

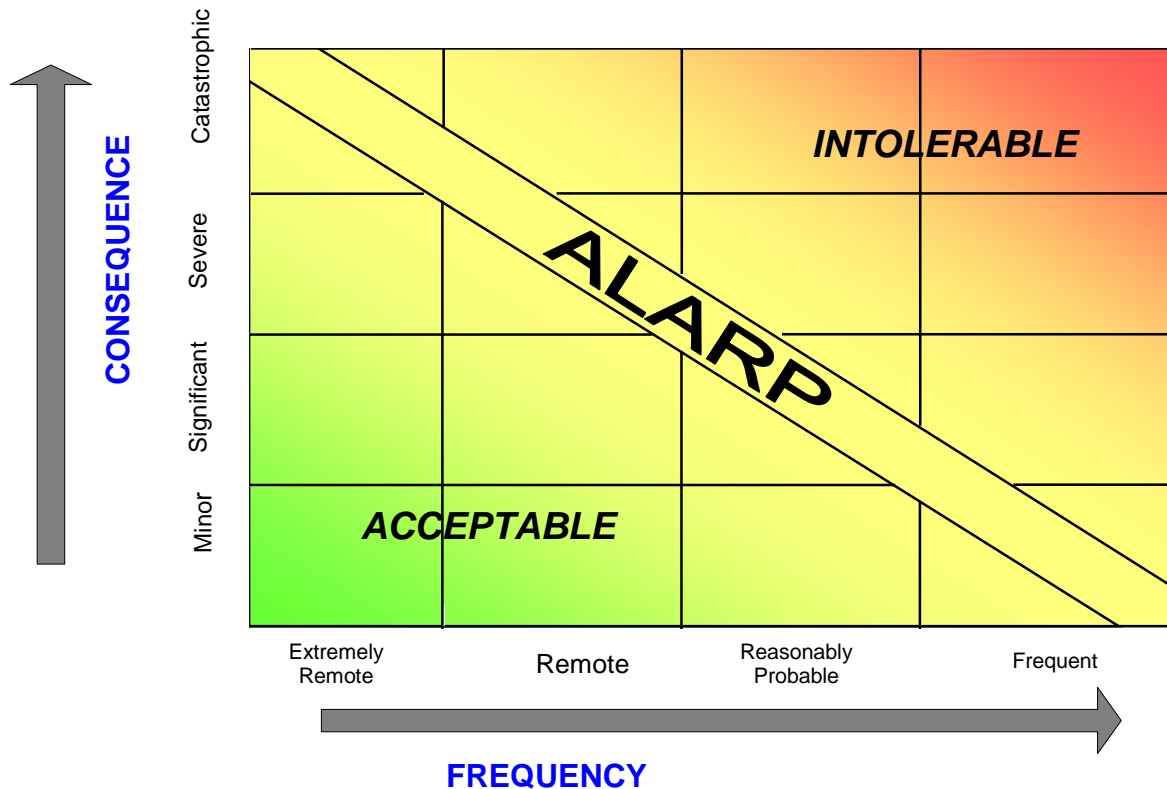
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# **ANNEX A**

## **RISK CRITERIA**

# 1 RISK ASSESSMENT

IMO Guidelines define a hazard as “something with the potential to cause harm, loss or injury” the realisation of which results in an accident. The potential for a hazard to be realised can be combined with an estimated (or known) consequence of outcome. This combination is termed “risk”. Risk is therefore a measure of the frequency and consequence of a particular hazard. One way to compare risk levels is to use a matrix approach:-



**Figure 1 Example Risk Matrix**

At the low end of the scale, frequency is extremely remote and consequence insignificant; risk can be said to be negligible. At the high end, where hazards are defined as frequent and the consequence catastrophic, then risk is termed intolerable. Between the two is an area, which is defined as ALARP, or “As Low As Reasonably Practicable”. ALARP corresponds to the point where further reduction of risk is impracticable, or where the cost of such reduction would obviously be highly disproportionate to the improvement.

For this study risk is applied in a partly qualitative way by using expert judgement. The risk assessment is also comparative, allowing the importance of hazards in relation to each other to be identified in terms of overall risk.

## 1.1 Criteria for Assessment

### 1.1.1 Risk Matrix Criteria

In this study, each hazard was reviewed with respect to cause and effect. Frequencies were derived for notional ‘most likely’ and ‘worst credible’ hazard events in each case, using the following frequency bands:-

Category	Description	Definition	Operational Interpretation
F1	Frequent	An event occurring in the range once a week to once a month.	Monthly
F2	Likely	An event occurring at least once per annum.	Annually
F3	Possible	An event occurring in the range once a year to once every 10 operating years.	1 – 9 years
F4	Unlikely	An event occurring in the range once every 10 operating years to once in 100 operating years.	10 – 99 years
F5	Improbable	An event occurring in the range less than once in 100 operating years.	>100 years

**Table A1 – Frequency Criteria for the Risk Assessment**

The Frequency table for the risk assessment were defined as show in Table A1.

The first three frequency categories are perhaps self-explanatory. Category F4 represents a frequency suggesting an event that could occur in the region of 10-99 operating years, this would reflect major events in the operating history of the Port. Category F5 is an event, which is *currently* considered to pose a very low probability, but where the consequential outcome is major/serious and thus needs to be included to take account of possible future changes in risk.

Using the assessed notional frequencies for the ‘most likely’ and ‘worst credible’ events for each hazard, the probable consequences associated with each event were assessed in terms of damage to:-

- Life (e.g. personal injury, fatality, etc.)
- Property, especially to Third party (i.e. not belonging to the port or terminal or their subcontractors)
- The Environment (oil pollution, etc.)
- Stakeholders (Reputation/Publicity/Loss of revenue streams)

### 1.1.2 Probable Consequences

Scale	People	Property	Environment	Stakeholders (Business)
<b>C0</b>	None	< €2,000	No effect of note	< €2,000
<b>C1</b>	<b>Negligible</b> (single slight injury)	<b>Negligible</b> ( > €2 K)	Tier 1 response (small operational) oil spill with no affect on environmental amenity (>€2 K)	<b>Negligible</b> ( >€2 K)
<b>C2</b>	<b>Slight</b> (multiple minor or single major injury)	<b>Minor</b> ( > €20K )	<b>Minor</b> Tier 2 spill declared but capable of being limited to immediate area within harbour enclosure. (> €20 K)	<b>Minor</b> Bad local publicity or short-term loss of dues, revenue, etc (> €20 K)
<b>C3</b>	<b>Moderate</b> (multiple major injuries or single fatality)	<b>Moderate - Major</b> ( > €200 K)	<b>Moderate</b> Tier 2 response required, with pollution outside harbour enclosure expected. Loss of environmental amenity. Chemical spillage or small gas release (> €200 K)	<b>Moderate</b> Bad widespread publicity, temporary port closure or prolonged restriction of navigation (> €200 K)
<b>C4</b>	<b>Major</b> (More than one Fatality)	<b>Major</b> ( >€2 M)	<b>Major</b> Tier 3 oil spill, widespread beach contamination or extensive damage to amenities. Serious chemical or gas release. (>€2 M)	<b>Major</b> Port closes, navigation seriously disrupted for more than 1-2 days. Ensuing loss of trade. (>€2 M)

**Table A2 – Consequence Criteria for the Risk Assessment**

In Table A2, consequence is assessed for each category and the possible impact for each.

### 1.1.3 Review and Verification Process

During the HAZID meeting, details of each hazard were recorded in a structured hazard list, together with the relevant causes in both most likely and worst credible scenarios.

Frequency and consequence data was then generated for each hazard in the structured hazard list in terms of “most likely” and “worst credible” scenarios, by a process of expert review. This was undertaken at a Hazard Scoring

Workshop where representatives from the relevant stakeholder groups were invited to attend.

During the workshop, each hazard was considered in turn and scored on the basis of the consequence in terms of human life, the environment, third party property and business for both the most likely and the worst credible scenarios. On completion of the workshop, the scoring data was entered into the hazard database and a ranked hazard list produced to show the risk profile.

The frequency and consequence data thus obtained was then reviewed by the study team to ensure internal consistency. The reviewed hazard list is reproduced in full in a subsequent Annex.

## 1.2 Risk Assessment

### 1.2.1 Risk Analysis

From the individual frequency and consequence ratings for each hazard, individual risk factors were derived on a scale of 0 (low risk) to 10 (high risk) as follows:

C o n s e q u e n c e	Cat 4	5	6	7	8	10
	Cat 3	4	5	6	7	9
	Cat 2	3	3	4	6	8
	Cat 1	1	2	2	3	6
	<b>Cat 0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
	<b>Frequency</b>	Less than once per 100 years	10 to 100 years	1 to 10 years	More than once per year	More than once per month

Where:-

- 0 & 1**      **Negligible Risk**
- 2 & 3**      **Low risk**
- 4 & 5**      **Tolerable Risk (ALARP)**
- 6 & 7**      **Heightened Risk**
- 8 & 9**      **Significant Risk**
- 10**         **High Risk**

The risk data obtained from this process was then tabulated (in terms of the 'most likely' and 'worst credible' scenarios (i.e. providing eight risk scores per hazard). The scoring of hazards was undertaken using both the incident data profile for the port company and the local knowledge of users.

It should be noted that occasionally, most likely scenarios can generate higher individual risk levels than worst credible; this is due to the increased frequency naturally associated with the most likely event. In effect, the assessment is scoring the risk associated with two different outcomes from the same initiating event. This tends to occur particularly where consequence levels are similar between most likely and worst case and/or where the frequency of the worst credible is very much less than that of the most likely.

### 1.2.2 Hazard Ranking

The risk data obtained from the above process was then analysed to obtain four indices for each hazard as follows:

- A) the average risk value of the four categories in the 'most likely' set
- B) the average risk value of the four categories in the 'worst credible' set
- C) the maximum risk value of the four categories in the 'most likely' set
- D) the maximum risk value of the four categories in the 'worst credible' set

Average risk values are sensitive towards hazards, which score moderately or highly over a number of categories, whilst the maximum risk values are sensitive towards hazards, which score particularly high in any category.

These values were then aggregated to produce a numeric value representing the average of the four indices.

The hazard list was then sorted in order of the aggregate of the four indices to produce a Ranked Hazard List, in descending order, with the highest risk hazards at the top. This list is produced in full in a subsequent Annex to this report.