



European Maritime Safety Agency

**SAFEMED III Seminar
on Marine Accident Investigation**

18 and 19 February 2014

EMSA, Lisbon

**Event and contributing
factor analysis.**

**Analysis, conclusions and
safety recommendations**

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European Maritime Safety Agency

Event and contributing factor analysis.

**Analysis, conclusions and safety
recommendations**

Estimated duration:

- ✓ 1 hour

Content:

- ✓ Analysis
- ✓ Event classification
- ✓ Accidental events and contributing factors
- ✓ Causes of occurrence events
- ✓ Analysis chart
- ✓ Conclusions and safety recommendations

Analysis Why Analyse?

- Structured Systematic Approach
- Critical Thinking Techniques
 - Applies logic
 - **Avoids Bias**
- Ensures complete and thorough investigation

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Analysis Investigation Effort



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Analysis Methods

- Many to choose from
- Select according to specific
- Time/Event line basic requirement of every investigation
- 5-Whys approach will usually get reasonable results
- Plus use aspects of other tools –eg GEMS, Change Analysis
- Suggest working on an Event and Contributing Factors Chart
 - ⇒ **Event and Contributing Factors Analysis (ECFA)**

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Event classification

- Event: An action, omission or other occurrence
 - ✓ Each event should describe an occurrence or happening and not a condition, state, circumstance, issue, conclusion, or result (i.e., “pipe wall ruptured”, not “the pipe wall had a crack in it”)
- Three types of events
 - ✓ **Casualty Events (CE):**
The accident itself

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CE001
DD/MM/YYYY - HH:MM:SS
Type (Fixed types)
Description

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Casualty event types (1 st level)	Casualty event types (2 nd level)	Casualty event types (3 rd level)
Capsizing/Listing	Capsizing	
	Listing	
Collision	With other ship	
	With multiple ships	
	Ship not underway	
Contact	Floating object	Cargo
		Ice
		Other
		Unknown
	Fixed object	
	Flying object	
Damage to ship or equipment		
Grounding/stranding	Drift	
	Power	
Fire/Explosion	Fire	
	Explosion	
	Foundering	
Flooding/Foundering	Flooding	Progressive
		Massive
Loss of control	Loss of electrical power	
	Loss of propulsion power	
	Loss of directional control	
	Loss of containment	
Hull failure		
Missing		
Non-accidental event	Acts of war	
	Criminal acts	
	Illegal discharge	
	Other	

CE001
DD/MM/YYYY - HH:MM:SS
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Directly related with the accident

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Accidental Event types
Environmental effect
Equipment failure
Hazardous material
Human Erroneous Action
Other agent or vessel
Unknown

AE001
DD/MM/YYYY - HH:MM:SS
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Description

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The accident itself
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Directly related with the accident
 - ✓ **Generic Events (GE):**
Not directly related with the accident

GE001

DD/MM/YYYY - HH:MM:SS

Type (Fixed types)

Description

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Accidental Event types

Environmental effect
Equipment failure
Hazardous material
Human Erroneous Action
Other agent or vessel
Unknown

GE001

DD/MM/YYYY - HH:MM:SS

Type (Fixed types)

Description

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Directly related with the accident
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GE001
DD/MM/YYYY - HH:MM:SS
Type (Fixed types)
Description

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Event classification

- Continuous if they are based upon valid **factual evidence**. Lines in other case.

CE001
DD/MM/YYYY - HH:MM:SS
Type (Fixed types)
Description

CE002
DD/MM/YYYY - HH:MM:SS
Type (Fixed types)
Description

AE001
DD/MM/YYYY - HH:MM:SS
Type (Fixed types)
Description

AE002
DD/MM/YYYY - HH:MM:SS
Type (Fixed types)
Description

GE001
DD/MM/YYYY - HH:MM:SS
Type (Fixed types)
Description

GE002
DD/MM/YYYY - HH:MM:SS
Type (Fixed types)
Description

- Numbered and chronologically ordered

AE001
DD/MM/YYYY - HH:MM:SS
Type (Fixed types)
Description

AE002
DD/MM/YYYY - HH:MM:SS
Type (Fixed types)
Description

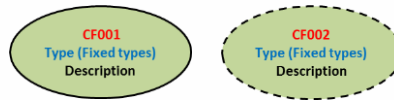
GE001
DD/MM/YYYY - HH:MM:SS
Type (Fixed types)
Description

CE001
DD/MM/YYYY - HH:MM:SS
Type (Fixed types)
Description

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Accidental events and contributing factors

- CF are the **causes** of the **Accidental Events**



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Contributing factors (1 st level)	Contributing factors (2 nd level)	Contributing factors (3 rd level)
	Regulatory activities (REACT)	Checks
		Audit
		Surveillance
		Monitoring
		Inspection
		Regulation
		Regulatory standards
		Regulatory procedures
	Emergency preparedness (EPREP)	Lack of warning systems
		Lack of decision support
		Life saving equipment
		Emergency training program
		Inadequate fighting equipment
		Maintenance of life saving equipment
		Crisis handling
		Management training
	Maintenance policy (MAIPOL)	Emergency procedures
		Emergency plans
		Lack of follow-up and compliance with
		LTA planning
	Design (DESIGN)	Lack of competent repair personnel
		Lack of priority IMR
		LTA change-management
		LTA System review and evaluation
	System Acquisition (SYSAC)	LTA design verification
		Design error
		Innapropriate regulations
		Deviation from standards/specifications
		Substandard components
		Substandard contractors
		Control of contractors
		Verification of contract requirements
		Inadequate testing
		High turn-over, lack of continuity
		Opportunity for advancement

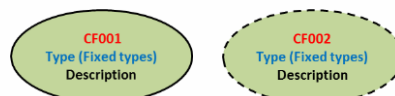
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Contributing factors (1 st level)	Contributing factors (2 nd level)	Contributing factors (3 rd level)
Shipboard operation	Emergency preparedness (EMERG)	Information to passengers
		Lack of leadership
		Inadequate control of life saving equipment
		Lacks initiative to deal with emergencies
		Training ignored
	Environmental conditions (ENVIR)	Contingency plans not updated
		Restricted fairway
		Hindrances in the seaway
		Traffic density hinders vessel control
	Maintenance (MAINT)	Too low visibility for observation
		System out operation
		Improper performance of maintenance/ repair
		Inadequate maintenance
	Inadequate tools and equipment (TOOLS)	Lack of maintenance
		Failure not detected during IMR
		Use of wrong equipment
		Inadequate standards or specifications
	Physical stress (PHYSTR)	Inadequate tool or aid
		LTA assessment of needs and risks
		Right tools and equipment unavailable
		Lack of oxygen
	Work place conditions (WRKPL)	Other health hazards
		Toxic substance
		Temperature
		Climate
		Acceleration
		Sea motion
		Vibration
		Noise
		Anthropometric factors, dimensions
		Lack information, inadequately presented information
		Display design, controls
		Inadequate illumination
		hazardous/ messy workplace
		LAT mental and psychological state

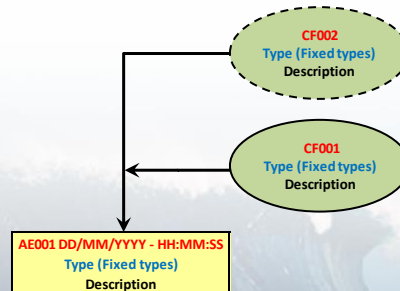
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Accidental events and contributing factors

- CF are the **causes** of the **Accidental Events**



- Numbered and related to **Accidental Events**



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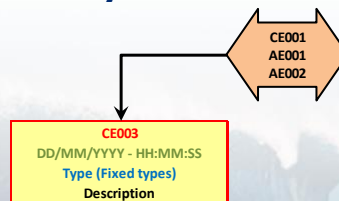
Causes of occurrence events

- Are the **Causes** of each **Casualty Event**
- This **Causes** can be **Accidental Events** or **Casualty Events**



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- Related to **Casualty Events**



Analysis Chart

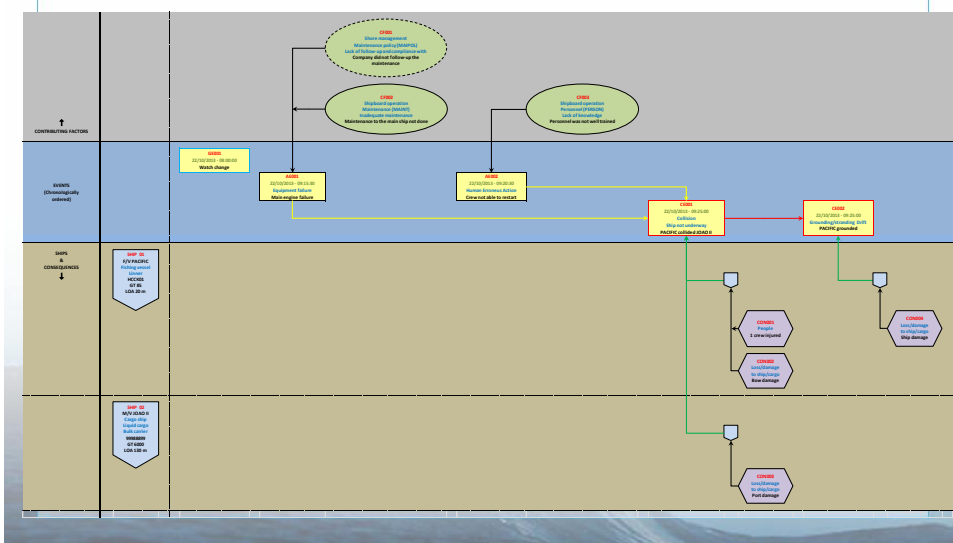
- Put **Events, Contributing Factors, Ships, Consequences** and **Causes** all together in a chronologically ordered **Chart**

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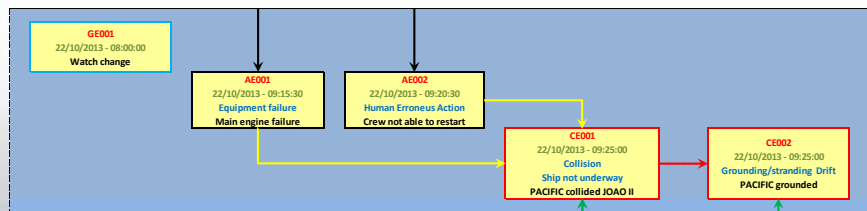
Analysis Chart



Analysis Chart

- Put **Events**, **Contributing Factors**, **Ships**, **Consequences** and **Causes** all together in a chronologically ordered **Chart**
- It includes:
 - ✓ **Events** chronologically ordered, including **Cause Links**

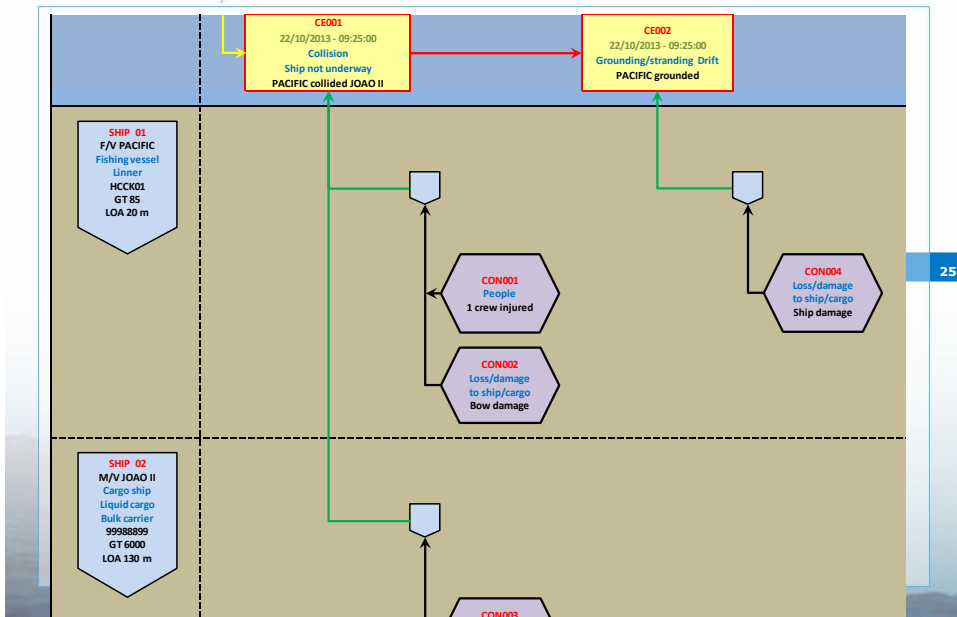
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Analysis Chart

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 - ✓ **Ships** and **Consequences**, related with **Casualty Events**

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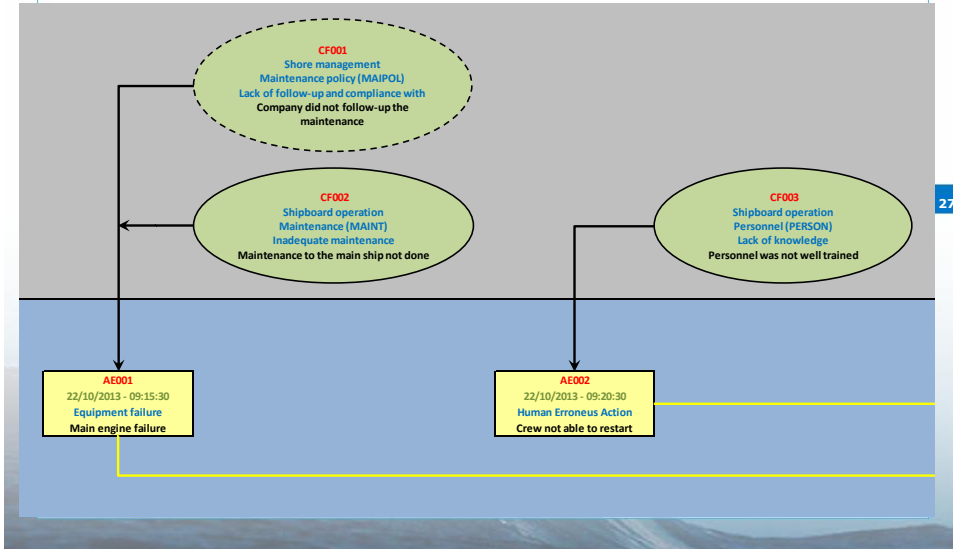
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Analysis Chart

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- It includes:
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 - ✓ **Ships** and **Consequences**, related with **Casualty Events**
 - ✓ **Contributing Factors**, related with **Accidental Events**

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Analysis Chart



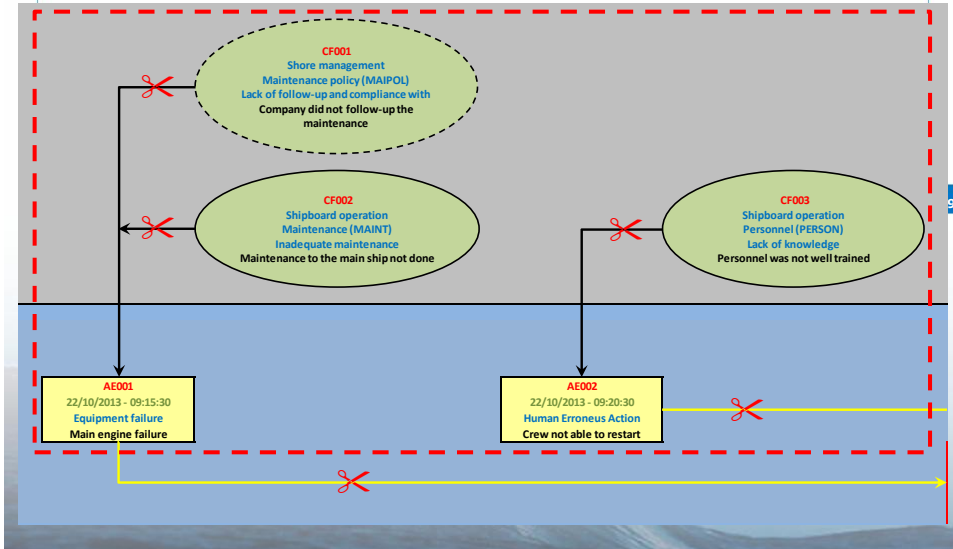
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Conclusions and safety recommendations

- **Conclusions** should be obtained from the information in the **Chart**
- **Safety Recommendations** should be obtained from the **Causes** and **Contributing Factors**

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Conclusions and safety recommendations



Conclusions and safety recommendations

- **Conclusions** should be obtained from the information in the **Chart**
- **Safety Recommendations** should be obtained from the **Causes** and **Contributing Factors**



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Thanks for listening!