Table of Contents

Page

Chapter 14 Risk Mitigation and Hazard Control 2

1. Introduction 2

1.1 ... Regulatory Backdrop: 2
1.2 ... Our Objectives: 2
1.3 ... Definitions: 2

2. Policies 3

2.1 ... Project Planning: 3
2.2 ... HAZID Process: 3
2.3 ... HSE Plan: 3
2.4 ... JSAs: 3
2.5 ... MOC: 3
2.6 ... Meetings: 3
2.7 ... Observation Cards: 4
2.8 ... PTWs: 4
2.9 ... MOPO: 4
2.10 . PPE: 4
2.11 . STOP-WORK Authority: 4
2.12 . Training: 4

3. HAZID PROCESS 5

3.1 ... Purpose: 5
3.2 ... Hazard Register 5
3.3 ... Consequence Classification: 6
3.4 ... Probability Classification: 6
3.5 ... Risk Matrix 7

Chapter 14 Risk Mitigation and Hazard Control	
References:	[ISM Code] *International Safety Management Code* (2018)

1. Introduction

1.1 Regulatory Backdrop:

The ISM Code does not set out a separate section for *Risk Mitigation and Hazard Control*, but its intention is apparent in every one of those sections that we mitigate risk and impact of our workplace hazards. The Code's frequent use of words such as *objectives, ensure, continuously improve, periodically review, motivate the crew, preparedness, prevent recurrence*, and *verification* all make clear the expectation of risk mitigation to control these hazards. In the ***Objectives (1.2)*** section of the Code is written: "*assess all identified risks to its ships, personnel and the environment and establish appropriate safeguards*." This chapter provides guidance for doing so.

1.2 Our Objectives:

There are inherent hazards in our workplace afloat and ashore. Our objective here is to (1) identify and render our workplace hazards reasonably inconsequential by assessing the severity and probability of a corresponding incident and (2) put mitigations in place to reduce incident likelihood and impact to an acceptable level. Our over-arching goal is to cause no harm to people, our vessels, or the environment.

1.3 Definitions:

HAZID Process: Hazard Identification and Risk Mitigation process - a high-level, structured review method used early in a project's life cycle to spot HSE risks before project execution plans are locked in. Our HAZID process is detailed in **section 4** of this chapter.

HSE: Health, Safety, and Environment – a set of three universally recognized areas of focus associated with human sustainability. Our society accepts as a top priority the need and responsibility to mitigate risk and control hazards in these three areas.

JSA: The Job Safety analysis (JSA) is a participatory risk assessment conducted by the line workers and led by the supervisor before beginning a task. It requires participation and encourages contribution by all workers who will participate in that task. The JSA process breaks a task into component steps, identifies hazards associated with each step and describes how the risks associated with these hazards will be mitigated.

MOC: Management of Change – a practice designed to evaluate, approve, and track modifications to a standardized process before they are implemented. MOC ensures that changes to equipment, procedures, materials, labor type, or organizational structure do not introduce hidden HSE risks.

PPE: Personal Protective Equipment - clothing, gear, or device worn to protect the body from injury, illness, or workplace hazards. Our standard PPE includes work gloves, hard hat, steel-toed footwear, safety glasses, hearing projection, and other items specific to the job.

SOP: Standard Operating Procedure - a set of specific step-by-step instructions created to help workers carry out complex or routine tasks safely, consistently, and efficiently. These instructions are not to be changed without proper review, approval, and communication to the workers.

2. Policies

2.1 Project Planning:

Planning for new projects shall include our HAZID process prior to project mobilization. The project planning process shall include completion of a project specific HSE plan, review of process-specific JSAs, and any needed MOC assessments and JSAs for activities outside of our SOPs..

2.2 HAZID Process:

We shall maintain and continually improve our HAZID process to assess our work processes and mitigate the risk of incidents impacting health, safety, and that of our environment. In this, we shall:

- identify and maintain a working registry of our work process hazards,
- assess and classify the consequences and probabilities of incidents potentially arising from each hazard,
- assign and implement acceptable mitigations for the most severe and impactful combination of incident consequence and probability.

2.3 HSE Plan:

Per ***Section 2.1 Project Planning*** of this chapter, a project-specific HSE Plan shall be conducted as appropriate during the planning stage. This plan shall be reviewed during the project's kickoff meeting with all on-board.

2.4 JSAs:

Per ***Section 2.1 Project Planning*** of this chapter, JSAs shall be conducted as appropriate. During the active project, a participatory JSA shall be conducted or reviewed by the line workers and led by the supervisor before beginning a hazardous work process. It shall require full participation from those conducting the process and is to encourage contribution by all workers charged with the work.

2.5 MOC:

Per ***Section 2.1 Project Planning*** of this chapter, MOCs shall be conducted as appropriate during the planning stage of new projects or any time a significant change in process, equipment, or personnel occurs. This MOC shall be reviewed during the project's kickoff meeting with those affected. Our MOC procedure is described in detail in the corresponding SOP.

2.6 Meetings:

Kickoff: At the beginning of each project, we shall conduct a Kickoff Meeting that reviews and discusses our safety policies and protocols including the elements listed in this section as well as our drills. All participants shall sign the minutes.

All-Hands Safety Meetings: All vessels shall conduct all-hands safety meetings at least weekly. Discussions shall include (1) observation cards submitted in the last 24 hours, (2) weather and sea-state, (3) upcoming tasks, and (4) vessel movements and any simultaneous operations (SIMOPs).

Toolbox: All vessel departments shall conduct Toolbox Meetings at each shift change. The Master and Party Chief shall ensure that shift workers participate in toolbox meetings conducted for their departments. Discussions shall include (1) work performed on last shift, (2) upcoming work for the next shift, (3) any maintenance items that need to be addressed, and (4) any new hazards/mitigations from the previous shift. All participants from both shifts shall sign the minutes.

Lessons-Learned: At the end of each project, we shall conduct a Lessons-Learned meeting that reviews and discusses what we learned from the project and what we can do better next time. All participants shall sign the minutes.

2.7 Observation Cards:

We shall provide safety observation cards onboard all vessels to be submitted for review at the next safety meeting.

2.8 PTWs:

Our PTW (Permit to Work SOP-GEN-019) program shall include the requirement to properly permit especially hazardous activities on our vessels including:

- energy isolation (SOP-GEN-005),
- confined space entry (SOP-GEN-004),
- working at heights (SOP-GEN-009), and
- hot work and welding (SOP-GEN-026).

2.9 MOPO:

Each day the Master (working with the Party Chief if during survey operations) shall make the decision whether the current and forecast conditions will permit safe work on the back deck. We have established thresholds above which various survey operations are deemed unsafe. These thresholds are stated in our matrix of permitted operations (MOPO). Work shall also be stopped during the workday if weather forecast or a change in these criteria causes the Master (and survey team) to conclude that a deployed tool may not be safely retrieved.

2.10 PPE:

The Master and Party Chief shall ensure that individuals use the recommended PPE as required by our PPE Matrix and as recommended in the JSA. PPE shall be regularly inspected and replaced whenever it shows signs that it may provide inadequate protection. The HSE officer shall be consulted whenever issues arise concerning PPE equipment use and replacement.

2.11 STOP-WORK Authority:

We strive to build a team environment in which each employee feels responsible for the safety of himself and his teammates. Any employee, regardless of position or experience, shall be empowered, encouraged, and expected to STOP WORK if they feel anything is unsafe, or if they are unsure of their role/ responsibilities regarding an operation. There shall be no repercussions from management for using STOP WORK Authority. If a manager does not honor a STOP WORK from an employee, the employee shall contact the HSE Officer immediately for resolution.

2.12 Training:

The goal of all our safety training is to get employees to recognize hazards around them and proactively work to reduce the probability and severity of an incident. Employees shall be trained in hazard identification through one or more sources, including our computer-based training programs, safety videos, in person training, and weekly HSE talks. This training shall include the proper use and care of PPE.

3. HAZID PROCESS

3.1 Purpose:

Our HAZID process is used to assess and mitigate risks to constrain our workplace hazards for the purpose of precluding HSE incidents. It is used for standard and non-standard processes as well as for new projects. The results of the HAZID process also improve our hazard control tools such as Project HSE Plans, SOPs, JSAs, MOCs, and engineering controls. Working through these proactive control tools for a project can also feed new controls back into the HAZID process.

3.2 Hazard Register

We maintain a **Hazard Register** that includes a comprehensive set of work process hazards we have identified and classified. It is used as a starting template to identify, evaluate, and classify hazards of new projects and processes. A snippet of this template is shown below. We classify the consequence and the probability of a potential incident caused by each hazard using the classification tables presented and discussed next in this chapter.

Prior to each project, we review the register with the client and add any new project-specific hazards. We identify and evaluate any further risk mitigations needed, and the project's register is updated accordingly. The completed exercise serves as our HAZID process for that project and is also used to update any affected project JSAs and for development of any MOC.

Hazard Register Template

					Hazard Classification			Hazard Classification After Additional Mitigation Measures	
ITEM #	ELEMENT	POTENTIAL HAZARDS / INCIDENTS	EFFECTS/ THREATS/ RISKS	CONTROLS IN PLACE	CONSQ	PROB	FURTHER MITIGATION	CONSQ	PROB
7	Permits to Work	Inadequate work controls causing incident/accident/equipment damage/loss.	Loss, injury, mistakes, unsafe acts, lost time, financial loss, damage/loss of equipment	Process Checklists, JSAs, Off-Process PTWs, Toolbox Meetings, Stop-work policy, mgmt team meetings, continual mgmt team evaluation of weather	2	D		2	D
8	Transit Navigation	Loss of GPS signal, loss of nav equipment function, inadequate charts causing incident/accident	Running aground, collisions, entering restricted areas	Backup bridge GPS system. Charts, Pubs, and Voyage Plans in place. NTMs incorporated weekly.	2	E		2	E
9	Site Navigation	Imprecise coordinates, wrong geodetics, obsolete/wrong/no calibrations, imprecise tool offsets, loss of GPS signal, loss of nav equipment function causing	Striking seabed infrastructure causing damage or leakage. sample/measure at wrong location, loss of quality/efficiency	Pre-start validation of Client's geodetic settings in nav system, vessel offsets, calibrations, coordinates. Backup GPS system.	2	E		2	E
10	Station Holding Ability	Vessel unable to maintain position within specifications, sea state building, causing incident/accident/loss	Equipment damage, injury, reputation, financial loss, poor quality	Stop Work authority in place. Matrix of Permitted Operations (MOPO) in place. Experienced helmsmen, navigator, Party Chief.	4	C		4	C
11	Lifting Gear Use	Unsafe operations in sea conditions, swinging gear, runaway gear, untrained staff, failure of winch, a-frame, crane, other gear, during lift, causing incident/accident/damage.	Injury, loss, equipment damage, project delay	All lifting equipment SWL inspected and certified, process checklists, field-tested processes, personnel qualified & certified for position, properly designed systems, weather stand-down threshold/decision, procedure in place for disposal of gear taken out of service.	2	D		2	D
12	Slips, Trips, & Falls	Unsafe walking and working surfaces due to sea conditions. Poor housekeeping, rushing, fatigue, heat/body stress, causing injury	Injury	On-board hospital, PPE per matrix, ERP, experienced crew & staff, non-slip surfaces, awareness training, visual warnings, safety signage, fall-protection gear, observation cards, Safety HSE Awareness topic, cross-dept audits	3	C		3	C

3.3 Consequence Classification:

The **Consequence Classifications Table** shown below is used in our HAZID process. Consequence of potential incidents arising from our Hazard Register is ranked numerically as **Class 1, Class 2, Class 3,** or **Class 4,** with **Class 1** being the most serious.

CONSEQUENCE CLASSIFICATIONS				
Class	**Health & Safety**	**Societal Disruption**	**Environmental Impact**	**Financial Impact**
1	**Fatality**	**Serious Impact on large community**	**Major/extended duration/full scale response (>2,500 bbl)**	**Corporate-major**
2	**Serious injury**	**Limited impact on small community**	**Serious/significant resource commitment (3 to 2,500 bbl)**	**Corporate intermediate**
3	**Medical treatment**	**Minor impact on public**	**Limited response of short duration (½ to 3 bbl)**	**Company department**
4	**Minor or no impact**	**No impact on public**	**Minor or no response (<½ bbl**	**No material impact**

3.4 Probability Classification:

The following **Probability Classification Table** is used in our HAZID process. Probability of potential incidents arising from our Hazard Register is ranked alphabetically as **Class A, Class B, Class C,** or **Class D,** with **Class A** being the most probable.

PROBABILITY CLASSIFICATIONS		
Class	**Chance of Recurrence**	**Probability**
A	**Possibility of repeat incidents**	**1 in 2 jobs**
B	**Possibility of isolated incidents**	**1 in 4 jobs**
C	**Possibility of occurring later**	**1 in 20 jobs**
D	**Not likely to recur**	**1 in 100 jobs**
E	**Will practically never recur**	**1 in 400 jobs**

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3.5 Risk Matrix

Below is our **Risk Matrix,** which grids *consequence* vs. *probability* and forms twenty red, yellow, or green bins. These colors determine the probability of exposing ourselves to a workplace hazard risk-ranked by these two distinct variables. Potential incidents of high consequence and high probability are unacceptable (we have no tolerance for the risk), so high-risk activities need additional mitigation measures to reduce risk prior to conducting the activity. This reduction is represented in the matrix by a hazard moving from a red (unacceptable) bin into a yellow (acceptable) or green (optimal) bin.

An additional mitigation measure could be, for example, adding a physician or medic on-board for a project planned for remote location with limited ability to get an injured person to medical care in time to save life or limb.

Posted on this example matrix are the **Item #s** of the six hazards in the example Hazard Register. Note that they all fall into yellow or green bins, meaning that the risk of each hazard causing an incident with our standard controls in place is acceptably low.

Also posted for illustration in bin **2B** of the grid is **Hazard #11** (heavy gear being lifted and put over the side), but without our standard lifting-gear controls in place. This would represent a situation where:

- lifting gear had not been fully load-tested, something fails upon loading, the load falls,
- lifting process was not engineered or practiced, exposed a deckman to swinging gear, or
- faulty or wrong part hurriedly used in load line, lack of inspection, the part breaks, the load falls.

In such a situation, the likelihood of a gear failure is 100%, being just a matter of time, with the free-swinging or falling load threatening very serious consequences to personnel and perhaps also the environment. But with our standard lifting gear controls in place, likelihood of failure is dramatically reduced, and the risk to personnel and environment is now tolerable. Risk reduction of this lifting process (Hazard #11) into an acceptable range is shown by the blue arrow.

