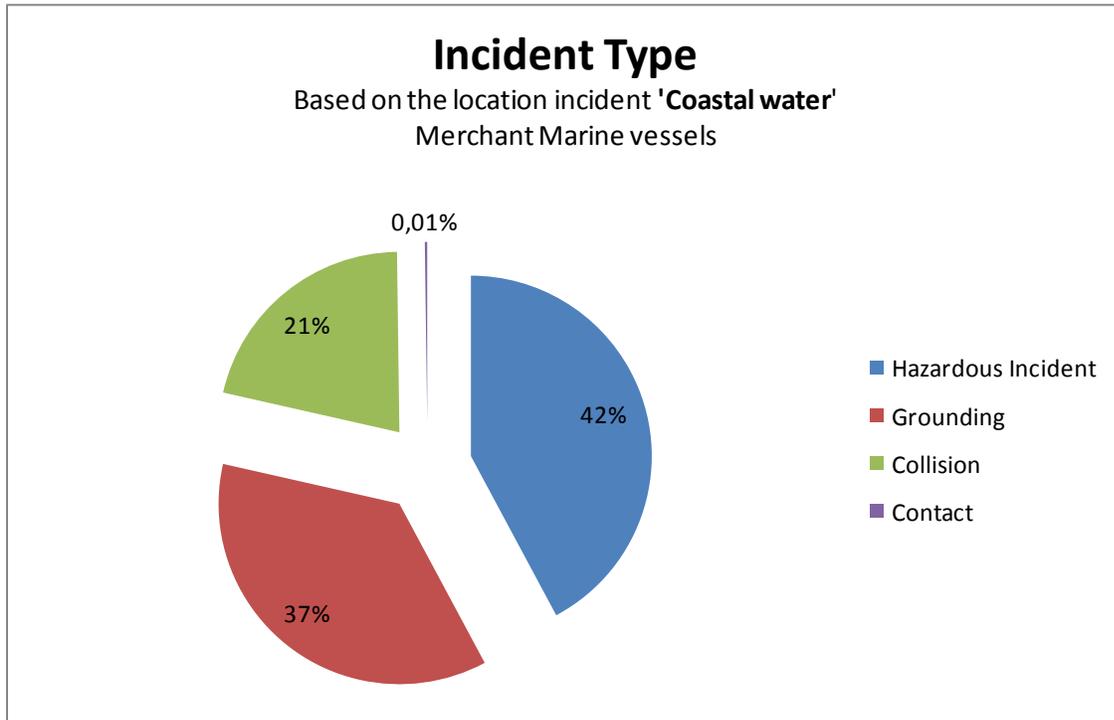


Figure 6-5 Incident Type - Coastal waters

Incident Type - Port/Harbour : statistics are based on the 36% of incidents occurred with Merchant Vessels in the Uk		
Location Of Accident	Incident Type	Frequency
Coastal waters	Hazardous Incident	399
Coastal waters	Grounding	344
Coastal waters	Collision	201
Coastal waters	Contact	2

Incident type – Port/ harbor area

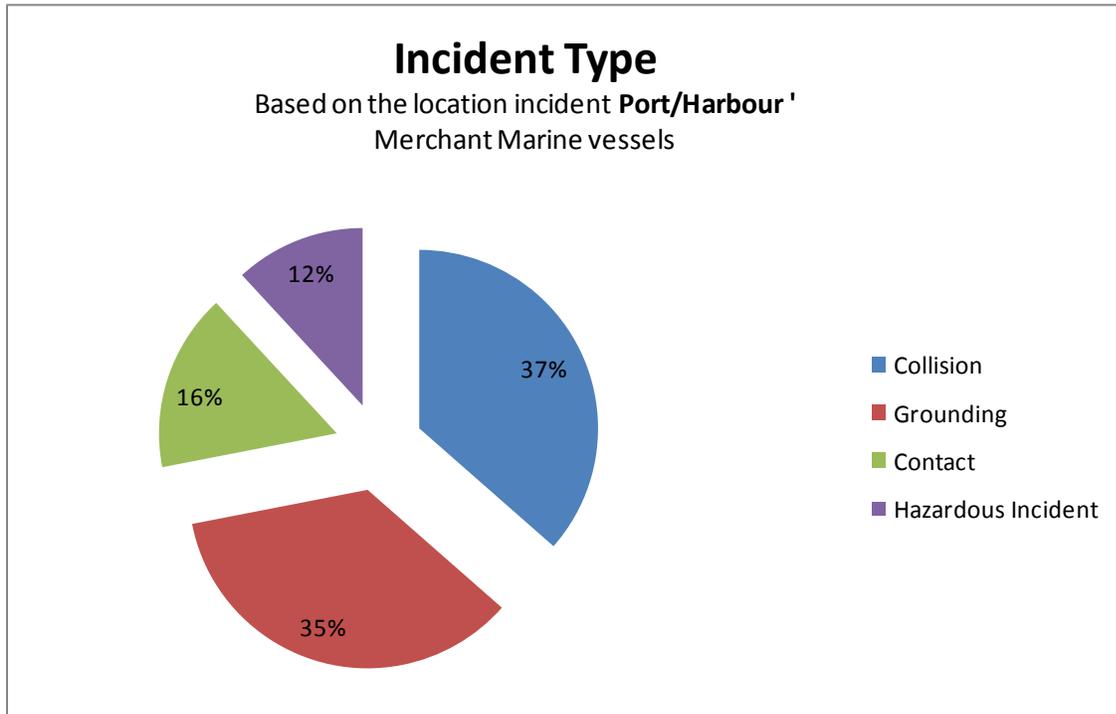


Figure 6-5 Incident Type - Port/harbor area

Incident Type - Port/Harbour : statistics are based on the 29% of incidents occurred with Merchant Vessels in the Uk		
Location Of Accident	Incident Type	Frequency
Port/harbour area	Collision	286
Port/harbour area	Grounding	278
Port/harbour area	Contact	127
Port/harbour area	Hazardous Incident	93

Incident type – High seas

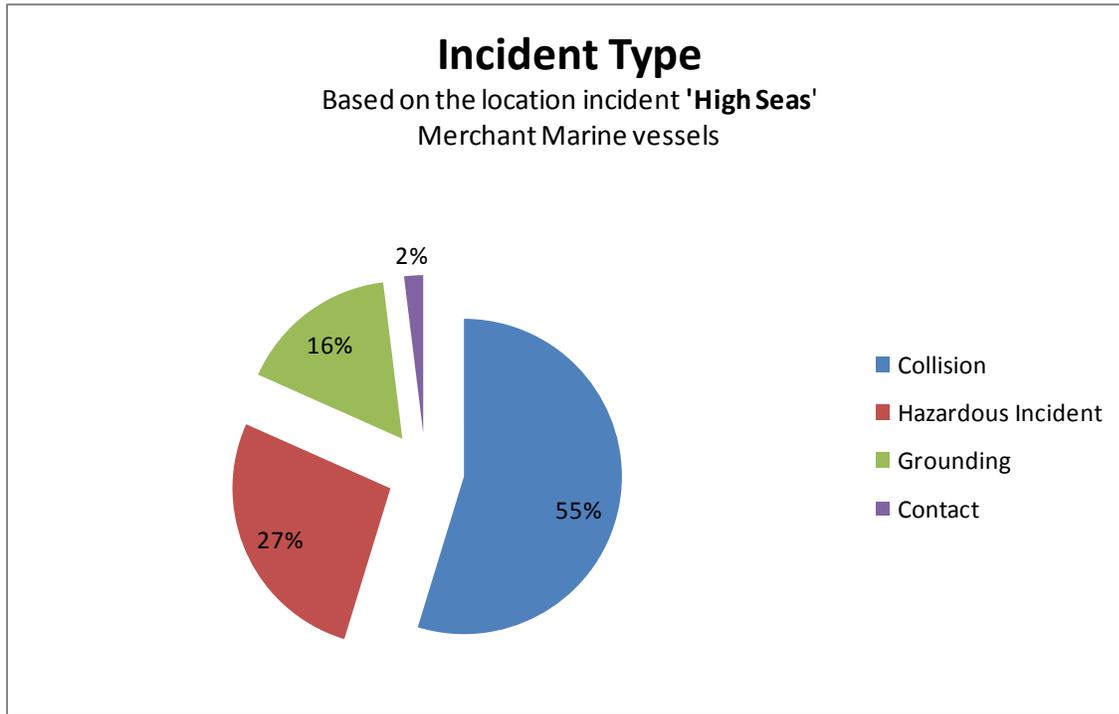


Figure 6-8 Incident type - High seas

Incident Type - High Seas : statistics are based on the 13% of incidents occurred with Merchant Vessels in the Uk		
Location Of Accident	Incident Type	Frequency
High seas	Collision	197
High seas	Hazardous Incident	97
High seas	Grounding	59
High seas	Contact	7

Incident type – River/canal

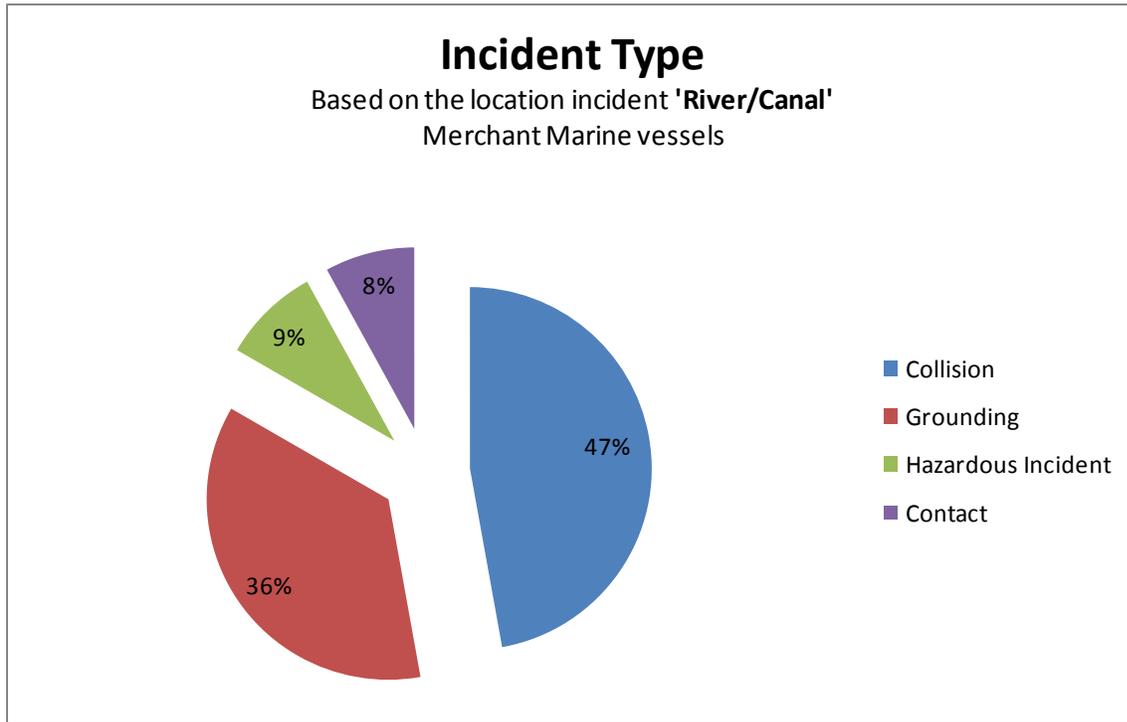


Figure 6-9 Incident type – River/ canal

Incident Type - River/Canal : Statistics are based on the 21% of incidents occurred with Merchant Vessels in the UK

Location Of Accident	Incident Type	Frequency
River/canal	Collision	266
River/canal	Grounding	204
River/canal	Hazardous Incident	49
River/canal	Contact	45

## 7. Where

In this chapter we will study the Frequency of the incidents occurred on one of the locations on board the vessel like navigational space or engine room. We call this the WHERE.

**Where:** Identifies **Where** on the ship the **What** Occurred

**The Involving:** What set of circumstances were involved in the incident

**What:** provides the next level of detail on what the incident involves. What can be hardware, such as an item of equipment or structure, or a human factor, such as a procedural, organizational or behavioral issue; it can also be used to indicate what specific aspect of **the involving** featured in the incident.

*The objective of the Involving tree is to use a number of pre-defined incident factors to describe the sequence of events leading to, during and after an incident and the underlying causes of those events. The standard phrases are in turn split into the headings Involving, **What, How/Why**, linked to the **What** and for **Where** the **What** occurred.*

**Frequency: Count of the Where:** frequency of Incidents occurred on one of these locations

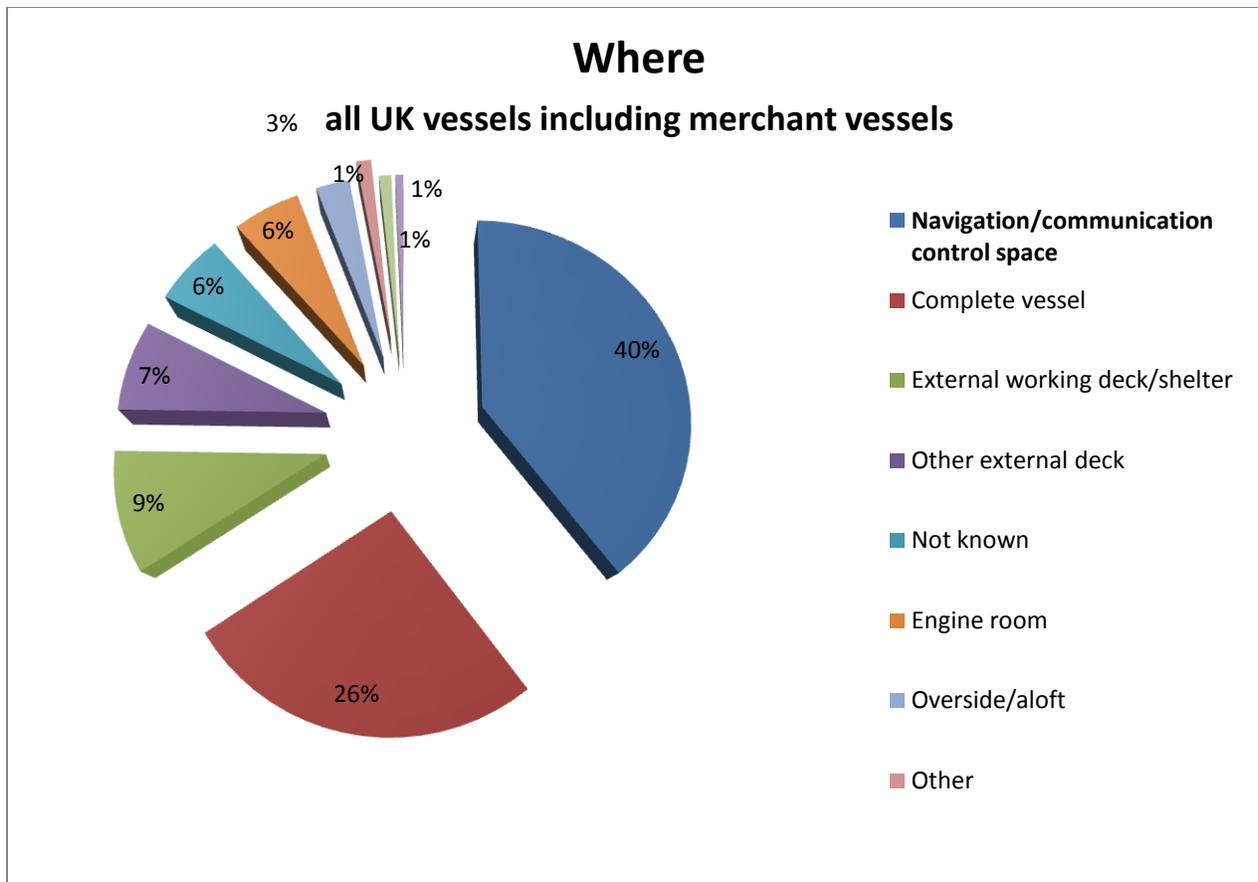


Figure 7-1 Frequency of incidents occurred ' Where' on the ship

Where	Frequency
Navigation/communication control space	351
Complete vessel	230
External working deck/shelter	85
Other external deck	65
Not known	53
Engine room	50
Over side/aloft	25
Other	11
Other internal deck/space	9
Hull structure	6

## 8. What

In this chapter we will study the Frequency of the incidents occurred on one of the locations on board the vessel like navigational space or engine room. We call this the WHERE and what the incident involves. We call this the WHAT

**What:** provides the next level of detail on what the incident involves. What can be hardware, such as an item of equipment or structure, or a human factor, such as a procedural, organizational or behavioral issue; it can also be used to indicate what specific aspect of **the involving** featured in the incident.

*The objective of the Involving tree is to use a number of pre-defined incident factors to describe the sequence of events leading to, during and after an incident and the underlying causes of those events. The standard phrases are in turn split into the headings Involving, **What, How/Why**, linked to the What*

**These statistics are based on the top 10 out of the 183 categories of the How and Why Incidents occurred.**

**Frequency: Count of What:** frequency of Incidents occurred.

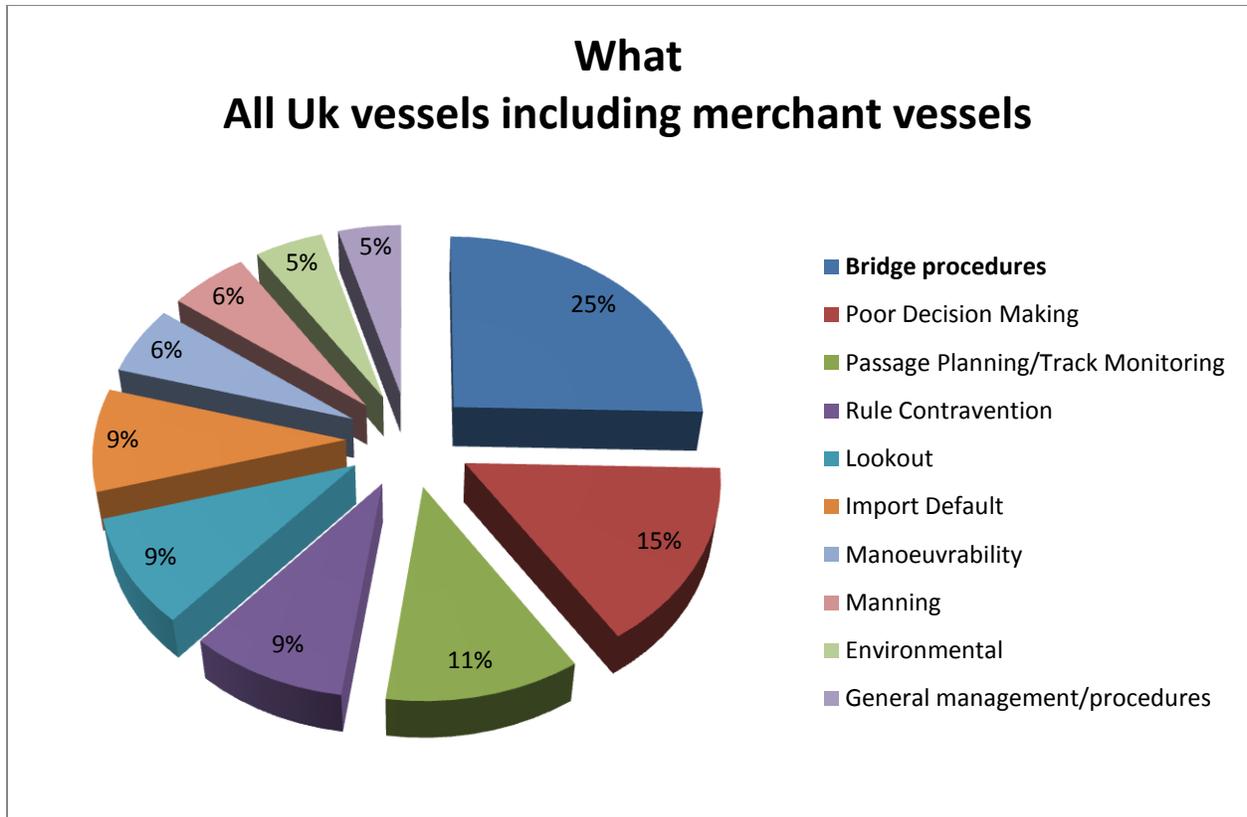


Figure 8-1 What set of circumstances were involved in the incident

What	Frequency
Bridge procedures	1131
Poor Decision Making	686
Passage Planning/Track Monitoring	508
Rule Contravention	411
Lookout	409
Import Default	389
Maneuverability	260
Manning	247
Environmental	215
General management/procedures	197
General - Unsafe practices	164
Communications/Orders	110
Navigational Instruments(Radar, GPS, ECDIS etc)	95

Navigation/Communications equipment	84
Management failure	79
Other	71
Involving Mooring Operations	69
Bridge Environment	63
Machinery Failure	62
Involving Towing Operation	59
Restricted maneuverability	49
Involving Fishing Operations	43
Steering system	39
General management failure	39
Vessel does not respond to the helm	30
Propellers - fixed/controllable pitch	28
Hull structure, bow - forward of the collision/forward most bulkhead	28
Equipment	24
Other flooding	23
Main engine failure	21
Main engine fuel system	19
Main engine control system	19
Safe ship environment	18
Person overboard	17
Massive flooding	17
Bridge Control Equipment	17
Gearing & clutches	14
Hull structure, side mid-length - between the bow and stern structure	12
Means of Access (to and from ship)	11
Main engine cooling system	11
Hull structure, bottom mid-length - between the bow and stern structure	11
Communications/Alarm	11
Poor manoeuvrability	9
Capsize	9
Involving Passenger launch/Workboat operation	7
Hull structure, stern - aft of the aft peak/aft most bulkhead	6

Generators	6
Winch	5
Listing	5
Grounding	5
Shafts & bearings	4
Safety Equipment and Emergency response	4
Progressive flooding	4
Maintenance System	4
Lifejackets/survival suits	4
During Lifting Operation	4
Distribution	4
Deck, other	4
RNLI Lifeboat rescue	3
Life raft	3
Lifeboat/Rescue craft	3
Helicopter rescue	3
Cargo/stores/catch handling	3
Unknown	2
Thrusters/nozzles	2
Rudder(s)	2
Other vessel rescue	2
Hull structure, complete cross section	2
Down flooding	2
Deck, weather deck	2
Subdivision concern	1
Stability/Flooding failure	1
Main machinery	1
Hydraulic system	1
Derricks	1
Crane	1

### What – hazardous incidents – coastal waters

Statistics are based on the incidents that occurred in Coastal waters, for Merchant Marine vessels only. These statistics are based on the 36% of Incidents that occurred in Coastal waters. This is a top 10 of the 24% of The Hazardous incidents, occurred in Coastal waters

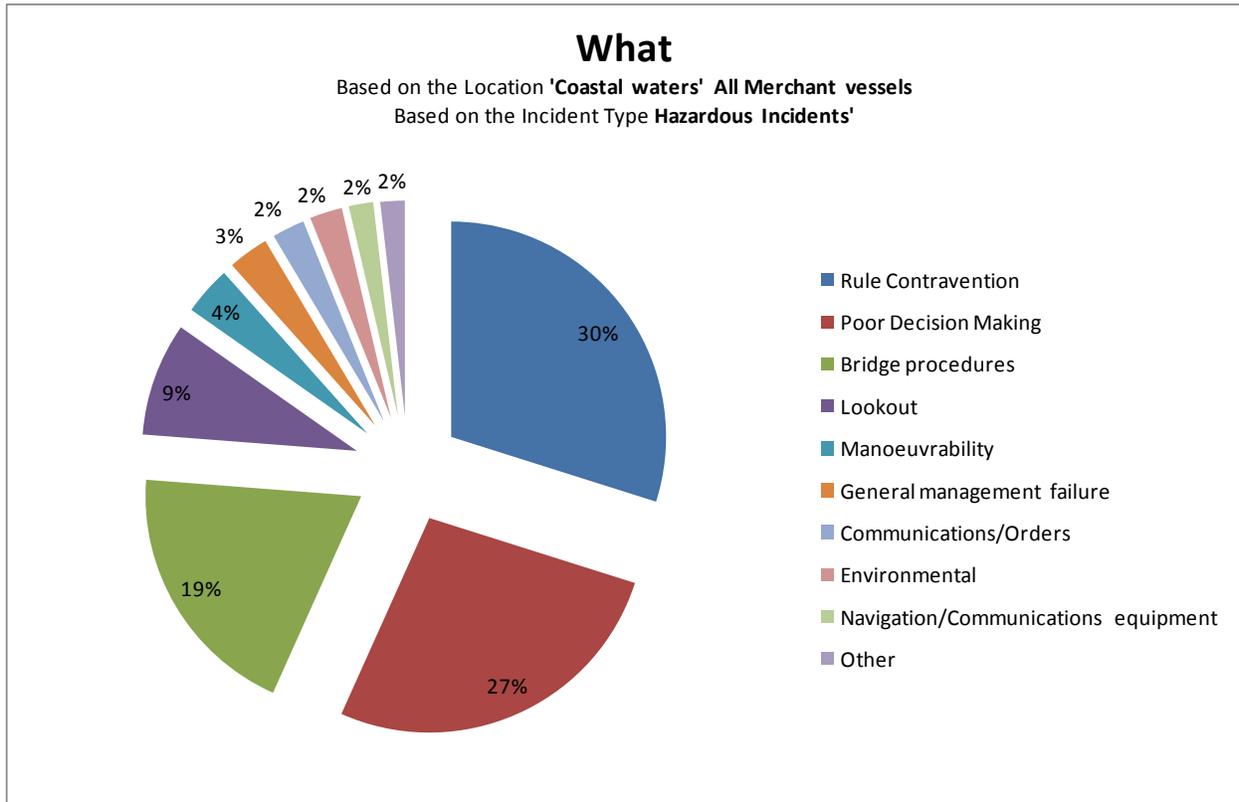
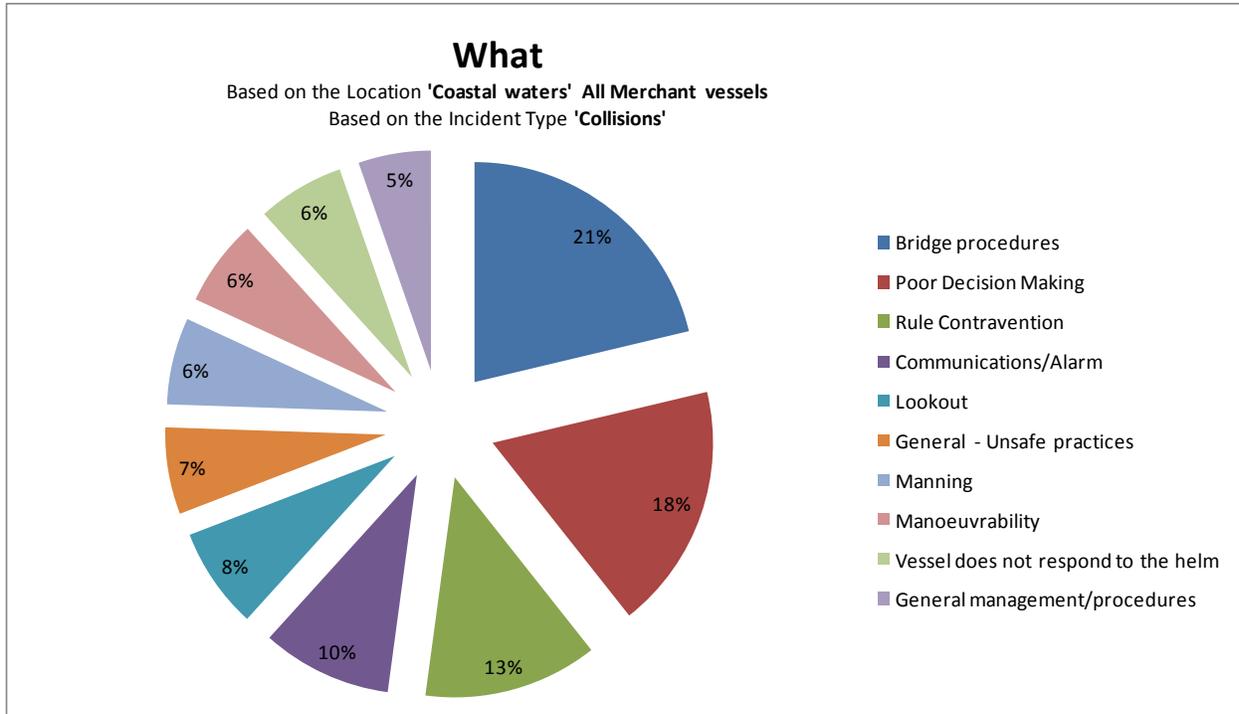


Figure 8-2 what - hazardous incident - Coastal waters

What	Frequency
Rule Contravention	49
Poor Decision Making	44
Bridge procedures	32
Lookout	14
Manoeuvrability	6
General management failure	5
Communications/Orders	4
Environmental	4
Navigation/Communications equipment	3
Other	3

## What – Collision – coastal waters.

These statistics are based on the 36% of Incidents that occurred in Coastal waters. This is a top 10 of the 21% of Collisions, occurred in Coastal waters



**Figure 8-2 What - Collision - Port/ harbor area**

Total Merchant Vessels	Total Frequency
Bridge procedures	20
Poor Decision Making	17
Rule Contravention	12
Communications/Alarm	9
Lookout	7
General - Unsafe practices	6
Manning	6
Manoeuvrability	6
Vessel does not respond to the helm	6
General management/procedures	5

### What – Grounding – Coastal waters

These statistics are based on the 36% of Incidents that occurred in Coastal waters. This is a top 10 of the 33%% of the Groundings, occurred in Coastal waters

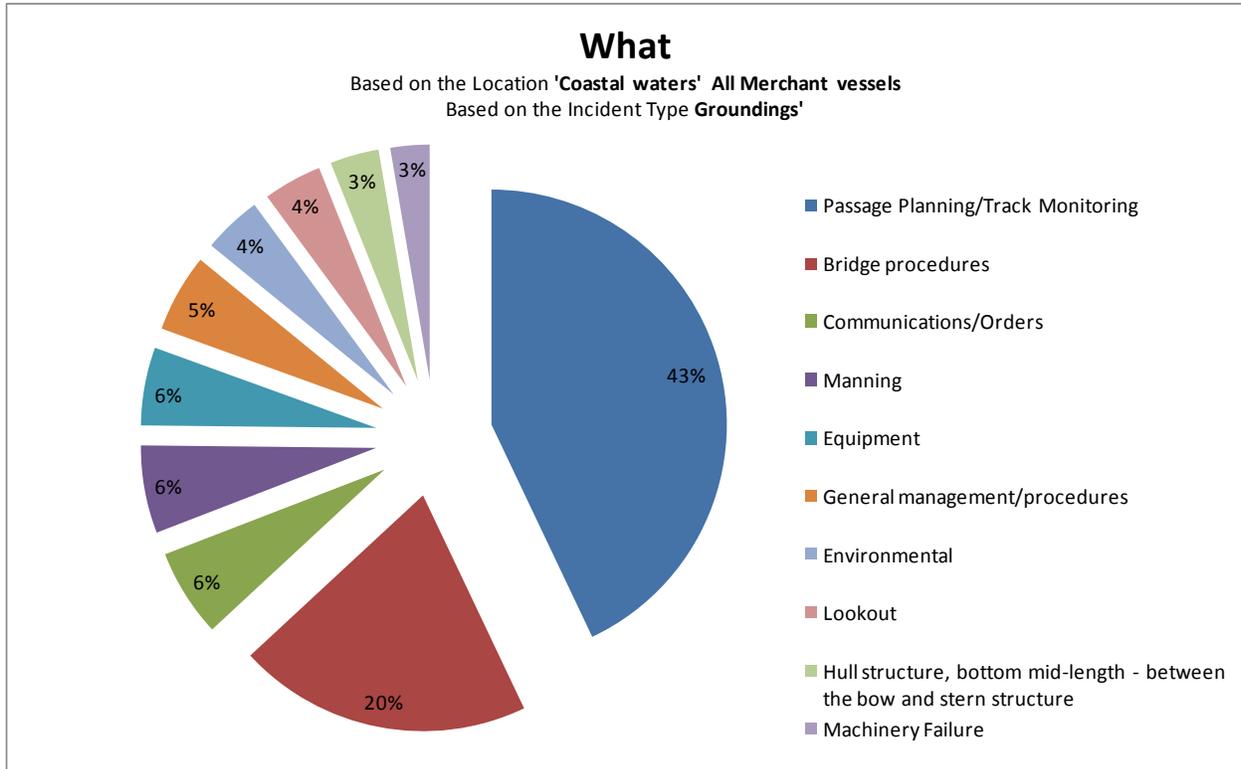


Figure 8-3 What - Grounding – coastal waters

What	Frequency
Passage Planning/Track Monitoring	64
Bridge procedures	30
Communications/Orders	9
Manning	9
Equipment	8
General management/procedures	8
Environmental	6
Lookout	6
Hull structure, bottom mid-length - between the bow and stern structure	5
Machinery Failure	4

# 9. Underlying accident factor Category

Underlying accident factor category are the technical and human factors of the underlying chain of factors that will lead to an incident.

**Underlying (Accident) Factors and sub factors:** These are the technical and human factors often underlying the chain of factors leading to an incident.

**Count of Underlying (Accident) Factors and sub factors:** frequency of the underlying factors and sub factors occurred on board the vessels

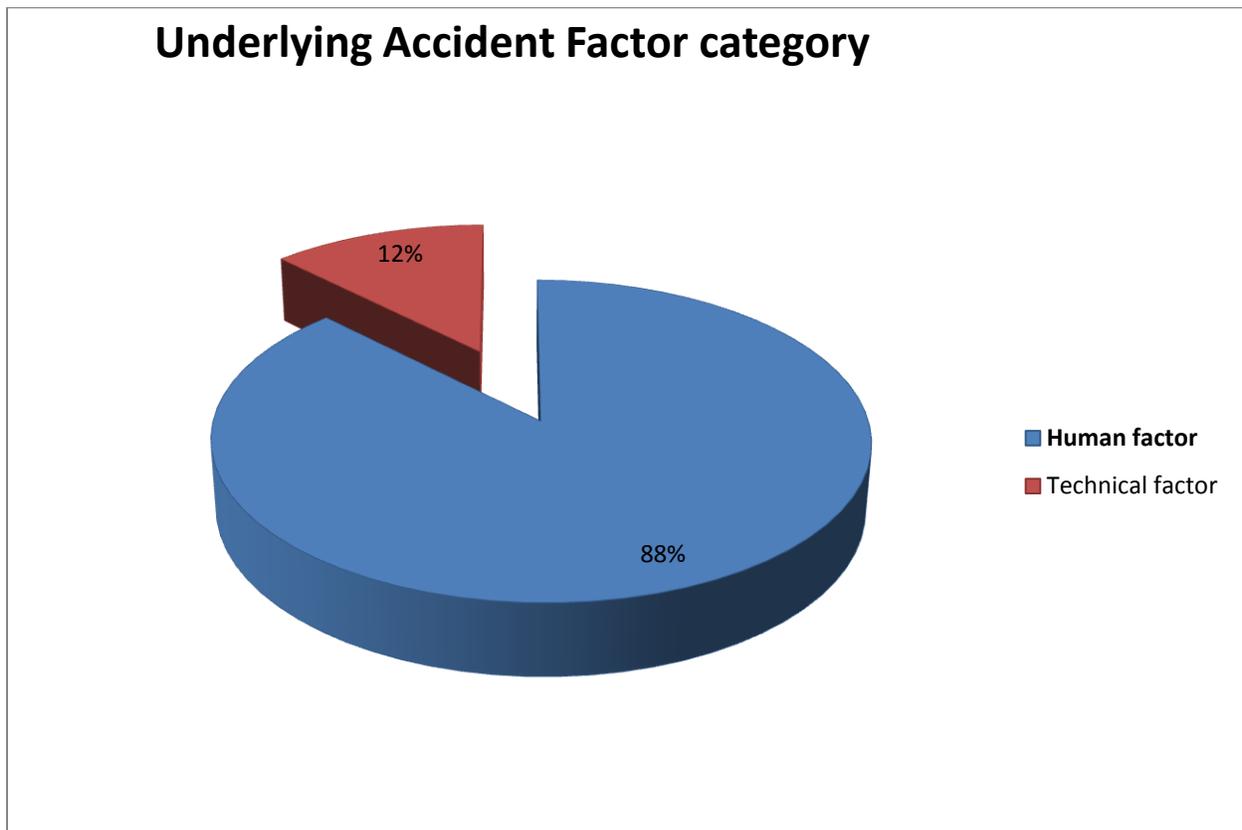


Figure 9-1 Underlying Accident factor

# 10. Underlying accident (sub) factor

The Underlying accident sub factor are the underlying chain of technical or human factors that lead to an incident. In this chapter we will look at the frequency of these factors occurred on board the vessels. For a full list of definitions of all the Human factors see **chapter 13: Human factors Definitions**

**Underlying Factors and sub factors:** These are the technical and human factors often underlying the chain of factors leading to an incident.

**Count of Underlying Factors and sub factors:** frequency of the underlying factors and sub factors occurred on board the vessels

Underlying accident factor will lead to the underlying accident sub factor to fail.

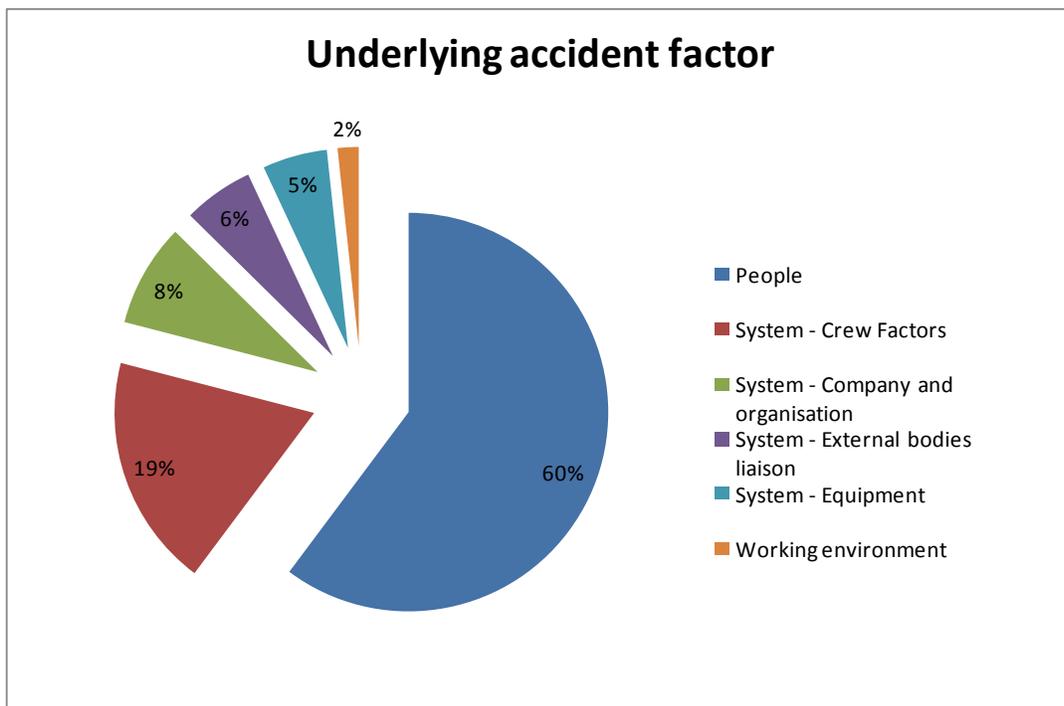
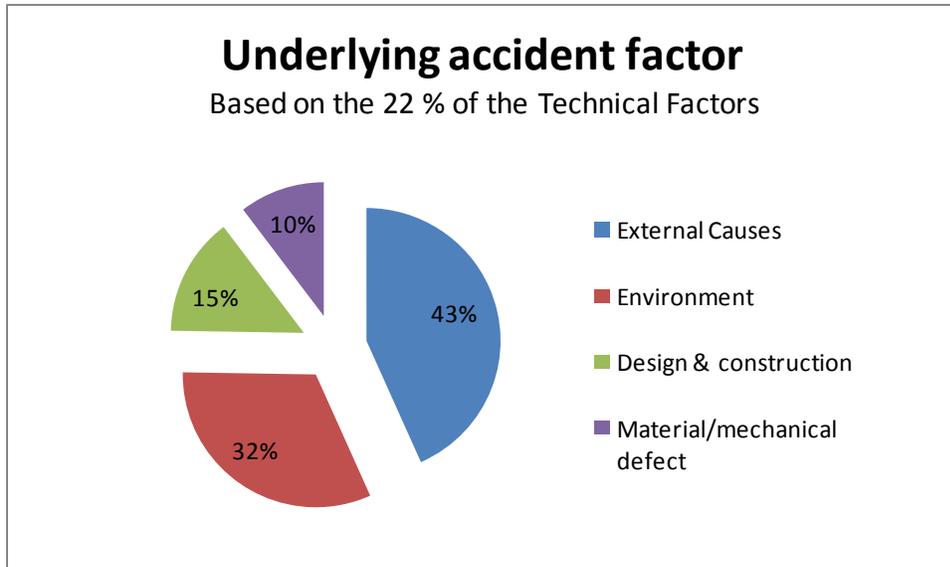


Figure 10-1 Underlying Accident –human factors

Vessel Category	Underlying Accident Factor Category	Underlying Accident Factor	Frequency
Merchant Vessels	Human factor	People	425
Merchant Vessels	Human factor	System - Crew Factors	133
Merchant Vessels	Human factor	System - Company and organisation	59
Merchant Vessels	Human factor	System - External bodies liaison	40
Merchant Vessels	Human factor	System - Equipment	37
Merchant Vessels	Human factor	Working environment	12



**Figure 10-2 Underlying Accident –technical factors**

Underlying Accident Factor	Frequency
External Causes	42
Environment	31
Design & construction	14
Material/mechanical defect	10

# 11. Underlying sub factor

The underlying sub factors are the underlying chain of the accident sub factors leading to an incident.

These statistics are based on the top 10 out of the 102 categories of sub factors.

**Underlying sub factors:** These are the technical and human factors often underlying the chain of factors leading to an incident.

**Frequency: Count of sub factor:** frequency of the sub factors occurred on board the vessels

Underlying accident sub factors will directly lead to the incident.

Statistics are based on the 88% of underlying accidents factor category 'Human factors'

Merchant vessels only

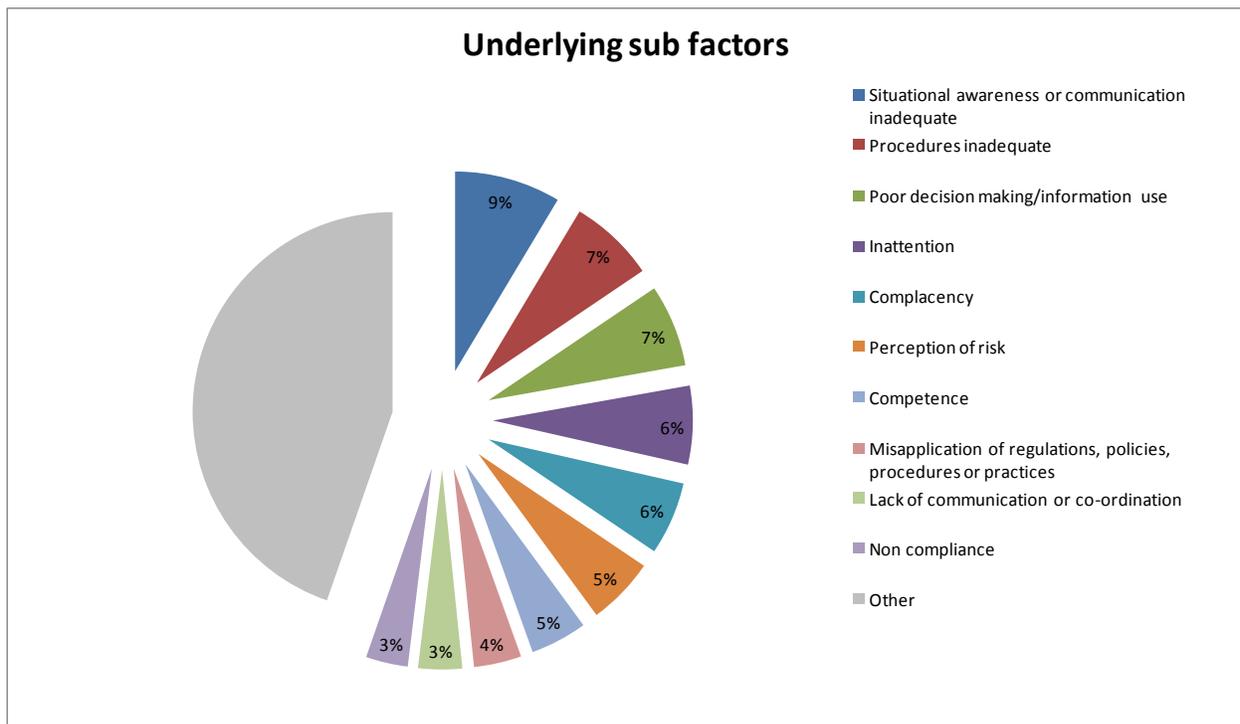


Figure 11-1 Underlying Accident sub factors

## Underlying sub factor – People

Statistics are based on the 88% of underlying accidents factor category 'Human factors'.  
And the underlying accident factor people

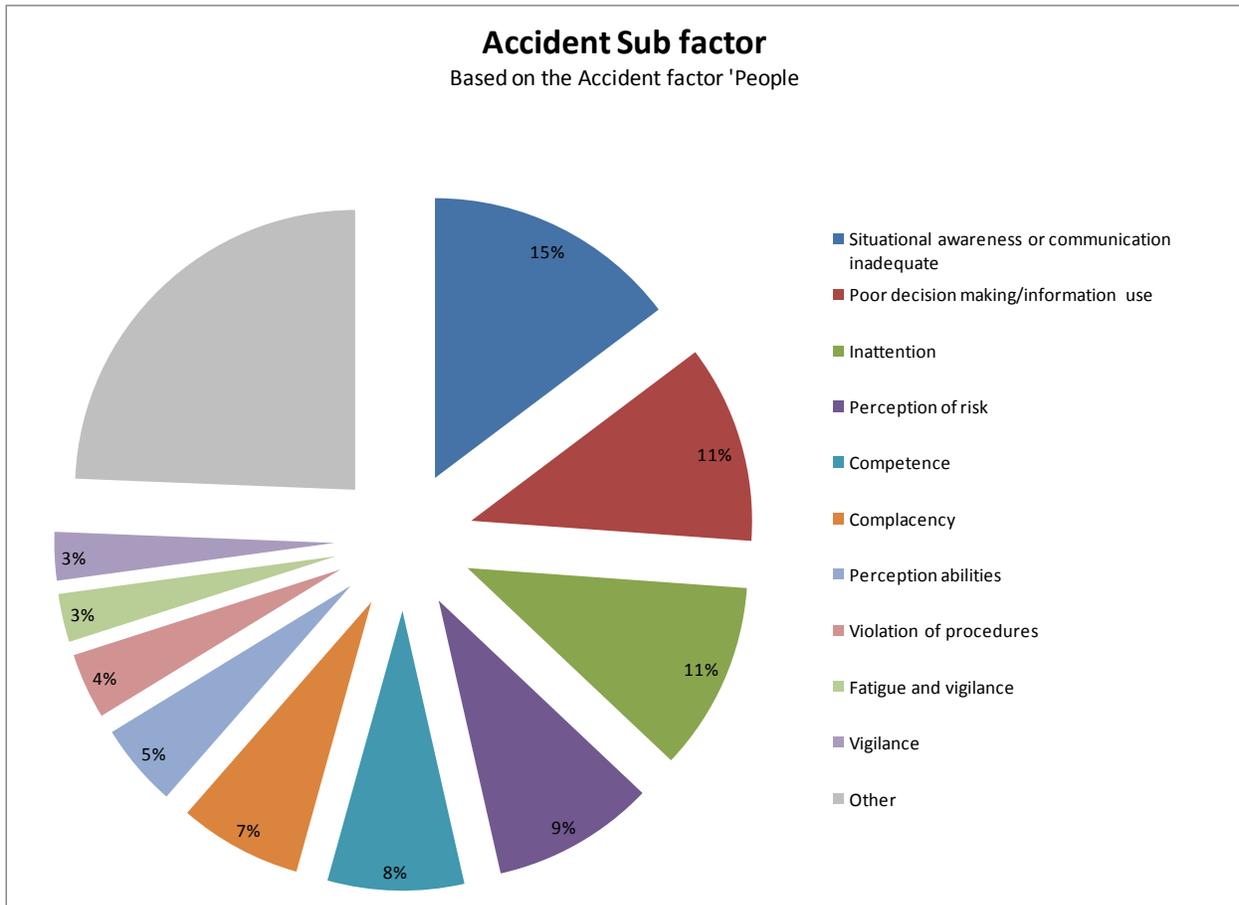
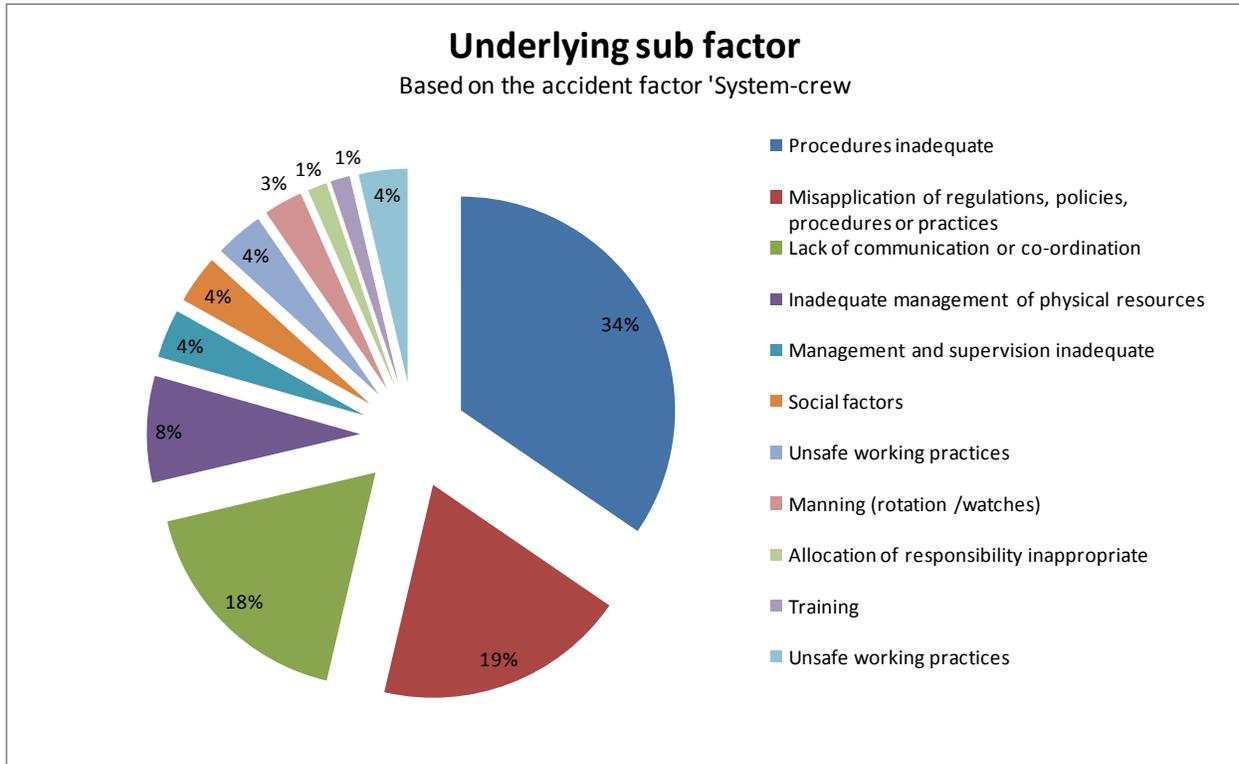


Figure 11-2 Underlying Sub factor - People

Underlying Accident Sub-factor	Frequency
Situational awareness or communication inadequate	58
Poor decision making/information use	45
Inattention	43
Perception of risk	37
Competence	31
Complacency	28
Perception abilities	19
Violation of procedures	15
Fatigue and vigilance	11
Vigilance	11
Other	96
Other Factors	Frequency
Excessive work load	8
Personality	8
Self discipline (lack of)	8
Training, inexperience, knowledge	8
Fatigue	7
Knowledge of regulations/standards inadequate	7
Task difficulty	7
Understimulation	7
Diminished motivation	5
Alcohol use	4
Communication or co-ordination (lack of)	4
Culture	4
Knowledge of ship operations inadequate	4
Training which itself is inadequate	4
Communication, language	2
Physical illness	2
Technical knowledge inadequate	2
Health: drugs/alcohol	1
Health: medical condition	1
Injury	1
Time pressures	1
Unaware of role/task/responsibility	1

## Underlying accident Sub factors – system crew factors

Statistics are based on the 88% of underlying accidents factor category 'Human factors' and the underlying Accident factor 'System-Crew'

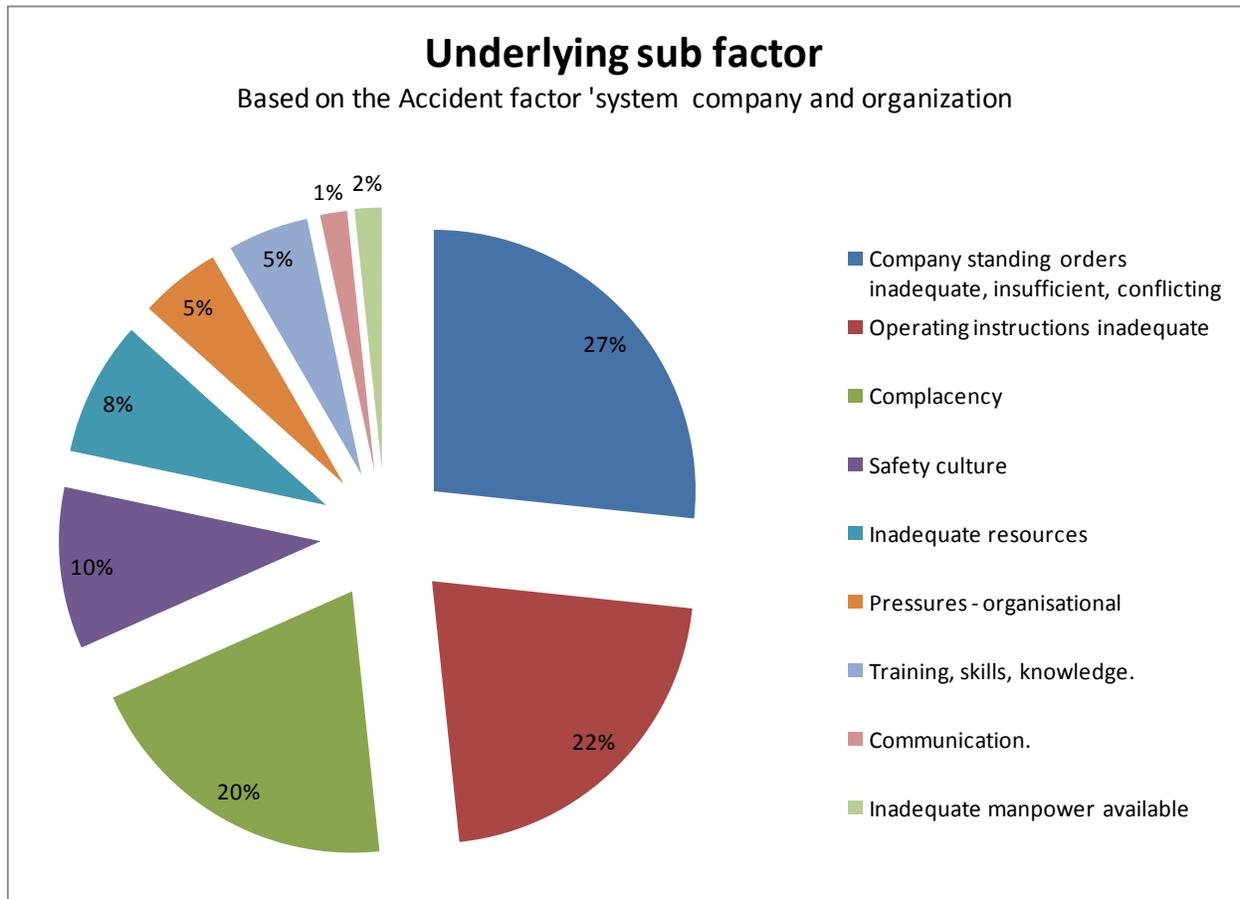


**Figure 11-1 underlying sub factor - System Crew factors**

Underlying Accident Sub-factor	Frequency
Procedures inadequate	47
Misapplication of regulations, policies, procedures or practices	26
Lack of communication or co-ordination	24
Inadequate management of physical resources	11
Management and supervision inadequate	5
Social factors	5
Unsafe working practices	5
Manning (rotation /watches)	4
Allocation of responsibility inappropriate	2
Training	2
Unsafe working practices	5

### Underlying sub factors – System Company and organization

Statistics are based on the 88% of underlying accidents factor category 'Human factors' and the underlying Accident factor 'System-company and organization'.



**Figure 11-2 Underlying sub factors - System Company and organization**

Underlying Accident Sub-factor	Frequency
Company standing orders inadequate, insufficient, conflicting	16
Operating instructions inadequate	13
Complacency	12
Safety culture	6
Inadequate resources	5
Pressures - organisational	3
Training, skills, knowledge.	3
Communication.	1
Inadequate manpower available	1

# 12. How and Why

**How and Why:** In this chapter we will analyze the How or why the hardware or human factor failed.

**These statistics are based on the top 10 out of the 76 categories of the what Incidents occurred.**

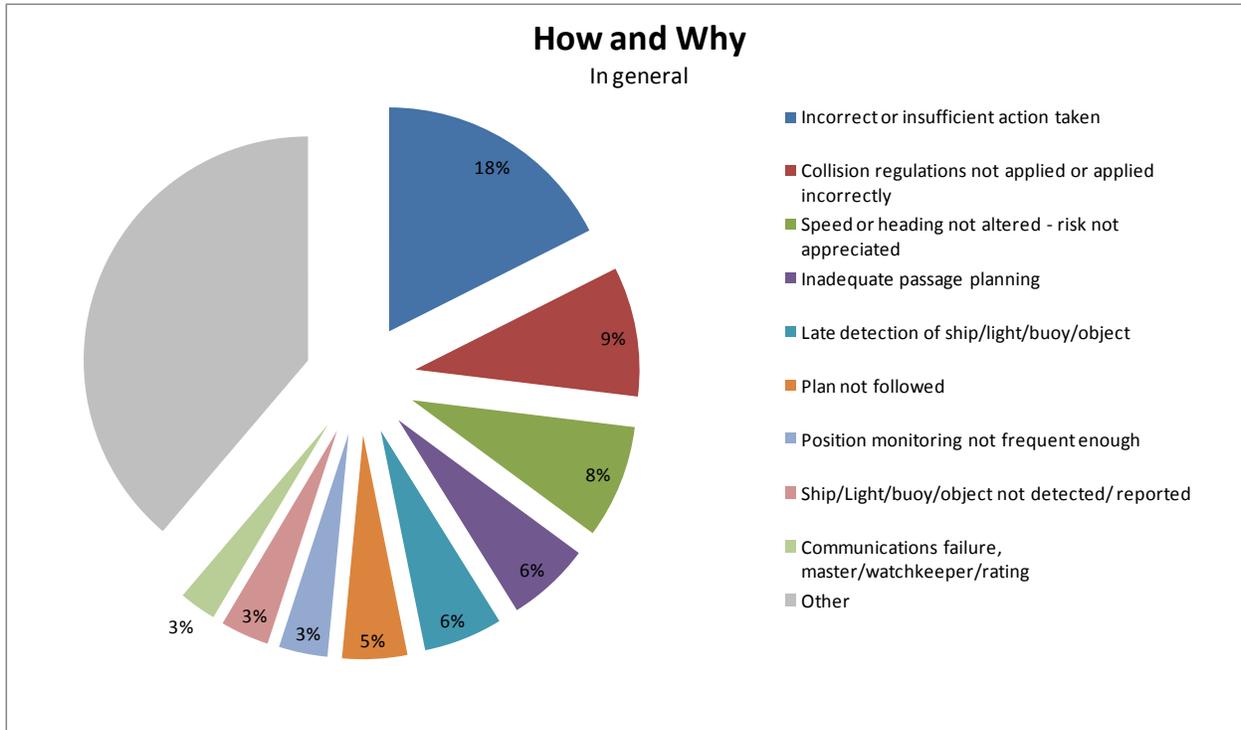
*The objective of the Involving tree is to use a number of pre-defined incident factors to describe the sequence of events leading to, during and after an incident and the underlying causes of those events. The standard phrases are in turn split into the headings Involving, **What, How/Why**, linked to the **What** and for **Where** the **What** occurred.*

**The Involving:** What set of circumstances were involved in the incident

**What:** provides the next level of detail on what the incident involves. What can be hardware, such as an item of equipment or structure, or a human factor, such as a procedural, organizational or behavioral issue; it can also be used to indicate what specific aspect of **the involving** featured in the incident.

**Where:** Identifies **Where** on the ship the **What** Occurred

**Count of How and Why :** frequency of Incidents .



**Figure 12-1 Why the Human factor failed**

How/Why	Frequency
Incorrect or insufficient action taken	105
Collision regulations not applied or applied incorrectly	56
Speed or heading not altered - risk not appreciated	49
Inadequate passage planning	36
Late detection of ship/light/buoy/object	34
Plan not followed	28
Position monitoring not frequent enough	21
Ship/Light/buoy/object not detected/ reported	21
Communications failure, master/watchkeeper/rating	16
Other	232
Other Categories	Frequency
Use of chair at control station	15
No positions fixed	14
Speed - too fast for conditions	14
Communication failure, master/pilot	13
Position monitoring inaccurate	12
Conditions had greater effect than expected	11
Communication (2-way) not encouraged	9
Ship/light/buoy/object incorrectly identified/reported	9
Company, master's or other orders not followed or followed incorrectly	8
Features/functions/alarms not used or used incorrectly	8
No, or inadequate, master's orders	8
Lack of role monitoring	6
Other regulation, code or guidance not applied or applied incorrectly	6
Inappropriate roles allotted	5
No lookout posted	5
Safety management system failure	5
Sole watchkeeper	5
Veers off course	5
Chart incorrect	4
Company, master's or other orders not followed or followed incorrectly	4
Individual takes inappropriate role	4
Lack of leadership	4
No helmsman used	4
Visibility poor from control position	4
Inadequate organisation	3
Instrument not used	3
Perception of risk	3
Poor visibility in fog/mist/rain/snow etc	3
Positions not checked by another method or person	3
Verbal order or instruction not understood/misinterpreted	3

**How and Why the incident occurred- situational awareness or communication inadequate** Statistics are based on the 88% of underlying accidents factor category 'Human factors' and the underlying Accident sub factor 'People', followed by the underlying sub factor 'Situational Awareness or communication inadequate' .

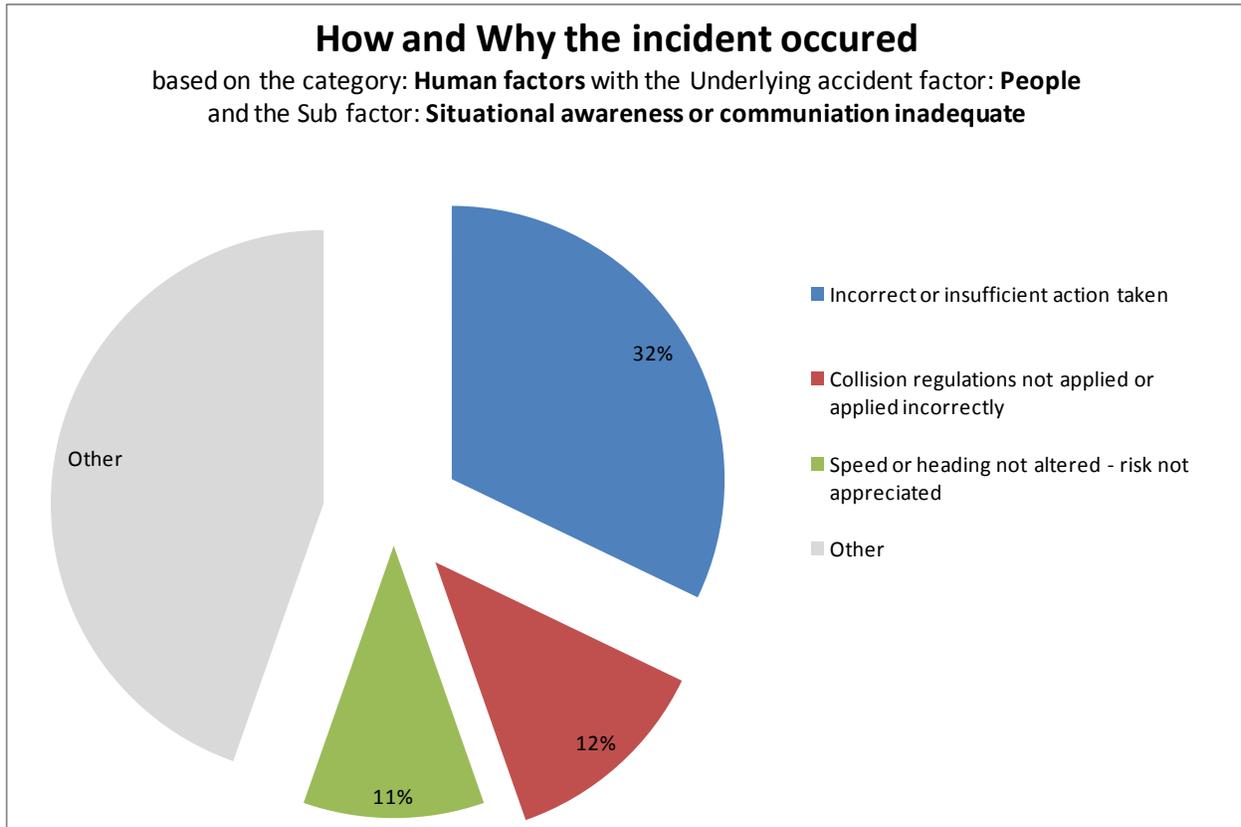


Figure 12-2 How and Why situational awareness or communication inadequate

How/Why	Frequency
Incorrect or insufficient action taken	18
Collision regulations not applied or applied incorrectly	7
Speed or heading not altered - risk not appreciated	6
Other	25
Other categories	Frequency
Inadequate organisation	4
Ship/light/buoy/object incorrectly identified/reported	4
Plan not followed	3
Position monitoring inaccurate	3
Position monitoring not frequent enough	3
Company, master's or other orders not followed or followed incorrectly	2
Communication failure, master/pilot	1
Late detection of ship/light/buoy/object	1
No positions fixed	1
Other regulation, code or guidance not applied or applied incorrectly	1
Speed - too fast for conditions	1
Use of chair at control station	1

## How and Why the incident occurred- poor decision making/information.

Based on the category: Human factors with the Underlying accident factor: People and the Sub factor: Poor decision making / information use

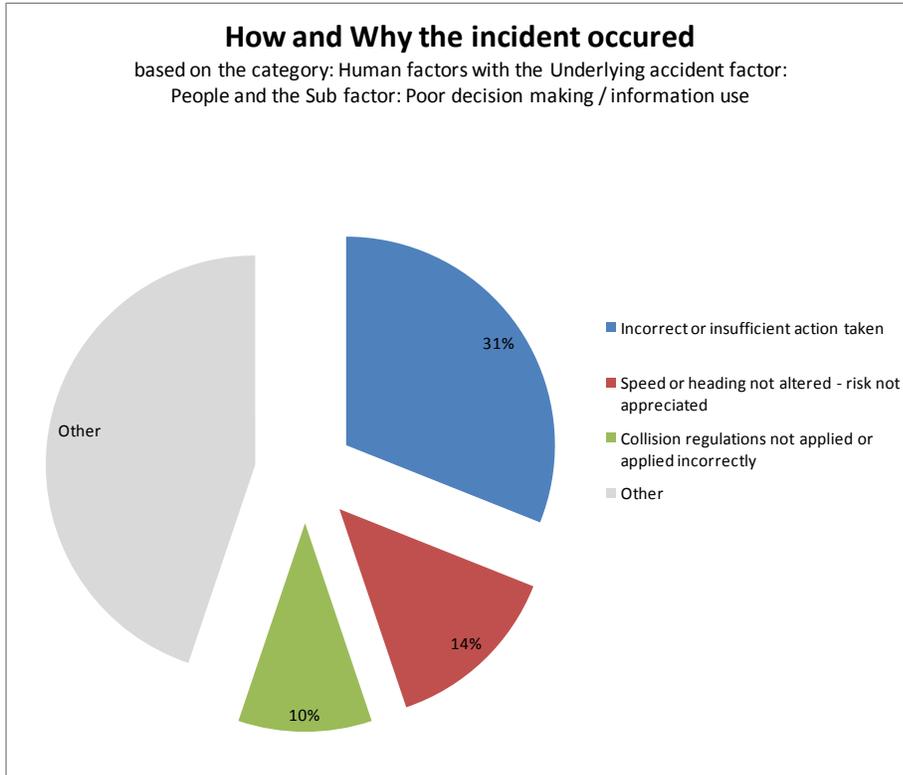


Figure 12-3 How and Why - **poor decision making/information**

How/Why	Frequency
Incorrect or insufficient action taken	9
Speed or heading not altered - risk not appreciated	4
Collision regulations not applied or applied incorrectly	3
Other	13
<b>Other categories</b>	
Communication (2-way) not encouraged	2
Chart incorrect	1
Conditions had greater effect than expected	1
Inadequate passage planning	1
Inappropriate roles allotted	1
Late detection of ship/light/buoy/object	1
No helmsman used	1
Plan not followed	1
Positions not checked by another method or person	1
Ship/Light/buoy/object not detected/ reported	1
Speed - too fast for conditions	1
Veers off course	1

## How and Why the incident occurred- inattention

Based on the category: Human factors with the Underlying accident factor: People and the Sub factor: Poor decision making / information use

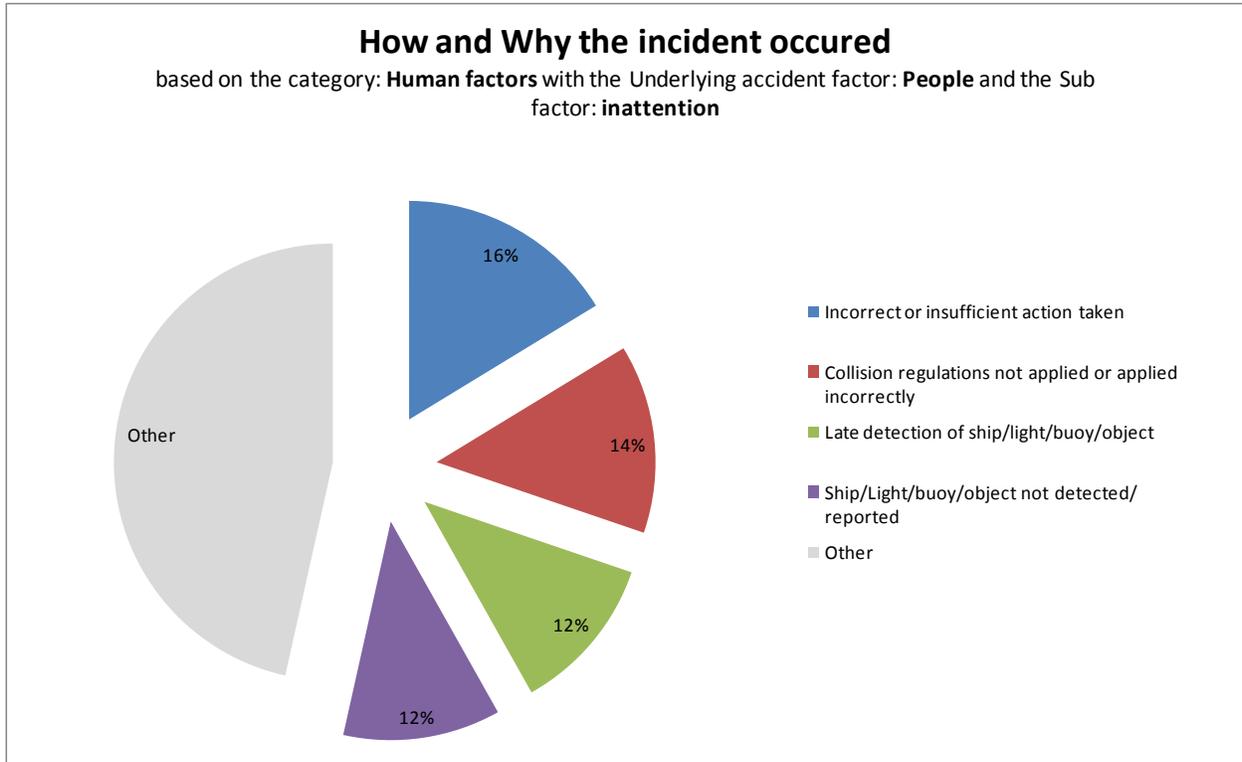


Figure 12-4 How and Why - **inattention**

How/Why	Frequency
Incorrect or insufficient action taken	7
Collision regulations not applied or applied incorrectly	6
Late detection of ship/light/buoy/object	5
Ship/Light/buoy/object not detected/ reported	5
Other	20
Other categories	Frequency
Communication failure, master/pilot	2
Position monitoring inaccurate	2
Ship/light/buoy/object incorrectly identified/reported	2
Speed or heading not altered - risk not appreciated	2
Communication failure, master/pilot	1
Communications failure, master/watchkeeper/rating	1
Company, master's or other orders not followed or followed incorrectly	1
Conditions had greater effect than expected	1
No positions fixed	1
Perception of risk	1
Plan not followed	1
Poor visibility in fog/mist/rain/snow etc	1
Position monitoring not frequent enough	1
Speed - too fast for conditions	1
Use of chair at control station	1
Watchkeeper unfit for duty	1

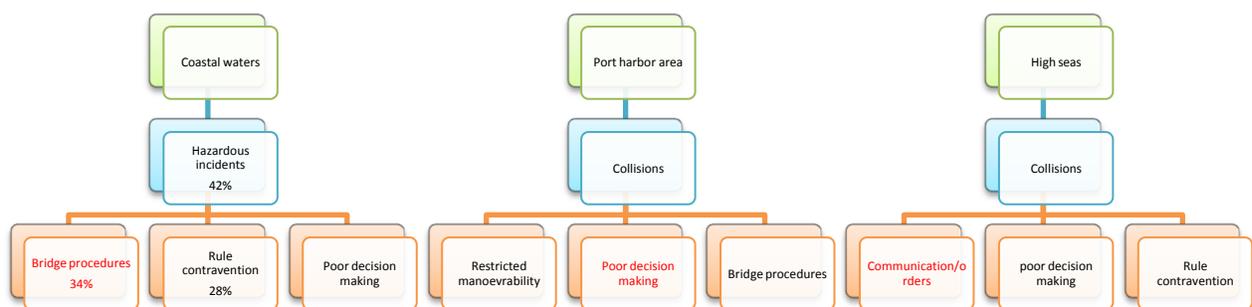
# 13. Conclusion

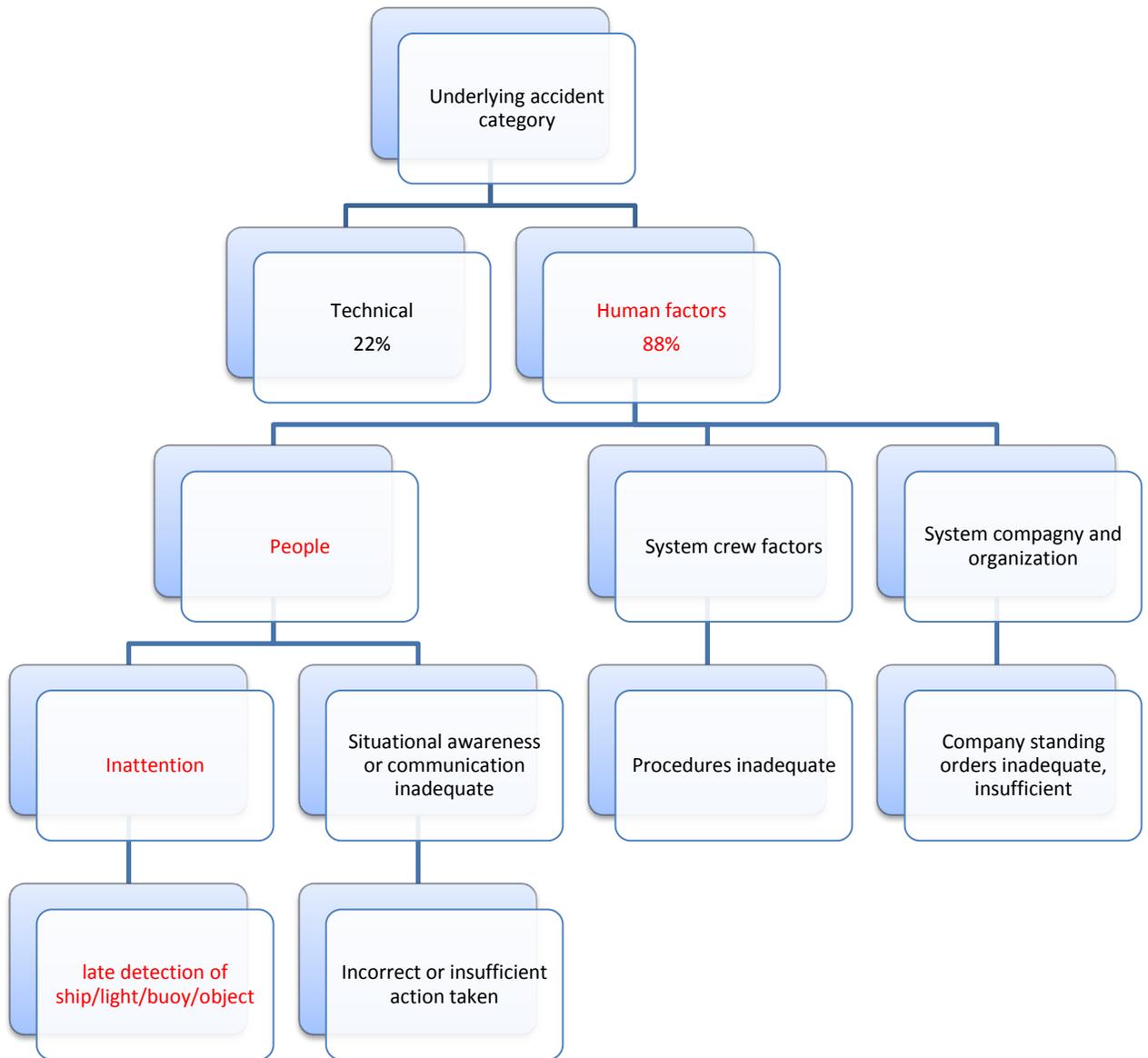
We carried out analyses to identify the most critical dangerous/ emergency cases issues that can be used in developing scenarios to develop the training approach and content.

For the first 6 chapter we can conclude that the best possible scenario for set up a training approach will be In **Coastal waters**, involving a **Hazardous incident or Grounding**.

The second perfect based scenario will be in a **port or harbor area involving grounding**.

For a training scenario based on an incident that will occur on high seas the perfect based incident type to practice will be a collision.





**The perfect emergency training scenario will be a scenario based on all these highest percentage of underlying accident/sub factors**

# 14. Human Factor Definitions

SYSTEM The system envelopes external bodies, company organization and equipment.

SYSTEM - EXTERNAL

BODIES LIAISON External bodies influence shipboard operation which leads to incident.

Certificate fraud Fraudulent documents. Eg forged certificates of competency.

Poor regulations, policies,  
or practices

Poor regulations, policies, procedures or practices:

any problem with standards, regulations, policies, procedures or practices may be conflicting,

inaccurate, inadequate, lacking in sufficient detail, or outdated.

SYSTEM - COMPANY

ORGANISATION

For any vessel, the way it operates, its organizational structure, and safety culture, will be

greatly influenced by the company it belongs to. The influence of management factors on the

potential for incidents is recognized as important. (E.g. ISM Code). This section of the classification scheme allows for those management failures contributing to the

occurrence of

the incident event to be classified. Often the owner/company is the master- fishing vessels.

This may impact on the classification under either Company Organization or Crew Factors

category. For example, masters and company standing orders are the same under these

circumstances. In this case classification is suggested as follows: - where problem is a matter

of general policy and would be relevant even if someone took over from the master, then it is

classified as a company issue. - Alternatively, where the problem is specific to the master/owner then this is classified as a crew issue.

Complacency Organization is inappropriately satisfied with a standard of performance

Company standing orders

inadequate

The policy, standards, and to some extent procedures may all contribute to the incident.

For

example company standing orders may be inadequate, insufficient/conflicting or safety procedures that may be in place may not be operated, e.g. ISM in place but not

observed or

operated.

Inadequate manning Staff establishment insufficient to ensure that all required tasks can be performed by properly

certificated personnel with necessary skills level, experience, physical and mental abilities.

Inadequate manpower available

Not assigning, or not ensuring the availability of, adequate personnel with appropriate skill

levels to a ship, or to a specific task aboard the ship, to ensure safe and efficient operation.

Inadequate resources

The resources needed to complete the job effectively and safely will involve time, finance and

personnel. This category is primarily concerned with manning. E.g. Inadequate time is allowed

for crew hand-over to a new crew, or pressures of a turnaround time in port means that the

crew do not have sufficient rest breaks. Insufficient resources in terms of emergency equipment are not provided for emergency operation although legislative requirements are met.

The ship fails to carry adequate spares.

Operating instructions

inadequate Procedure and instructions incorrect, ambiguous or misleading leading to errors in performance

Pressures - organizational

Pressures on master and crew which originate from the company to meet certain requirements.

Other pressures can arise as a result of master's operational policy. E.g. Need to meet tide and

berthing requirements or pressure due to inadequate resourcing leading to master bypassing

company procedures.

Safety culture Characteristics of large-scale bodies (operating companies, industry sectors) that influence the

approach taken to safety issues.

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SYSTEM - CREW

FACTORS

On board ship, the interaction of the crew, the internal organization and the way in which

individuals work together as a team, all impact on the likelihood of a human error. Often the

owner/company is the master- fishing vessels. This may impact on the classification under

either Company Organization or Crew Factors category. For example, masters and company

standing orders are the same under these circumstances. In this case classification is suggested

as follows: - where problem is a matter of general policy and would be relevant even if someone took over from the master, then it is classified as a company issue. -

Alternatively,

where the problem is specific to the master/owner then this is classified as a crew issue.

Inadequate management of

physical resources

Poor management of physical resources, namely the tools, equipment, supplies, facilities, food,

water, fuel, etc, needed to perform tasks. Examples of faulty management of physical resources

include: absence of physical resources, shortage of physical resources, physical resources

stored improperly, physical resources difficult to obtain when needed.

Failure to maintain

discipline

Failing to ensure that personnel submit to authority, regulations and procedures.

Examples

include: tolerating unqualified or inept personnel, not enforcing regulations and procedures,

tolerating insubordination.

Misapplication of

regulations, policies,

procedures or practices

The application of standards, regulations, policies and procedures, or practices at an incorrect

time, or in inappropriate circumstances.

Procedures inadequate Standing orders do not give sufficient information, or they are open to misinterpretation or

misunderstanding.

Social factors Characteristics of interaction within small groups or teams.

SYSTEM - EQUIPMENT Equipment of the vessel.

Equipment badly

maintained

Planned maintenance is not carried out, or regular checks to see if maintenance work is required are not completed. Sufficient spares may not be carried. Alternatively, poor

maintenance may result because personnel on board do not have the required

knowledge to

complete the maintenance tasks.

Equipment misuse Intentional abuse of equipment provided or an over use. E.g.VHF radio or equipment is on

board the vessel but is not used for the purpose intended.

Equipment not available Equipment not available to complete task safety or to ensure installation is fit for purpose.

Lack of spare gear.

Equipment poorly designed  
for operational use

Single piece of equipment not designed to support the range of tasks it was intended to be used

for. Includes poor software display design.

Poor human factors design

Specifying job or task requirements which were unreasonable, inefficient, impossible, excessive, or impractical. Examples include: excessive watch duration or frequency, requiring

a single operation to monitor simultaneously displays that are spatially separated, requiring

exposure to hazardous materials without protective gear.

Personnel unfamiliar with  
equipment/not trained in use

Personnel may operate equipment incorrectly or be unable to operate it at all because they are not trained to use it.

System logic

Characteristics of a computer-based systems, inherent in logic of software rather than display

design, that makes prediction of system behavior difficult & impedes understanding of system states.

WORKING

ENVIRONMENT

This is in effect the vessel, which provides the context in which the crew must work and live.

External environment cannot be controlled but will have an effect on the performance of personnel. There are also internal environmental factors which can be controlled, changed and

modified. This is the work environment context in which the individual and crew must carry

out their tasks. It relates to on boards ship and any factors arising during unloading and unloading in port. This section records issues which may have occurred as a result.

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Accommodation Layout of accommodation and its associated general housekeeping can lead to incidents.

Humidity Can cause reduced levels of performance and discomfort of individual. Can lead to distraction

from task in hand. Can reduce work capacity of the individual.

Noise

Performance degraded by noise, either due to persistent noises, e.g. nuisance alarms, accommodation fan noise etc. Also alarms which are not useful because for example low noise

threshold. E.g. a persistent nuisance alarm may lead to a level of noise on the bridge such that

it is difficult to hear communications from the engineered accurately.

Poor husbandry Slipping tripping and falling hazards may result from poor housekeeping. Dirty bilges, removal

of lagging of exhaust pipes may result in fire for example.

Ship movement weather

conditions Element that is difficult to control but can radically affect performance.

Temperature High or low temperatures affect performance and working conditions i.e.

slipping incidents in

ice conditions.

Vibration Excessive vibration impact on quality of sleep and health.

Visual environment

An adequate visual environment is critical for many tasks. Not only for the lookout or view

from the bridge but also for the range of tasks to be carried out which fail due to: inadequate or

incorrect lighting to supplement natural daylight or lighting for working in darkness, or failure

to provide natural light.

Two categories of problems arising in the visual environment:

Lighting: failure to provide adequate lighting for the tasks to be carried out.

Example: lighting in the chart room is inadequate for accurate color rendering or reading detail.

Visibility: poor visibility where good visibility is usually required, for example the visibility from the bridge, or the visual field where the lookout is normally posted.

Hazardous natural environment

A situation in which the natural environment causes required tasks to become more difficult

than usual. Examples include storms, high waves, shallow water, severe shoaling, strong

currents or tides, ice, rock, submerged wrecks, severe eddies, ship traffic, wind, fog, mist, rain,

snow, sleet, haze, dust and airborne debris.

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**PEOPLE** An individual related to the investigation.

### **Alcohol use**

Consumption of alcoholic beverages which diminishes an individual's ability to perform tasks.

This includes drinking on or too close to duty which can impede an individual's abilities; drunkenness on duty; excessive drinking over a long period of time, which results in a permanent decrease in mental abilities.

### **Competence**

Not competent to carry out the duties assign. This may arise for a variety of reasons such as a crewmember may be certificated but not actually competent to level prescribed on the certificate.

**Complacency** Individual is inappropriately satisfied with a standard of performance

**Culture** Characteristics derived from nationally ethnic backgrounds that influence interactions with

other crew members or attitudes to safety.

**Diminished motivation** Lack of will or desire to perform well, resulting in a decrease of an individual's performance or required tasks.

**Drug use**

Use of medicine or narcotic which affects individuals' abilities to perform tasks. There are

many different effects on mental or physical capabilities that can result from the use of legal

and illegal drugs, including extreme drowsiness, a false sense of competence, and hallucinations. The user may also be distracted by the constant need to obtain more drugs. In

addition individuals may not be aware of the side effects of legal drugs and may take them

while on duty or forget to report taking them.

**Excessive work load**

Diminished physical or mental capability as the result of the sum total of all the mental and

physical tasks a human must perform within a prescribed time resulting in diminished performance.

**Fatigue**

Fatigue in crew can result in a variety of factors and is variable amongst individuals, and depends on the watch keeping system and management/shipboard policies. Some suffer fatigue

as a result of long term effects of working a watch keeping system, and/or result of stress.

Others may suffer fatigue on a more immediate basis due to lack of sleep for example.

**Situational awareness or communication inadequate**

**inadequate**

An incorrect understanding of the current situation which can lead to faulty hypothesis regarding a future situation, or an understanding which is based upon incorrect beliefs, leading to compounded errors that can substantially increase the risk to the ship.

Examples

include arriving at a hypothesis without confirmation of which direction an oncoming ship will

steer, incorrect interpretation of alarms on board ship.

**Knowledge of**

**regulations/standards**

**inadequate**

Inadequate knowledge of national/international regulations and standards: Lack of knowledge

of understanding of regulations due to inadequate experience and/or training.

**Knowledge of ship****operations inadequate**

Lack of knowledge due to inadequate experience, ignorance of regulations, lack of knowledge

of procedures, inadequate training, and/or unawareness of role/responsibility.

Examples:

individuals might lack knowledge in navigation, seamanship, shipboard regulations, cautionary notices, chartroom notations of labeling.

**Technical knowledge****inadequate**

Due to inadequate experience and or training, not having the general knowledge which is

required for the individual's job on board. Examples include navigation, seamanship, propulsion systems, cargo handling, communications and weather.

**Inattention**

The loss of attention. This includes failing to monitor displays; not maintaining a proper lookout; forgetting to perform an assigned duty. Inattention may also be the result of other

causes such as a personal problem, fatigue, drugs boredom, or hearing problems.

**Injury**

Physical damage to the body which causes a decrease in mental or physical abilities.

Examples include a head injury, other injuries such as a broken finger, or severe burns, where

pain causes distraction and loss of mental ability

**Communication or coordination****(lack of)**

Not making use of all available information sources to determine current status. This may be

the result of lack of initiative on the part of the individual, or a lack of initiative and /or cooperation

on the part of others. Examples include poor communication between bridges

officers, poor communication with pilots, and poor deck to engine room co-ordination

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**Self discipline (lack of)** Inadequate ability of an individual to control personal conduct.

Examples include loss of

temper or unprofessional behavior.

**Language problem** Impediments to proper communication due to at least one party working in a foreign language.

**Mental illness** Psychotic or erratic behavior: depression; hallucinations; other forms of abnormal

behavior which are unexplainable.

**Mental impairment** Diminished mental ability that can reduce or impede an individual's normal ability to perform the mental part of required tasks.

**Language skills inadequate**

A lack of basic language skills necessary to communicate and perform duties required. This includes total or partial inability to speak, read or comprehend the primary language and/ or other required language sufficiently to understand shipboard commands, instructions, procedures, labels, warnings and regulations.

**Perceptual abilities** Abilities of the individual in terms of perception i.e. visual, auditory, tactile, smell etc.

**Personal problem**

That which preoccupies emotions and reduces the ability to perform required tasks.

Examples

include: physical disabilities, death or illness in the family, marital and other relationship problems, health concerns, financial problems, anger, or poor interaction with required tasks.

**Personality** Relative enduring characteristics of behavior.

**Physical illness**

Sickness which produces a decrease in mental or physical abilities, but not generally considered as mental illness. Examples include: general disability accompanying colds and

flue, hallucinations due to high fever, migraine headaches, seasickness and even severe

indigestion and exposure to toxic substances.

**Task difficulty** Inherent characteristics of a task that, independent of the training experience, or expertise of the operator, make successful completion improbable.

**Threat** Degradation of performance due to the psychological impact of impeding or perceived risk of death, injury, or damage.

**Time pressures** Degradation of performance due to insufficient time to gather information, make decisions, or execute actions.

**Unaware of role/task/responsibility**

Inadequate knowledge of the specific job required of an individual. Examples include a lack of

understanding of command responsibilities, communication responsibilities, safety responsibilities, maintenance responsibilities and emergency responsibilities.

**Under stimulation** Degradation of performance due to boredom.

**Vigilance** Ability to maintain a sufficient level of attention to monitor the progress and control the vessel adequately.

**Training which itself is inadequate**

Errors made where training itself is inadequate. For instance the syllabus may not include a subject, or the training establishment may be at fault, or the examination procedure may not be rigorous enough etc.

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