DNV GL – Marine Systematic Cause Analysis Technique (M-SCAT 8.2)

DNV·GL

TYPE OF LOSS

☐ People (Safety/Health)
☐ Asset (Damage)
☐ Environmental
☐ Financial (Fines, Claims, Insurance)
☐ Non-Conformity (Product/Service)
☐ Reputation/Complaint
☐ Process/Business

DESCRIPTION OF EVENT

RISK EVALUATION

A risk evaluation of the event is required based on an analysis of the consequence potential and the probability/frequency of the event recurring by a competent individual against defined evaluation criteria. The risk evaluation is used to assess the significance of the event relative to others and prioritise the implementation of improvement actions.

TYPE OF EVENT

1. Fall from Elevation (Person/Equipment/Material)
2. Fall on Same Level (Slip and Fall/Trip Over)
3. Struck against (bump into / run into)
4. Struck By (Hit By Moving Object)
5. Caught In, On, Between or Under
6. Contact with Temperature Extremes (Heat/Cold)
7. Contact with Electricity
8. Exposure to Noise
9. Exposure to Vibration
10. Exposure to Radiation
11. Contact with Hazardous Substance/Dose (Toxic/Corrosive/ Carcinogenic/ Biological/Viral)
12. Overstress by Overexertion, Overload, Ergonomic Factors
13. Ship Collision
14. Ship Grounding
15. Ship Contact Damage (Docks, Locks, Buoys, etc.)
16. Fire
17. Explosion
18. Loss of Ship Hull/Watertight Integrity
19. Failure of Mechanical Equipment
20. Failure of Electrical System
21. Failure of Instrumentation/Logic/Loop
22. Cargo Damage and/or Loss
23. Environmental Release (to Air/Water/Soil)
24. Loss of Ship Stability
25. Customers/Stakeholders Complaints
26. Act of Violence

IMMEDIATE CAUSES – SUBSTANDARD ACTS

1. Under the Influence of Medicine/Alcohol/Drugs
2. Failure to Follow Procedure/Instruction
3. Failure to Secure
4. Failing to Use Personal Protective Equipment Properly
5. Failure to Inform/Warn
6. Improper Lifting
7. Improper Loading
8. Improper Placement
9. Improper Position for Task
10. Incorrect Navigation or Ship Handling
11. Making Safety Devices Inoperable
12. Operating at Improper Speed
13. Operating Equipment Without Authority
14. Removing Safety Devices
15. Inadequate Servicing of Equipment/Machinery in Operation
16. Using Defective Tool/Equipment/Machinery/Device
17. Improper Operation of Tool/Equipment/Machinery/Device
18. Foul Play/Sabotage
19. Substandard Act by External Party (Not Under Own Control)
   - 19.1 Pilots
   - 19.2 Boatmen
   - 19.3 Terminal Personnel
   - 19.4 Local Authorities
   - 19.5 Incorrect Supply of Documents/Information
   - 19.6 Other External Party Not Under The Control of The Company/Shipboard Management
20. Failure to Comply with Customers/Stakeholders Requirements
21. Civil Disturbance (Riot, Unrest, Warfare)
22. Criminal Activities

IMMEDIATE CAUSES – SUBSTANDARD CONDITIONS

23. Cargo
24. Congestion/Restricted Space for Action
25. Defective Tool/Equipment
26. Incorrect Material
27. Electric Current Hazards
28. Exposure to Chemicals
29. Exposure to High Temperature
30. Exposure to Low Temperature
31. Noise Level Over Threshold
32. Radiation Hazard Over Threshold
33. Presence of Flammable/Explosive Atmosphere
34. Exposure to Dangerous Atmosphere Causing Suffocation or Poisoning
35. Inadequate Guard/Barrier
36. Insufficient/Excessive Illumination
37. Inadequate/Improper Personal Protective Equipment
38. Inadequate Ventilation
39. Inadequate Warning Systems
40. Incorrect/Inadequate Tool/Equipment
41. Outdated Charts, Publications and Other Documentation
42. Poor Housekeeping/Order
43. Inadequate Condition of Floor/Surface
44. Exposure to Adverse Weather Condition
45. Extreme Adverse Sea Conditions
46. Inadequate Port and Berthing Facilities

BASIC CAUSES – PERSONAL FACTORS

1. Inadequate Physical/Physiological Capability
- 1.1. Inappropriate height/weight/size/strength/reach, etc.
- 1.2. Restricted range of body movement
- 1.3. Limited ability/inability to sustain body positions
- 1.4. Substance sensitivity/allergy
- 1.5. Sensitivities to sensory extreme (temperature/sound/etc.)
- 1.6. Vision deficiency
- 1.7. Hearing deficiency
- 1.8. Other sensory deficiency (touch/taste/smell/balance)
- 1.9. Respiratory incapacity
- 1.10. Other permanent physical disability
- 1.11. Temporary disability

2. Inadequate Mental/Psychological Capability
- 2.1. Fears and phobias
- 2.2. Emotional disturbance
- 2.3. Mental illness
- 2.4. Intelligence level
- 2.5. Inability to comprehend
- 2.6. Poor coordination
- 2.7. Slow reaction time
- 2.8. Low mechanical aptitude
- 2.9. Low learning aptitude
- 2.10. Memory failure/lapse

3. Physical/Physiological Stress
- 3.1. Injury or illness
- 3.2. Fatigue due to task load or duration
- 3.3. Fatigue due to lack of rest
- 3.4. Fatigue due to sensory overload
- 3.5. Exposure to health hazard
- 3.6. Exposure to temperature extreme
- 3.7. Oxygen deficiency
- 3.8. Atmospheric pressure variation
- 3.9. Constrained movement
- 3.10. Blood sugar insufficiency
- 3.11. Alcohol/Drugs/Other Self Imposed Stress

4. Mental/Psychological Stress
- 4.1. Emotional overload
- 4.2. Fatigue due to mental task load or speed
- 4.3. Extreme judgment/decision demands
- 4.4. Routine/monotony/boredom/overly routine tasks
- 4.5. Extreme concentration/perception demands
- 4.6. Meaningless/degrading activities
- 4.7. Confusing directions/demands
- 4.8. Conflicting demands/directions
- 4.9. Preoccupation with problems/Distraction by concern
- 4.10. Frustration
- 4.11. Mental illness

5. Lack of Competence
- 5.1. Inadequate experience
- 5.2. Inadequate orientation/induction
- 5.3. Inadequate initial training
- 5.4. Inadequate update/refresher training
- 5.5. Misunderstood instruction/information
- 5.6. Lack of situational awareness/risk perception/risk awareness
- 5.7. Inadequate initial instruction/skill training
- 5.8. Inadequate practice
- 5.9. Infrequent performance
- 5.10. Inadequate coaching
- 5.11. Inadequate review instruction

6. Improper Motivation
- 6.1. Improper performance/behavior is tolerated/rewarded
- 6.2. Proper performance/behavior is discouraged/punished
- 6.3. Lack of incentive
- 6.4. Improper production incentive
- 6.5. Improper Cost Reduction Incentive
- 6.6. Excessive frustration
- 6.7. Inappropriate aggression
- 6.8. Improper attempt to save time/effort
- 6.9. Improper attempt to avoid discomfort
- 6.10. Improper attempt to gain attention
- 6.11. Inadequate discipline
- 6.12. Inappropriate peer pressure
- 6.13. Improper leadership example
- 6.14. Inadequate performance feedback
- 6.15. Inadequate reinforcement of proper behavior
- 6.16. Abuse (intentionally)
- 6.17. Misuse (unintentionally)

BASIC CAUSES – JOB/SYSTEM FACTORS

7. Unclear Organizational Structure
- 7.1. Unclear/conflicting reporting relationship
- 7.2. Unclear/conflicting assignment of function/role
- 7.3. Unclear/conflicting accountability/responsibility/task

8. Inadequate Leadership
- 8.1. Inadequate HSEQ/asset strategy
- 8.2. Inadequate leadership development
- 8.3. Inadequate delegation
- 8.4. Inadequate standards
- 8.5. Inadequate communication/implementation of policy/procedure/practice
- 8.6. Conflicting policy/procedure/practice
- 8.7. Inadequate work/process planning/programming
- 8.8. Condone deviation from policy/procedure/practice
- 8.9. Condone misuse of equipment/tool
- 8.10. Condone improper/inappropriate behavior
- 8.11. Inadequate management information
- 8.12. Inadequate monitoring/closure of audit actions

9. Inadequate Supervision/Coaching
- 9.1. Inadequate instruction/orientation/training
- 9.2. Inadequate information documents in supervision/coaching
- 9.3. Lack of supervisory/management job knowledge
- 9.4. Inadequate match between qualifications and job/task requirements
- 9.5. Inadequate performance measurement and evaluation
- 9.6. Inadequate performance feedback

10. Inadequate Management of Change
- 10.1. Inadequate hazard identification/risk evaluation in design
- 10.2. Inadequate identification of failure mode
- 10.3. Inadequate evaluation of customer/stakeholder requirement
- 10.4. Inadequate identification of legal requirement
- 10.5. Inadequate consideration of human/ergonomic factor in design
- 10.6. Inadequate design process / standard / specification / criterion
- 10.7. Inadequate process control automation
- 10.8. Inadequate (technical) standard/specification or absence thereof
- 10.9. Inadequate review of project risks
- 10.10. Inadequate monitoring of construction / fabrication / assembly
- 10.11. Inadequate assessment of operational readiness
- 10.12. Inadequate commissioning/handover process
- 10.13. Inadequate monitoring of initial operation
- 10.14. Inadequate management of change process

11. Inadequate Supply Chain Management
- 11.1. Inadequate specification on requisition/purchase order
- 11.2. Inadequate research on material / equipment / tool / supply / etc.
- 11.3. Inadequate specification to vendor
- 11.4. Inadequate mode/route of shipment
- 11.5. Inadequate receiving inspection/acceptance
- 11.6. Inadequate communication of information about hazards
- 11.7. Improper handling of material
- 11.8. Improper storage of material
- 11.9. Improper transporting of material
- 11.10. Inadequate shelf life/validation for re-use of materials/equipment
- 11.11. Inadequate identification of material
- 11.12. Improper salvage/waste disposal
- 11.13. Inadequate selection of contractor/supplier

12. Inadequate Maintenance/Inspection
- 12.1. Inadequate assessment of preventive maintenance needs
- 12.2. Inadequate preventive lubrication and servicing
- 12.3. Inadequate adjustment/assembly
- 12.4. Inadequate preventive cleaning/resurfacing
- 12.5. Inadequate communication of corrective maintenance needs
- 12.6. Inadequate scheduling of maintenance work
- 12.7. Inadequate assessment of repair needs
- 12.8. Inadequate parts substitution/replacement
- 12.9. Inadequate inspection method/interval
- 12.10. Unable to inspect

13. Excessive Wear/Tear
- 13.1. Inadequate planning of use
- 13.2. Improper decision on extension of service life
- 13.3. Inadequate inspection/monitoring
- 13.4. Improper loading/rate of use
- 13.5. Used for wrong purpose/task/activity

14. Inadequate Tool/Equipment/Machinery/Device
- 14.1. Inadequate assessment of needs and risks
- 14.2. Inadequate consideration of human factors/ergonomics
- 14.3. Inadequate (supplier) standard/specification
- 14.4. Incorrect measurement/detection/(process) control
- 14.5. Inadequate availability of tool / equipment / machinery / device
- 14.6. Inadequate inspection/repair/maintenance
- 14.7. Inadequate adjustment/calibration
- 14.8. Inadequate salvage and reclamation
- 14.9. Inadequate removal and replacement of unsuitable items

15. Inadequate Product/Service Design
- 15.1. Inadequate assessment of needs and risks
- 15.2. Inadequate product/service standard/specification/concession system
- 15.3. Inadequate product/service design/development
- 15.4. Inadequate product/service standard
- 15.5. Inadequate product/service design validation
- 15.6. Inadequate product/service design verification
- 15.7. Inadequate product/service planning
- 15.8. Inadequate product/service quality verification

16. Inadequate Work/Production Standards
- 16.1. Inadequate identification of requirements (regulatory/industry code/permit-to-operate)
- 16.2. Inadequate risk identification/evaluation in development of standard
- 16.3. Inadequate standard from supplier/contractor
- 16.4. Inadequate coordination with process design when developing standard
- 16.5. Inadequate employee involvement in developing standard
- 16.6. Conflicting standards/improper prioritization of standards
- 16.7. Inadequate publication of standard
- 16.8. Inadequate distribution of standard
- 16.9. Inadequate translation of appropriate language
- 16.10. Improper use of language
- 16.11. Inadequate training of standard
- 16.12. Inadequate reinforcing of standard with signs, color codes and job aids
- 16.13. Inadequate monitoring of standard compliance

17. Inadequate Communication/Information
- 17.1. Inadequate information handling
- 17.2. Unclear information
- 17.3. Inadequate transfer of information between internal parties
- 17.4. Inadequate transfer of information with client/stakeholder
- 17.5. Inadequate transfer of information with authorities
- 17.6. Inadequate transfer of information with other external parties
- 17.7. Inadequate communication structure
- 17.8. Inadequate databases/information system
- 17.9. Inadequate communication method/technique used

CONTROL AREAS FOR IMPROVEMENT ACTIONS

	S	PS	C
1 - LEADERSHIP			
1.1. Purpose and Values			
1.2. Goals			
1.3. Policy			
1.4. Strategy			
1.5. Stakeholder Engagement			
1.6. Business Processes			
1.7. Business Risks			
1.8. Accountabilities			
1.9. Management Commitment			
1.10. Process Safety Leadership			
2 - PLANNING AND ADMINISTRATION			
2.1. Business Planning			
2.2. Work Planning and Control			
2.3. Action Tracking			
2.4. Management System Documentation			
2.5. Records			
2.6. Process Safety Planning			
3 - RISK EVALUATION			
3.1. Health Hazard Identification and Evaluation			
3.2. Safety Hazard Identification and Evaluation			
3.3. Security Hazard Identification and Evaluation			
3.4. Environmental Hazards Identification and Evaluation			
3.5. Customer Expectations Identification and Evaluation			
3.6. Task Risk Evaluation			
3.7. Process Safety Information			
3.8. Process Hazard Analysis			
4 - HUMAN RESOURCES			
4.1. Human Resources System			
4.2. Recruitment			
4.3. Managing Individual Performance			
4.4. Recognition and Discipline			
4.5. Leaving the Organization			
4.6. Management of Organizational Change			
4.7. Process Safety Human Resources			
5 - COMPLIANCE ASSURANCE			
5.1. Regulations			
5.2. External Authorizations to Operate			
5.3. Industry Codes and Standards			
5.4. Reporting to Authorities			

	S	PS	C
5.5. Information Security			
5.6. Product Stewardship			
5.7. Compliance Assessment			
5.8. Process Safety Regulations			
5.9. Security of Process Information			
6 - PROJECT MANAGEMENT			
6.1. Project Co-ordination			
6.2. Project Planning			
6.3. Project Execution			
6.4. Project Control			
6.5. Project Close Out			
6.6. Process Safety Project Reviews			
7 - TRAINING AND COMPETENCE			
7.1. Training System			
7.2. Training Needs Analysis			
7.3. Instructor Competence			
7.4. Delivery of Training			
7.5. Leadership Orientation/Induction			
7.6. General Orientation/Induction			
7.7. Job Orientation/Induction			
7.8. Training Systems Evaluation			
8 - COMMUNICATIONS AND PROMOTION			
8.1. Communication System			
8.2. Meeting Co-ordination			
8.3. Management Meetings			
8.4. Group Meetings			
8.5. Joint Committee/Council			
8.6. Coaching			
8.7. Recognition			
8.8. Promotion Campaigns			
8.9. Away from Work Safety Information			
8.10. Process Safety Awareness			
9 - RISK CONTROL			
9.1. Health Hazards Controls			
9.2. Safety Hazards Controls			
9.3. Security Controls			
9.4. Environmental Hazard Controls			
9.5. Quality Control of Materials and Products			
9.6. Process Control and Operating Procedures			
9.7. Rules			

	S	PS	C
9.8. Work Permits			
9.9. Warning Signs and Notices			
9.10. Personal Protective Equipment			
9.11. Process Hazard Controls			
9.12. Operating Procedures for Controlling Process Risks			
9.13. Major Hazard Reports			
10 - ASSET MANAGEMENT			
10.1. Maintenance Program			
10.2. Maintenance Planning and Scheduling			
10.3. Execution of Maintenance			
10.4. Maintenance Review			
10.5. General Conditions Inspections			
10.6. Physical Conditions Tour			
10.7. Special Equipment Inspections			
10.8. Pre-Use Equipment Inspections			
10.9. Engineering Change Management			
10.10. Inspection, Measuring and Test Equipment			
10.11. Acquisition and Sale			
10.12. Asset Integrity Program			
10.13. Process Safety Inspections			
11 - CONTRACTOR MANAGEMENT / PURCHASING			
11.1. Contractor/Supplier Selection			
11.2. Contractor Operations			
11.3. Contractor/Supplier Assurance			
11.4. Supply Chain and Purchasing			
11.5. Logistics			
11.6. Managing Contractors in Process Areas			
12 - EMERGENCY PREPAREDNESS			
12.1. Emergency Needs Assessment			
12.2. Site Emergency Plan			
12.3. Off-Site Emergency Plan			
12.4. Crisis Plan			
12.5. Business Continuity Plan			
12.6. Emergency Plan Review			
12.7. Emergency Communications			
12.8. Emergency Protection Systems			
12.9. Energy Controls			
12.10. Emergency Teams			
12.11. Drills and Exercises			
12.12. First Aid			

	S	PS	C
12.13. Medical Support			
12.14. Organized Outside Help and Mutual Aid			
12.15. Preparedness for Major Accidents			
13 - LEARNING FROM EVENTS			
13.1. Learning from Events System			
13.2. Learning from Success			
13.3. Participation in Investigations			
13.4. Near-Miss and Substandard Conditions			
13.5. Complaints Management			
13.6. Event Announcements			
13.7. Away-from-Work Accidents			
13.8. Action Follow-Up			
13.9. LFE Reporting Verification			
13.10. Event Analysis			
13.11. Improvement Teams			
14 - RISK MONITORING			
14.1. Health Hazard Monitoring			
14.2. Safety Hazard Monitoring			
14.3. Security Hazard Monitoring			
14.4. Environmental Hazard Monitoring			
14.5. Customer Satisfaction			
14.6. Effectiveness of Monitoring			
14.7. Perception Surveys			
14.8. Behavioral Observation			
14.9. Task Observations			
14.10. Audits			
14.11. Process Hazard Monitoring			
15 - RESULTS AND REVIEW			
15.1. Business Results			
15.2. Management Review			
15.3. Reporting to Stakeholders			
15.4. Residual Risk Management			

LEGEND

S - System Inadequate. Action required to fill the gap in our management system e.g., improvement team to develop a new system, process or procedure.
PS - Performance Standard Inadequate. Action required to define better WHO does WHAT and WHEN e.g., change the procedure, instruction or rule.
C - Compliance with Performance Standard Inadequate. Action required to improve compliance e.g., implement a program of training, coaching or promotion.