

UK P&I CLUB



RISK AWARENESS

POLLUTION CLAIMS

An aid to risk identification and loss reduction

UK P&I CLUB
IS MANAGED
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DEFINITIONS

In this checklist, colour is used to denote the various elements in the risk awareness process

Threat

Something that if not controlled could cause a P&I incident

Consequence

The monetary cost to the Club/Member

Control

Something which reduces the possibility of a 'Threat' causing an incident

Something that should be in place after the incident to help reduce the cost of the claim

How effective do you think the Controls are on your ship – are there any accidents just waiting to happen?

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USING THIS CHECKLIST / SCORING

This booklet is a guide to the Controls and key points that the UK Club's Risk Assessors look for when inspecting a vessel.

It will allow you to carry out a similar check on the Threats and Controls and make sure the vessel has a good risk profile.

Each booklet in the *Risk Awareness* series deals with an area of Risk – Personal injury, collision, pollution, etc – and these are sub-divided into Threats and then Controls.

Each Threat is followed by a 'score' section where the individual Controls can be graded according to how effective they are:

- 1 Very good control**
- 2 Good control**
- 3 Average control**
- 4 Poor control**
- 5 Very poor control (maybe non-existent)**

Furthermore, there is space to make comments on certain Controls; to note ways in which deficient ones could be improved.

At the back, there is a section on Consequences, which is also divided into Controls that should be in place to mitigate the cost of any claim, i.e. after the event controls. These too can be graded.

Pollution

THREAT: BUNKERING OPERATION

CONTROLS:

Inspection and planned maintenance

- Machinery and equipment in all areas is logged into an inspection and planned maintenance system on board
- Adequate for the task
- Hose/pipelines pressure tested
- Certification of hoses in order
- Hose pipeline connections adequate

Trade competency of personnel to perform required duties

- Do all personnel have required certification for the jobs they do, are these certificates valid?
- Training checks, HR and ship follow-up on joining, full familiarisation and training on board the vessel as required for tasks to be performed

Sufficient personnel for required operation

- Are there adequate numbers of personnel available to cover all the required workload in safe manner?
- Rest periods adequate?

Effective supervision by officer/supervisor during operation

- Are proper supervision levels defined and is the supervisor required to take part in operations?
- Is the role defined correctly as oversight of the operation for safety?

Barge/Shore equipment

- Hose certificates checked?
- Quality of barge and crew provided is under charterer control?
- Approach performed at slow speed and in calm conditions?
- Barge tied to ship throughout transfer – moorings adequate – no DP operations?
- Fenders provided by bunkering barge?
- Visual inspection of hoses connected to the vessel for damage?

- Are enough personnel available on barge/shore?
- Are bunkering procedures agreed with barge/shore personnel to avoid spillage?

Bunkering procedures

- Are they adequate, are people aware of them?
- Bunkering plans in place?
- Ship/shore safety checklists correctly completed?
- Tank and pipeline valves set and checked – double checked?
- Valves to any overflow tank are open?
- Saveall plugs are in place?
- All deck scuppers plugged?
- Hose/pipeline connections checked?
- Tank levels monitored?
- Watch on deck?
- Oil spill equipment adequate and deployed?
- Pumping rate reduced at start and prior completion to avoid over pressure on tanks?
- Procedure to avoid deck overflow (rain water)?

Scupper and saveall plugs in place?

Communications established between all parties throughout operations

- Between all parties and control station throughout operations
- Is a back-up communications system provided should primary systems fail?
- Clear communication established between ship and barge before close approach allowed
- Are any language barriers properly addressed

Toolbox talks and work planning meetings

- Are these pre-work meetings held on board?
- They should include, as far as practical to do so, the following:
 - Risk assessment of operation to include the plan to be discussed and evaluated with the team members
 - Safety matters, to include:
 - Discuss the job plan overall
 - What is the job, and procedure to follow?
 - Who will do what?
 - Discuss the safety rules for the area of work to be done
 - What could go wrong?
 - What are the main hazards?
 - Assess the risks and how do you eliminate them?

- Get all to participate to create ownership of safety in the job to be done, and full safety awareness
- Ensure, as far as possible, all personnel understand the safety rules for the job to be done
- Remind all of the STOP procedure if the job changes (ie weather hazards, additional ropes required, winch problems, minor and major accidents should occur)

SCORE

Threat: Bunkering operation

Inspection and planned maintenance	
Trade competency of personnel	
Sufficient personnel for required operation	
Effective supervision during operation	
Barge/Shore equipment	
Bunkering procedures	
Scupper plugs and savealls in place	
Communications established	
Toolbox talks and work planning meetings	

COMMENTS

THREAT: CARGO LOADING/ DISCHARGE OPERATION

CONTROLS:

Loading/Discharge plan

- Plans understood and agreed by all parties?
- Pre-planning and stability calculations are conducted for transfer operations?
- Safety checklists are completed prior to commencing any transfer operation?
- Ventilation plans and procedures discussed?

High level alarms tested

- Record of testing – checked?
- Automatic shutdown valves tested regularly?

Tank/manifold valves set and checked

- Procedure to set up pipelines for operation and double check in place?
- Are physical checks made that valves are open/closed?

Hose/manifold equipment condition

- Hose/pipelines pressure tested annually?
- Certification of hoses in order?
- Visual inspection of connections prior to operations?
- Hose pipeline connections adequate?

Reduced pumping rate at start and finish

- Commencement leak checks in all areas at low pumping rates?
- Topping off procedures are discussed at all levels?

Toolbox talks and work planning meetings

- Are these pre-work meetings held on board?
- They should include, as far as practical to do so, the following:
 - Risk assessment of operation to include the plan to be discussed and evaluated with the team members
 - Safety matters, to include:
 - Discuss the job plan overall
 - What is the job and procedure to follow?
 - Who will do what?
 - Discuss the safety rules for the area of work to be done

- What could go wrong?
- What are the main hazards?
- Assess the risks and how do you eliminate them?
- Get all to participate to create ownership of safety in the job to be done and full safety awareness
- Ensure as far as possible all personnel understand the safety rules for the job to be done
- Remind all of the STOP procedure if the job changes (ie weather hazards, additional ropes required, winch problems, minor and major accidents should occur)

Sufficient personnel for required operation

- Are there adequate numbers of personnel available to cover all the required workload in safe manner?
- Rest periods adequate?

Trade competency of personnel to perform required duties

- Do all personnel have required certification for the jobs they do, are these certificates valid?
- Training checks, HR and ship follow up on joining, full familiarisation and training on board the vessel as required for tasks to be performed

Inspection and planned maintenance

- Machinery and equipment in all areas is logged into an inspection and planned maintenance system on board?
- Adequate for the task?

Scupper plugs in place?

SCORE

Threat: Cargo loading/discharge operation

Loading/Discharge plan	
High level alarms tested	
Tank/manifold valves set and checked	
Hose/manifold equipment condition	
Reduced pumping rate at start and finish	
Toolbox talks and work planning meetings	
Sufficient personnel for required operation	
Trade competency of personnel	
Inspection and planned maintenance	

COMMENTS

THREAT: BILGE AND SLOP OPERATIONS

CONTROLS:

Equipment condition/maintenance

- Pipes tested/checked?
- OWS maintenance and records, alarm tested regularly, cleaned regularly, spares on board, in PMS?
- ODM tested/calibrated and records, in PMS?
- Bilge and slop tanks inspection/maintenance and records on board?

Visual monitoring of overboard discharge

- Not complete reliance on ODM and OWS alarms
- A procedure is in place to visually monitor the overboard discharge?

Bilge condition

- All bilges are maintained in a clean and oil free condition at all times
- Any spillage to bilges or leakage cleaned up on a regular basis

Sludge incineration

- Sludge is incinerated if applicable
- Records are maintained in the ORB for all incineration in accordance with incinerator capacity
(Check ORB records against capacity of incinerator)

Sludge and slops disposed ashore/etc

- Certificates for sludge and slops disposed ashore are maintained
- If load on top is used then records are maintained for all operations where this is the case in the cargo record book
- Boil off of sludge to remove water, records are correctly maintained in ORB

Toolbox talks and work planning meetings

- Are these pre-work meetings held on board?
- They should include, as far as practical to do so, the following:
 - Risk assessment of operation to include the plan to be discussed and evaluated with the team members
 - Safety matters, to include:
 - Discuss the job plan overall
 - What is the job, and procedure to follow?
 - Who will do what?
 - Discuss the safety rules for the area of work to be done

- What could go wrong?
- What are the main hazards?
- Assess the risks and how do you eliminate them?
- Get all to participate to create ownership of safety in the job to be done and full safety awareness
- Ensure as far as possible all personnel understand the safety rules for the job to be done
- Remind all of the STOP procedure if the job changes (ie weather hazards, additional ropes required, winch problems, minor and major accidents should occur)

SCORE

Threat: Bilge and slop operations

Equipment condition/maintenance	
Visual monitoring of overboard discharge	
Bilge condition	
Sludge incineration	
Sludge and slops disposed ashore/etc	
Toolbox talks and work planning meetings	

COMMENTS

THREAT: BALLAST WATER POLLUTION

CONTROLS:

Equipment condition/maintenance

- Pipes tested/checked?
- Pumps in good order and tested regularly?
- Ballast eductors in good order and tested regularly?
- Ballast tank inspection/maintenance?

Ballast water exchange procedures

- Stability calculations and stress calculations performed for all ballast exchanges and recorded
- Ballast exchange procedure and plan in place for the vessel, where, how and when to exchange ballast
- Records to be kept are maintained, etc
- Pre-exchange plan for each operation
- Personnel involved instructed on procedures
- One person in charge of exchange
- Legal requirements to inform next port authorities met
- Pre-exchange and post exchange samples in clean containers maintained on board if required

Ballast water sterilisation

- Equipment fitted
- Requirement to have fitted and when is known
- Plan for fitting and when is on board

Toolbox talks and work planning meetings

- Are these pre-work meetings held on board?
- They should include, as far as practical to do so, the following:
 - Risk assessment of operation to include the plan to be discussed and evaluated with the team members
 - Safety matters, to include:
 - Discuss the job plan overall
 - What is the job, and procedure to follow?
 - Who will do what?
 - Discuss the safety rules for the area of work to be done
 - What could go wrong
 - What are the main hazards
 - Assess the risks and how do you eliminate them?
 - Get all to participate to create ownership of safety in the job

to be done and full safety awareness

- Ensure as far as possible all personnel understand the safety rules for the job to be done
- Remind all of the STOP procedure if the job changes (ie weather hazards, additional ropes required, winch problems, minor and major accidents should occur)

Control of ballast overflow in port

- Scuppers plugged against accidental overflow
- Decks always clean (minor oil spills)
- Planning to avoid ballast overflow during ballasting in port
- Vent heads clearly marked

Ballast water sampling

- Are procedures in place to keep ballast water samples on board (Ukrainian fines for polluted ballast?)

SCORE

Threat: Ballast water pollution

Equipment condition/maintenance	
Ballast water exchange procedures	
Ballast water sterilisation	
Toolbox talks and work planning meetings	
Control of ballast overflow in port	
Ballast water sampling	

COMMENTS

THREAT: GARBAGE DISPOSAL

CONTROLS:

Garbage management plan

- Plan checked/approved?
- Garbage disposal receipts maintained?

Crew instruction on garbage management and segregation

- Are all crew aware of and in compliance with the vessel's garbage management plan?
- Segregation procedures?
- Incineration procedures?
- Landing ashore procedures?
- Disposal overboard and where this can be done?
- Special area requirements?

Provision of garbage handling equipment

- Lidded bins and/or garbage handling rooms
- All interior waste bins are non combustible type with lids
- All exterior storage is in clean lidded bins and segregated for eventual disposal
- Incinerator
- Compactor
- Composter
- Recycling procedures

Segregation procedures

- Multiple garbage bins in all public areas of correct type with lids
- Segregation policy in garbage management plan is followed by all on board

Special area requirements are complied with

- Retention of all wastes on board in special areas apart from food wastes which are disposed according to regulations
- Logged into the garbage log

Required garbage landed ashore

- All plastics and non disposable garbage landed ashore
- All landed garbage is logged into garbage log and receipts for disposal are obtained from shore authorities

Garbage disposal oversight

- Garbage disposal oversight follows MARPOL regulations

- Distance from shore and only in approved areas (no disposal apart from commuted food waste) in special areas
- Procedures for cargo residues and dunnage followed and log records maintained

Incineration

- Approved type incinerator fitted (approved for plastics?)
- Vessel maintains correct records of garbage incinerations
- All incinerator ash landed ashore and receipts obtained/logged

Log entries to be correct for all disposals

- Garbage record book correctly updated
- All records to conform with the position of the vessel as in the deck log or official log of the ship

SCORE

Threat: Garbage disposal

Garbage management plan	
Crew instruction on management/segregation	
Provision of garbage handling equipment	
Segregation procedures	
Special area requirements are complied with	
Required garbage landed ashore	
Garbage disposal overside	
Incineration	
Log entries to be correct for all disposals	

COMMENTS

THREAT: SEWAGE DISPOSAL

CONTROLS:

Sewage disposal procedures defined

- Does the vessel have sewage disposal plan in place to ensure sewage is disposed according to MARPOL regulations?
- Discharge correctly treated
- Records of all discharges are maintained
- Procedures in port are defined

Sewage treatment on board

- Holding tanks
- Approved treatment plant with proper certification
- Discharge correctly treated or disposed at correct distance from the land
- Records maintained
- Equipment maintained PMS system for this is in place
- Training on equipment

Sewage discharge tested

- Method/frequency of testing
- Records of testing maintained in PMS system

SCORE

Threat: Sewage disposal

Sewage disposal procedures defined	
Sewage treatment on board	
Sewage discharge tested	

COMMENTS

THREAT: FUNNEL EMISSIONS

CONTROLS:

Exhaust gas emission monitoring

- Black smoke/soot from funnel
- Use of incinerator in port
- SECA area control
- Remote monitoring (CCTV)
- Monitoring and reporting by deck dept

Compliance with low sulphur fuel regulations

- Vessel has a low sulphur fuel plan
- For EU ports vessel has ultra low sulphur fuel on board
- Change over procedures followed and recorded for entering SECAs and EU ports when alongside
- Bunker samples and receipts
- Equipment modification for LS fuel carried out as required
- Lub oil changes as required
- Maintenance of records in approved form of log book
(Panama requires in the ORB, others do not have approved formats as yet)

Inspection and planned maintenance

- Machinery and equipment in all areas is logged into an inspection and planned maintenance system on board
- Adequate for the task

SCORE

Threat: Funnel emissions

Exhaust gas emission monitoring	
Compliance with low sulphur fuel regulations	
Inspection and planned maintenance	

COMMENTS

THREAT: HULL/EQUIPMENT FAILURES

CONTROLS:

Steel condition/maintenance/inspection

- Does on board PMS cover regular inspection to determine condition of hull and tanks in all areas of the vessel
- Corrosion (coating cover and pitting of steelwork)
- Erosion
- Bacteriological deterioration
- Stern gland oil seal checks
- Records/surveys
- Ultra sonic test records as determined by the age of ship and trade type
- CAP survey

SCORE

Threat: Hull/Equipment failures

Steel condition/maintenance/inspection	
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COMMENTS

THREAT: FAILURE OF HOSE OR PIPELINE

CONTROLS:

Hose/Pipelines pressure tested annually

- All cargo and bunker piping under PMS pressure tested and marked annually

Hose/Pipelines connection well secured

- New joint used at each manifold connection for bunkering and loading liquid cargo (cargo/bunker plan)
- All bolt holes secured with a bolt
- Cam type connections inspected and in good condition
- O ring seals renewed for every load operation
- Reducers checked and in good condition, fit for cargo to be carried.
- All piping and hoses are properly secured and supported to reduce stress and breakage due to stress

Pumping rate reduced at start and finish

Pressure monitored

- Pressure gauges fitted and under PMS for inspection and testing
- Fit for purpose and monitored at all times throughout the transfer operations

Scupper plugs in place

Oil spill kit available

Regular drills

- See 'Consequences' section

Communications established between all parties throughout operations

- Between all parties and control station throughout operations, and is a back-up communications system provided should primary systems fail

SCORE

Threat: Failure of hose or pipeline

Hose/Pipelines pressure tested annually	
Hose/Pipelines connection well secured	
Pumping rate reduced at start and finish	
Pressure monitored	
Scupper plugs in place	
Oil spill kit available	
Regular drills	
Watch on deck	
Communications established	

COMMENTS

THREAT: IN TRANSIT CARGO OPERATIONS

CONTROLS:

Heating of cargo

- Cargo expansion issues
- Tank level and temperature monitoring

Cargo planning

- Pre-planning and stability calculations are conducted for transfer operations
- Safety checklists are completed prior to commencing any transfer operation

Sufficient personnel for required operation

- Are there adequate numbers of personnel available to cover all the required workload in safe manner?
- Rest periods adequate?

Trade competency of personnel to perform required duties

- Do all personnel have required certification for the jobs they do, are these certificates valid?
- Training checks, HR and ship follow up on joining, full familiarisation and training on board the vessel as required for tasks to be performed

Stability/Stress calculations

- Is loadicator approved by class?
- Prior to any load or discharge is the stability loadicator test program run and are written records maintained?
- Are ship's stability calculations completed by certificated officers approved by flag state?
- Do all officers have required STCW documentation/training requirement?
- Are officers familiar with ship and voyage/stability requirements?
- Are officers fully competent in use of loadicator instrument?
- Are full and comprehensive written stability calculations retained on board?
- Are full clear and comprehensive list of all tanks/cargo weights of the vessel maintained in an approved format?
- Is the master updated regularly on ships stability criteria?
- Are hourly stability checks made during loading and discharging operations?

- Positive stability ensured throughout voyage and during load and discharge periods?

Scupper plugs in place?

SCORE

Threat: In transit cargo operations

Heating of cargo	
Cargo planning	
Sufficient personnel for required operation	
Trade competency of personnel	
Stability/Stress calculations	
Scupper plugs in place	

COMMENTS

THREAT: IN TRANSIT BUNKER TRANSFERS

CONTROLS:

Scupper plugs in place

Bunker transfer procedures

- Are procedures adequate, are people aware of them?
- Bunkering plans in place?
- Ship checklists correctly completed?
- Tank and pipeline valves set and checked – double checked?
- Valves to any overflow tank are open?
- Saveall plugs are in place?
- Tank levels monitored?
- Watch on deck?
- Oil spill equipment adequate and deployed?
- Pumping rate reduced at start and prior completion to avoid over pressure on tanks?
- Bunker temperature records maintained?

SCORE

Threat: In transit bunker transfers

Scupper plugs in place?

Bunker transfer procedures

COMMENTS

Consequences

CONTROLS:

Damage mitigation procedures

- What procedures are in place to help reduce the effects of a personal injury incident and how effective are they?
- Have all possible measures been taken and recorded to limit physical damage to crew/passengers in every possible way, as appropriate to the trade and type of the vessel?
- All mitigation measures are logged?

Alarm/Stop procedures

- Are procedures in place to warn ship/shore of incident and to stop the operation?
- Communications procedure in place for all incidents?
- General and fire alarms are functioning correctly?
- Automatic fire detection is good?
- Fixed gas detectors, where fitted, check regular calibration, etc.
- Verbal alarm raising system is defined and can be shown to be adequate?
- Procedure in place to suspend or stop the operation if an accident occurs and if it is safe to do so?
 - Pumps on board/ashore
 - Cargo conveyor belts
 - Cranes/derricks
 - Electrical power cut outs

Emergency drills/training

- Are drills/training procedures in place to cope with high risk incidents?
- Fire drills
- Security drills
- Anti-piracy drills
- Emergency steering drills
- SOPEP
- Anti pollution drills
- Pollution drills – bunker leak, cargo leak, grounding, collision, etc
- Watertight integrity drills – watertight doors, bulkhead valves, etc
- Ballasting procedures in the event of a hull breach

Emergency equipment adequacy/availability

- Is the ship's equipment available/adequate to deal with high risk incidents:
 - SOPEP equipment
 - Fixed fire equipment
 - Portable fire equipment
- Are crew familiar with the equipment?

Emergency reporting/communication procedures

- Are there reporting procedures in place and understood if an incident occurs?
- Reporting to owner, charterer, P&I correspondent
- Categorisation of incident?
- Timing of incident?
- Communication requirements
- Who was informed on board/on shore?
 - When?
 - How?
 - Why?
 - What did they do?
- Records of communications. (ship management, third parties, national authorities, P&I, etc)
- Letters of protest:
 - Are there procedures in place for issuing letters of protest?
 - Are the reasons for issuing letters of protest understood?
 - For all incidents LOP should be issued and where possible notarised, signed for receipt, etc
 - Copies retained on file on board and entered in the evidence log for use in defending the claim should it arise

Record keeping/evidence retention

- Information required to help process claims:
 - Log books preserved and records tallied with bell books (movement book – deck and engine)
 - Charts preserved and records kept as evidentiary chain
 - Voyage data recorder (VDR) information properly preserved and evidence used
 - Time of the incident GMT and local time?
 - What happened and to whom?
 - Where did it happen?
 - When did it happen?
 - What were they doing at the time?
 - What were the immediate consequences?

- Full list of witnesses to the incident
- Witness statements
- Electronic records of ship's operational position at the time of the incident
- Operational status of vessel, at sea, in port, tank cleaning, cargo operations, mooring, etc.
- Records of casualty communications and third part responses (salvors, other vessels, etc.)
- Oil pollution:
 - ORB (Parts 1 and 2 as applicable) and garbage logs are maintained and properly updated
 - Vessel has SOPEP or SMPEP as applicable
 - Vessel has correct certification for air, oil, sewage and garbage pollution properly updated
 - PMS system records maintained
 - Interface detectors on board and in good order/function test records maintained as appropriate
- Weather conditions:
 - Description of incident environment (hot, cold, stuffy, dark, confined, moving machinery, etc)
 - Description of weather
 - Description of sea state
- Use of NI publication *The Mariner's Role in Collecting Evidence*
- Photos of incident and location time/date stamped, camera set up recorded, full description given in title and/or in comments field
- Photos to be secured from tampering by using security settings under properties
- Layout diagram
- Ship's logs
- Procedures in use at time of incident
- Risk assessment records
- Exhibits (failed ladder, rope, etc)
- Service records
- Certifications
- Communications logs
- Permit to work records as applicable
- Toolbox talk records
- List of equipment (tools) involved in incident: condition of equipment, missing equipment
- Equipment certification, inspection logs, maintenance records

Capability of crew to deal with incident

- How capable is the crew to deal with the incident?
- Competence of individuals involved in incident (recruitment, certification, training records, fitness to work (medical records))
- Fatigue factors: hours of work/rest, time on shift
- Contracted time on board vessel
- Actual time on board vessel current period
- Competence of individuals involved in response
- Experience of crew involved in the incident
- Language barriers of crew/shore personnel involved if any

Use of third party assistance

- Procedures for contacting third parties for assistance in the event of an incident
- By phone, radio, satellite link etc
- General advice:
 - Club correspondent
- Stability advice:
 - Collision – classification society
- Pollution:
 - Authorities
 - Harbour master

Learning from incidents

- Are lessons learned from previous incidents?
- Non conformity raised for incident?
- Incident/Accident report correctly filled in?
- Incident is raised at safety meetings and full crew meetings:
 - Discussion of what went wrong and how this can be avoided in future
- Incident is discussed and appraised at Company level:
 - Actions to avoid future incidents are discussed and taken, improving barriers
- Incident promulgated to full fleet to avoid duplication if possible
- Incident promulgated industry wide if appropriate to enhance safety culture
- Full risk assessment undertaken to improve barriers/controls in on board checklists
- Toolbox talks, job hazard awareness (JHA) systems and others as appropriate in all fleet vessels

SCORE

Consequences

Damage mitigation procedures	
Alarm/Stop procedures	
Emergency drills/training	
Emergency equipment adequacy/availability	
Emergency reporting/communication procedures	
Record keeping/evidence retention	
Capability of crew to deal with incident	
Use of third party assistance	
Learning from incidents	

COMMENTS

METHODOLOGY

Following the well-known definition:

RISK = FREQUENCY x CONSEQUENCE

The Club has analysed the number and value of the Club's claims to prioritise high risk areas and determine what the THREATS are that cause these claims. Then, with the aid of those at the sharp end – our correspondents, surveyors, claims executives and underwriters, and last but not least, our crews – we have sought to determine what CONTROLS – be it engineered, procedural or managerial – have mitigated such claims, or would have done so if they had been in place. Those threats and controls can then be targeted for assessment, either with the help of the Club's own risk assessors, or by Members themselves in conjunction with their crews.

Although 60% of UK Club claims are caused by 'human error', human error is often only 'the straw that breaks the camel's back' – the last event in a chain of causal events.

These causal events can normally be traced back to failures in one or more areas of ship operation, we sometimes refer to them as 'accidents waiting to happen'.

How can we reduce the frequency of these 'accidents waiting to happen'? What 'controls' should we be looking at to ensure the 'threat' is contained and an 'incident' does not occur?

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