IALA GUIDELINE

G1138
THE USE OF THE SIMPLIFIED IALA RISK ASSESSMENT METHOD (SIRA)

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1. INTRODUCTION

The Simplified IALA Risk Assessment method (SIRA) was developed by IALA to provide a risk assessment methodology suitable for small, simple assessment requirements, based on current industry best practice. The SIRA allows competent authorities (and other maritime organisations, such as ports and harbours) to assess maritime and navigation risk in their waters so that they can meet their obligations for the safe management of navigation. In situations where comprehensive and complex assessment of risk may initially be unnecessary, SIRA provides a means of conducting a risk assessment and ensuring the results are appropriately considered and recorded for future reference.

1.1. PURPOSE

The purpose of this document is to provide guidance on SIRA's structured process which identifies navigational hazards, and undesirable scenarios in an area of interest. Using the SIRA tool, a qualitative evaluation of the level of risk is undertaken and it is possible to identify potential risk control options, including their effectiveness in mitigating risk to acceptable levels.

1.2. SCOPE

The SIRA tool follows the International Maritime Organization (IMO) *Formal Safety Assessment* (FSA) [1] methodology (see Figure 1). It is intended as a basic tool to identify risk control options covering the hazards that a competent authority or other organization should address as part of its obligations. It is intended that a SIRA assessment is based on available data and information, together with expert opinion elicited from maritime stakeholders.

For assessment of more complex risk situations and phenomena, competent authorities (or other maritime organizations) are encouraged to consider the use of more advanced risk management tools as described in Guideline *G1018* on *Risk Management* [2]. However, a satisfactory understanding of the maritime environment, traffic patterns and stakeholder interests is an essential first step to understand the risk level within an area of interest and SIRA is designed to assist that process.

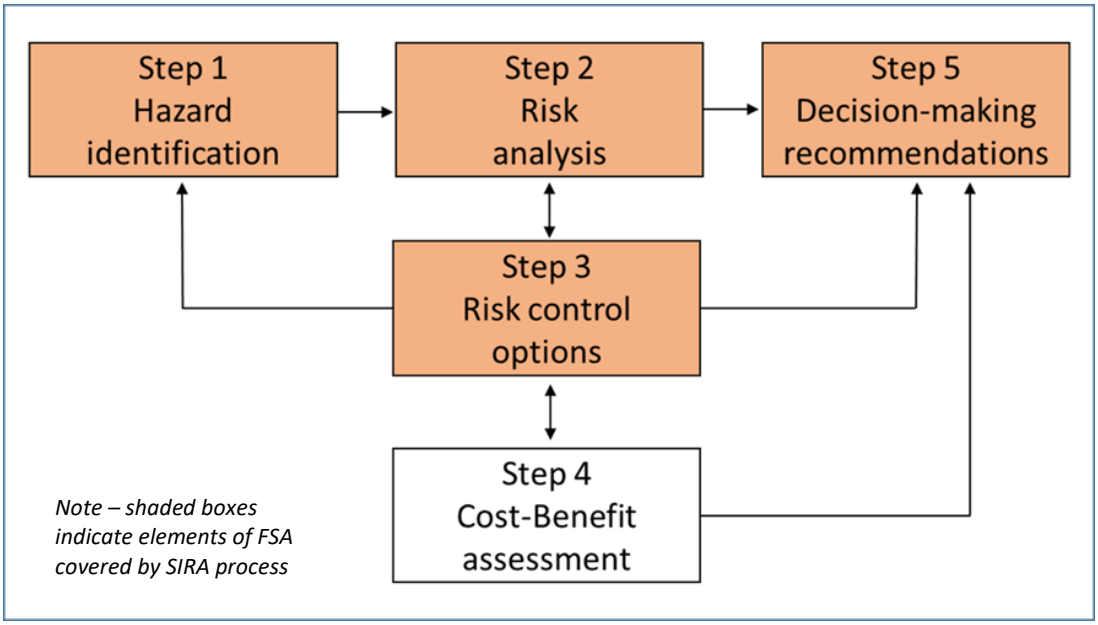

Figure 1 International Maritime Organization Formal Safety Assessment (FSA) process

Note that as illustrated in Figure 1, the SIRA process does not include cost benefit appraisal of the identified risk control options (termed cost-effectiveness in Step 4 of the FSA). It does, however, provide an opportunity to record estimated whole life costs as a starting point for more sophisticated financial analysis by decision makers (see section 2.6.1).

2. THE SIRA PROCESS

2.1. OVERVIEW

The SIRA process is based on the principles set out in the FSA and Guideline *G1018 [2]*. Risk is defined as the combination of two factors (a) the probability (or likelihood of an undesirable scenario occurring) and (b) the potential severity of the consequences (or impact) of that undesirable scenario.

Specific definitions of several of the terms mentioned above are provided in G1018 but for absence of doubt the definitions below are relevant to the SIRA process:

- *Accident:* An unintended event involving fatality, injury, ship loss or damage, other property loss, damage or environmental damage.
- *ALARP:* As Low As Reasonably Practicable; the minimal level of risk that may be achieved, when the costs of further reduction would be grossly disproportional to the benefit
- *Consequence, Impact:* The outcome and severity of an accident expressed in terms of, for example, monetary value, loss of life, environmental damage, etc.
- *FSA:* Formal Safety Assessment, the methodology promulgated by IMO to control maritime risk.
- *Hazard:* A potential to threaten receptors including human life, health, property or the environment.
- *Incident:* Used to indicate an unwanted event which does not necessarily involve damage or harm (compare: *Accident*).
- *Likelihood, probability:* The probability of an event, frequently used within the context of a qualitative risk assessment (compare: Probability)
- *Probability:* the statistical expectance of the number of occurrences per unit of time (frequency) – term used within the context of a quantitative risk assessment (compare: *Likelihood*)
- *Risk:* The combination of the expected frequency (probability) of accidents and the severity of the consequences. Risk can be quantitatively expressed as the product of both.
- *Risk Assessment*: A systematic process encompassing hazard identification, risk analysis and the identification of risk control measures, i.e., Steps 1 to 3 of the IMO Formal Safety Assessment (FSA).
- *Risk Control:* Taking actions (Risk Control Measures, Risk Control Options) in order to mitigate risk
- *Residual risk:* The level of risk remaining when control measures have been implemented.
- Undesirable scenario: Defined as either an incident (near miss) or accident occurring.

The SIRA involves a structured process that identifies and rates the risk of individual hazards (and undesirable scenarios). Where a risk is assessed as unacceptable, then risk control measures are identified to reduce it to acceptable levels. Where risk is neither inacceptable nor insignificant, the aim should be to make them “as low as reasonably practicable (ALARP)”. See section 2.6.1 for further discussion of this concept.

If the area of interest being analysed is vast or complex, division of the area into two or more zones for individual analysis should be considered, ensuring that interaction between zones is taken into account.

A “hazard” is something that may *cause* an undesirable scenario. The SIRA method is based on the causal relationship between hazards, undesirable scenarios and the consequences (or impact), if the undesirable scenario occurs.

The causal sequence is illustrated in the figure below; see Annex 1 and Annex 2 for detailed examples of categories and undesirable scenarios:

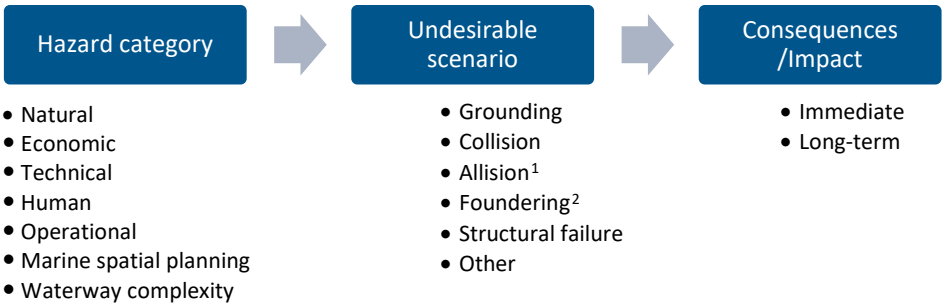

Figure 2 Causal relationship between hazard categories and consequences

The identification of hazards should be based on available information such as environmental data, adequate nautical charts and publications, natural hazards and dangers, volume of traffic, etc. See Annex A for further examples.

Based on the identified hazards, possible undesirable scenarios are identified by a group of stakeholders. SIRA addresses each undesirable scenario in turn, such as the grounding of a vessel on a reef or the collision between two vessels.

The likelihood of the occurrence of each undesirable scenario is estimated, as well as its potential consequences, in the immediate and long term. The SIRA process includes the following steps:

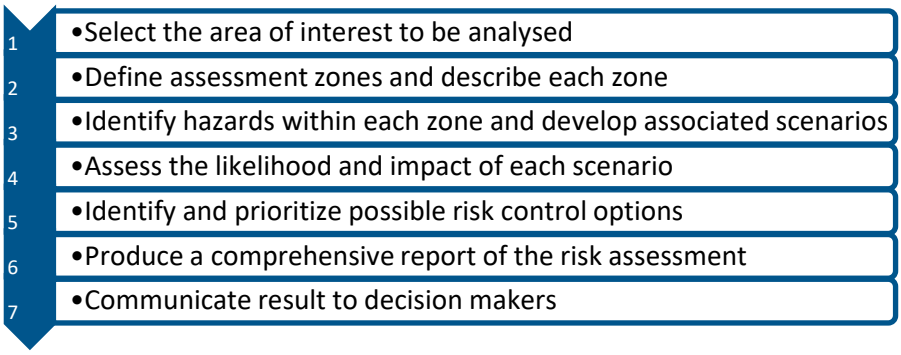

Figure 3 The SIRA process

Steps 2-6 of this process could be carried out in a workshop, together with a group of relevant stakeholders. Preparation for the process by the facilitator includes performing a preliminary zone selection, describing each zone in detail, identifying all relevant stakeholders, and inviting those stakeholders who should participate in the process.

The outcome of the process should be well documented in a written report, supported by a risk assessment matrix with the details of identified hazards, undesirable scenarios and proposed risk-mitigating measures for each zone. *G1079 Establishing and Conducting User Consultancy* [2] may assist in the facilitation of workshops

[1] “Allison” is defined as a vessel striking a fixed man-made object such as a pier or berthing dolphin.

[2] “Foundering” is defined as the sinking of a vessel that is not the result of an earlier collision. For example, a vessel might founder if its cargo shifted during bad weather.

2.2. SELECTION OF ZONES

Countries have maritime regions in which the environmental conditions, the volume of traffic and degree of risk vary. Examples are offshore zones, coastal zones, straits and choke points, restricted waters, major ports and inland waterways. In broad terms, the offshore and coastal water zones can cover a large area, with smaller zones being defined for instance, in restricted waters and choke points.

By dividing areas of interest into defined geographical regions or zones, a risk assessment of each zone can be carried out and risk control options developed for that zone.

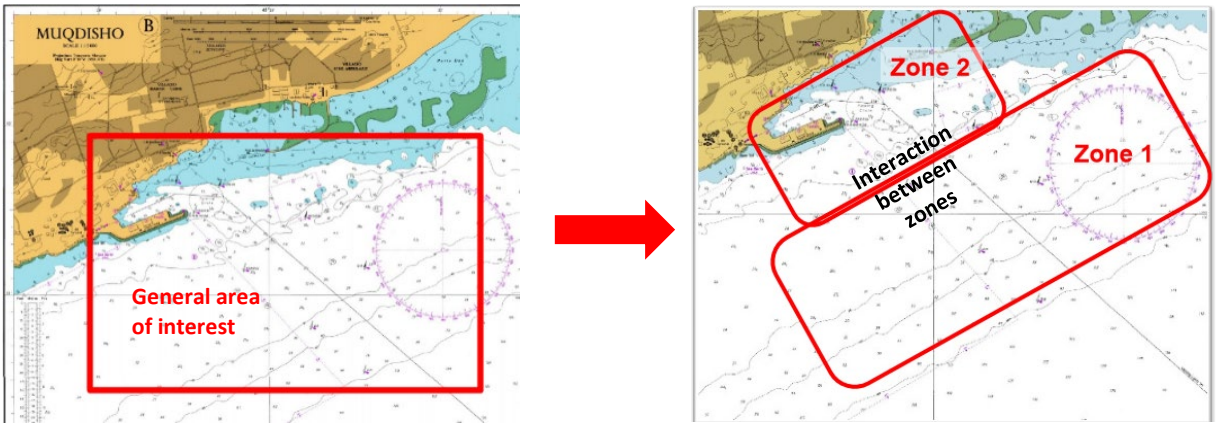

Figure 4 Example of division of area of interest into zones – Port of Mogadishu

If zones are close to each other or overlapping, the possible interaction between hazards in these zones should be considered. In some regions, where there is considerable seasonal change (e.g., ice formation, tropical cyclones, increased leisure or fishing activity, etc.) a separate analysis may be required for each season. There may also be variations between day and night-time conditions.

Once zones have been selected, each zone and its variations can be described in terms of:

- Geographical coordinates
- Volume and mix of traffic
- Bathymetry (e.g., charts, recent hydrographic surveys)
- Geometry of routes in the area, traffic choke points and sharp bends
- Oceanographic, meteorological and environmental conditions
- Existing fixed and floating Marine Aids to Navigation and routing measures
- Port regulations and services e.g.:
  - VTS
  - Pilotage services (either voluntary or compulsory)
- History of maritime incidents such as collisions and groundings
- Relevant stakeholders
- Particularly Sensitive Sea Areas (PSSA), marine parks and other ecologically sensitive areas
- Restricted and danger areas
- Coastal communities (e.g., heritage, tourism, leisure, industry, fishing)

Consideration must be given to the accuracy of available data (e.g., CatZOC).

The zones should be described in sufficient detail to identify potential hazards, and the likelihood and impact of undesirable scenarios.

2.3. IDENTIFYING HAZARDS (FSA STEP 1)

Hazards can be grouped into the following categories:

- Natural
- Economic
- Technical
- Human
- Operational
- Marine spatial planning
- Waterway complexity

Hazard identification should be based on all available relevant information, including, but not limited to:

- Volume and mix of traffic along all routes and areas within the zone.
- Geometry of routes in the area, traffic choke points and sharp bends.
- Isolated dangers including wrecks and obstructions.
- Quality of hydrographic data and charted information available.
- Anchorages, fishing grounds; aquaculture and offshore energy sites and access and egress routes
- Safe minimum depth required for vessels operating within the waterway and tidal constraints.
- Meteorological visibility in the zone.
- Passages through a narrow channel, restricted waters or port entry.
- Possible effects of low sun, background lighting or glare.
- Spoil grounds, undersea cables, military exercise areas and PSSA and other areas of ecological interest.
- Historical evidence of natural and/or malicious interference to GNSS signals.
- Information in the *IMO Ships' Routeing Publication* and *Sailing Directions.*
- Problems with marine communications that have been identified in the past.
- History of maritime incidents such as collisions and groundings.
- Future or proposed infrastructure, technological or environmental developments

When identifying hazards, the largest scale charts covering the zones should be used, and if available, AIS density plots are very useful for describing actual routes within each zone.

Annex A lists examples of potential hazards inviting the user to determine those that could lead to one or more undesirable scenarios within a zone. An undesirable scenario may be caused by one or more hazards in combination.

2.4. IDENTIFY UNDESIRABLE SCENARIOS (FSA STEP 1)

The hazards identified may lead to several different undesirable scenarios. Each hazard should be considered carefully, and the possible scenarios it may cause should be identified and recorded. This could take the form of a workshop session, during which each identified scenario and the underlying hazards are discussed thoroughly with stakeholders. Undesirable scenarios can be categorized including the following:

- Grounding
- Collision
- Allision
- Foundering
- Structural failure
- Other

The probability of grounding depends on many factors, such as the bathymetry, draft and speed of the vessels, vessel motions. Consideration should be given to the effect of tidal range, flow rate and direction in critical areas, as well as prevailing wind speed and direction.

The probability of collisions depends on navigational conditions, waterway configuration, type and volume of traffic. The basic types of collisions are head-on, overtaking, bend, crossing and merging collisions. An analysis of the routes and their geometry, combined with the volume and mix of traffic can reveal probable collision scenarios in each zone.

The probability of a vessel striking a fixed man-made object (allision), such as an offshore platform or port infrastructure, depends on the existence of such structures along the routes and the density of traffic.

Foundering may be related to the quality of the vessel, cargo loading/lashing conditions and weather, together with the experience of the crew operating the vessel.

Structural failure can be a failure of the vessel itself, or a feature external to the vessel. This may be caused by extreme environmental conditions, poor maintenance, cargo handling or even malicious interference.

Human involvement is a significant factor since the root cause of many undesirable scenarios can be related to human error. As such, human factors must form an important consideration in the overall risk assessment. Consideration should also be given to the potential for unmanned or remotely operated vessels in the area of interest.

Annex B lists examples of possible undesirable scenarios.

2.5. LIKELIHOOD AND IMPACT (CONSEQUENCES) (FSA STEP 2)

SIRA specifies five levels of likelihood and five levels of the impact that each type of undesirable scenario would create. Each is allocated a score from which a risk value is calculated as the product of likelihood and impact scores.

Table 1 provides an example for a scale of likelihood for undesirable scenarios. If historical data is available, it may be necessary to adjust the likelihood scale to reflect the known frequency of undesirable scenarios. The scale should be defined before assessing individual risks and maintained throughout the process.

Table 2 provides an example impact scale for a selection of categories, such as service disruption and the environment, and these categories are a suggested starting point. For example, areas of interest that also contain heritage or cultural assets may require individual consideration. The impact categories should reflect the features of the area of interest. The highest score across the categories should be used in combination with the likelihood score to obtain the risk value.

It is important to check whether the resulting risk values (see Table 4) correspond to the understanding of the organisation, e.g, would a scenario with an expected recurrence rate in category "Frequent' and impact category "Severe" indeed be regarded as intolerable, etc.

Examples of how impact categories could be defined are included in Annex C.

Table 1 Descriptions of likelihood

Classification	Score	Likelihood
Very rare	1	Very rare or unlikely, will occur only in exceptional circumstances and not more than once every twenty years.
Rare	2	Rare, may occur every two to twenty years.
Occasional	3	Occasional, may occur every two months to two years.
Frequent	4	Frequent, may occur once weekly to every two months.
Very frequent	5	Very frequent, may occur at least once every week.

Table 2 Descriptions of impact categories

Description	Score	Service disruption	Human	Environment	Reputation	Economic
Insignificant	1	No service disruption apart from some delays or nuisance.	No injury to humans, perhaps significant nuisance.	No damage.	Unaffected. No effort or expense required to recover	Insignificant impact
Minor	2	Some non-permanent loss of services such as the closure of a port or waterway for up to 4 hours.	Minor injury to one or more individuals who may require hospitalization.	Limited short-term damage to the environment.	Minimally affected. Little effort to recover.	Minor impact
Severe	3	Sustained disruption to services such as the closure of a port or waterway for 4-24 hours	Injuries to several individuals requiring hospitalization.	Short term damage to the environment in a small area.	Damaged. Some effort and expense to recover	Severe impact
Major	4	Sustained disruption to services such as the closure of a major port or waterway for 1-30 days or permanent or irreversible	Severe injuries to many individuals or loss of life.	Long term to irreversible damage to the environment in a limited area	Severely damaged. Considerable effort and expense required to recover.	Major impact

Description	Score	Service disruption	Human	Environment	Reputation	Economic
		loss of services				
Catastrophic	5	Sustained disruption to services such as the closure of a major port or waterway for months or years	Severe injuries to numerous individuals and/or loss of several lives.	Irreversible damage to the environment in a large area.	Irrevocably destroyed or damaged.	Catastrophic impact

For the Economic category, the organization conducting the SIRA should decide on the descriptions of scores 1 to 5, to reflect the five distinct levels of impact of an undesirable scenario on their local and/or regional economy.

2.6. THE ACCEPTABILITY OF RISK

Having determined likelihood and impact scores by consensus, the risk value can be calculated in accordance with the matrix in the table below:

Table 3 Risk value matrix

		PROBABILITY/(LIKELIHOOD)				
		Very Rare (1)	Rare (2)	Occasional (3)	Frequent (4)	Very frequent (5)
CONSEQUENCE (IMPACT)	Catastrophic (5)	5	10	15	20	25
	Major (4)	4	8	12	16	20
	Severe (3)	3	6	9	12	15
	Minor (2)	2	4	6	8	10
	Insignificant (1)	1	2	3	4	5

The next step is to determine whether those risks are acceptable or not. SIRA specifies four colour-banded levels of risk. These are shown in the table below:

Table 4 Action required for risk categories

Risk value	Risk category	Action required
1 – 4	**Green**	**Low risk** not requiring additional risk control options unless they can be implemented at low cost in terms of time, money and effort.
5 – 8	**Yellow**	**Moderate risk must be reduced to the ALARP level**, through the implementation of additional risk control options that are likely to require additional funding.
9-12	**Amber**	High risk for which substantial and urgent efforts **must be made to reduce it to ALARP levels** within a defined period. Significant funding is likely to be required and services may need to be suspended or restricted until risk control options have been actioned.
15-25	**Red**	**Very high and unacceptable risk f**or which substantial and immediate improvements are necessary. Major funding may be required, and ports and waterways are likely to be forced to close until the risk has been reduced to an acceptable level.

2.6.1. THE CONCEPT OF "AS LOW AS REASONABLY PRACTICABLE" – ALARP

The FSA methodology (see Figure 5) requires that any risks that are intolerable (i.e., in the red category in SIRA) should be identified and improved immediately. In reality, this may not be immediately achievable through the application of the SIRA process. It may require more detailed analysis through tools such as the Ports and Waterways Safety Assessment (PAWSA) [4] to get more detailed risk information for the remaining intolerable risks and their potential mitigation measures.

For those risks in the green category the level of risk is considered acceptable. For those risks lying in between these upper and lower bounds (i.e., yellow and amber), they should be appraised to understand how the risks can be reduced to a level "as low as reasonably practicable" ALARP.

The definition of this ALARP level within the FSA is a level that is considered to be cost effective, technically practicable, and the associated costs should not be disproportionate to the benefits gained. This implies therefore that there should be a balance between the reduction in risk and the costs of achieving that reduction.

Different organizations will have differing views of what is reasonably practicable to reduce risk and what level of residual risk is acceptable; this balance is also referred to as risk appetite.

By definition in the FSA, in order to understand how control measures identified through a navigational risk assessment reduce the risk level to ALARP, it is also necessary to undertake a cost-effectiveness analysis. This is beyond the scope of SIRA as illustrated in Figure 1; the SIRA methodology facilitates identification of control measures that theoretically will reduce the risk, and an estimated cost of those control measures, but does not undertake a cost-effectiveness analysis. The control measures and associated costs, however, can be examined in a subsequent cost-effectiveness appraisal (Step 4 of the FSA), to identify if the resulting level of risk is ALARP in reality (i.e., technically feasible *and* reasonably affordable) and if the residual risk is acceptable for the organization.

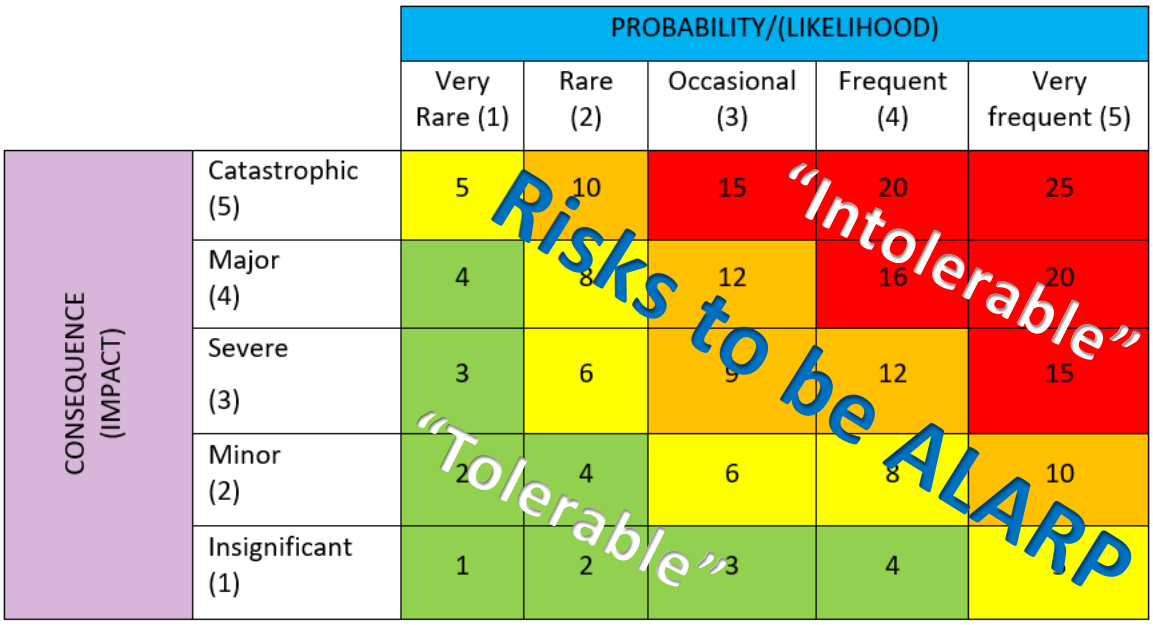

Figure 5 Illustration to show FSA defined ALARP regions in SIRA matrix

2.7. RISK CONTROL OPTIONS (FSA STEP 3)

An objective of the assessment is to identify risk mitigation options for each undesirable scenario that could reduce the risk to an acceptable level if implemented. These may include:

- Improved coordination and planning
- Additional training and education
- Enforcement of new or existing rules and procedures
- Improved and up to date charted information, including hydrographic, meteorological and general promulgation of navigation information
- Enhanced AtoN service provision
- Improved radio communications
- Active traffic management, such as VTS
- Changes to the waterway
- Pilotage requirements

Due to the nature of the process, the outcome of the risk assessment is qualitative/subjective. The aim is to reach a consensus on each risk control option so that the relevant organization can consider implementing the proposed risk mitigation measure(s). The recommended risk mitigation measures should be prioritized to facilitate decision making. An initial whole life cost estimate of the recommended risk mitigation options may also be useful for decision makers.

2.8. COMPLETING THE RISK MATRIX

The risk assessment record takes the form of a matrix:

- listing all hazards considered likely to result in an undesirable scenario;
- assigning a risk value to the undesirable scenario;
- considering risk mitigation measures for each scenario; and
- reappraising of risk value (residual risk) following mitigation.

This enables decision-makers to prioritise and assign appropriate resources to implement the suggested measures, therefore reducing the risk to an acceptable level.

An example of a risk matrix can be found in Annex D. A template risk matrix can be found on the IALA website. This is a Microsoft Excel workbook with a template worksheet to assist risk assessment for a zone. The worksheets can be duplicated to align with the number of zones and the workbook serves as an essential record of the workshop conversations and risk assessment.

2.9. REPORTING (FSA STEP 5)

It is important to prepare a formal record of the risk assessment process and its outcomes. This will provide evidence of the decision process and risk mitigation measures considered and recommended. It will also provide for a comprehensive record when future deliberations take place in the area of interest. The report should include:

- An executive summary, covering the main points and recommendations of the assessment
- Scope and limitations of the risk assessment
- Stakeholders that participated in the process and their specific area of expertise
- A description of the area of interest including details on vessel traffic, hydrographic data, environmental and meteorological conditions
- An analysis and identification of hazards to navigation and undesirable scenarios
- A summary of existing measures that support safe navigation in the area. This can include aids and services to navigation, routeing measures, vessel traffic services, shipborne systems, navigation resources and pilotage, etc.
- Assessment of the likelihood and consequence for each hazard/undesirable event
- Proposed risk mitigation measures and responsible organization(s)
- Assessment of the risk, based on the implementation of the proposed risk mitigation measures
- Conclusions and recommendations

3. DEFINITIONS

Specific definitions have been listed in section 2.1. The definitions of terms used in this Guideline can also be found in the *International Dictionary of Marine Aids to Navigation* (IALA Dictionary) and were checked as correct at the time of going to print. Other than the terms listed in 2.1, where conflict arises, the IALA Dictionary should be considered as the authoritative source of definitions used in IALA documents.

4. ABBREVIATIONS

ALARP	As low as reasonably practicable
CatZOC	Category of Zone of confidence – refers to the quality of hydrographic data as shown on charts
FSA	International Maritime Organization Formal Safety Assessment
GNSS	Global Navigation Satellite System
PSSA	Particularly Sensitive Sea Area

5. REFERENCES

[1] IMO. MSC-MEPC.2/Circ.12/Rev.2 Formal Safety Assessment.

[2] IALA. Guideline G1018 Risk Management.

[3] IALA. Guideline G1079 Establishing and Conducting User Consultancy.

[4] IALA. Guideline G1124 The Use of Ports and Waterways Safety Assessment (PAWSA Mk II) Tool.

ANNEX A HAZARD EXAMPLES

Hazards	
Natural	Safe minimum depth (m)
	Proximity of danger (NM)
	Tide, wind, wave, and current effect
	Ice conditions
	Minimum visibility (NM)
	Low sun issues
	Background lighting
	Loss of PNT (geographical obstruction)
	Earthquake and tsunami
Economic	Legal action problems
	Insufficient AtoN funding issues
Technical	Shipborne navaid failure
	Quality and validity of charted information
	Loss of vessel control due to mechanical failure
	Loss of communications
	Loss of connectivity
	Cyber interference
	AtoN failure
	Loss of PNT
	Substandard ships
Human	Crew competency
	Fatigue
	Safety culture
	Influence of alcohol and/or drugs
	Availability and competency of VTS
	Competency of other AtoN provider
	Availability and competency of pilotage
	Piracy/terrorism
	Political issues
	Culture and language issues
	Crew medical issues
	Crew distractions
Operational	Impact of smaller vessels
	Fishing activities

Hazards	
	Seasonal activities
	Poor passage planning
	Inadequate routeing guidance
	Poor route monitoring
	Poor promulgation of maritime safety information (MSI)
	Poor response to marking of new danger
Spatial planning conflicts	The existence of wrecks and new dangers
	Crowded waterway issues
	The existence of restricted areas (e.g., spoil grounds, fish farms)
Waterway complexity	Sharp bends
	Narrow fairway
	Manoeuvring space
	Traffic considerations
	Limited available depth of water
	New or existing obstructions
	Mobile seabed
	Channel siltation

ANNEX B SCENARIO EXAMPLES

Scenarios	
Collisions	Head-on
	Overtaking
	Bend
	Crossing
	Merging
Groundings	Grounding on rock
	Grounding on soft bottom
	Grounding on wrecks
Allisions	Windfarms
	Oil rigs
	Wave and tidal energy structures
	Breakwaters
	Aquaculture site
	Aids to Navigation
Foundering	Capsizing
	Sinking
Structural failure	Structural failure of the vessel
	Structural failure of features external to the vessel (bridge, lighthouse etc.)
Other	Engine fire
	Cargo fire
	Pollution
	Cargo loss

ANNEX C EXAMPLES OF SIRA IMPACT CATEGORY DESCRIPTIONS

C.1. E.G. FOR TROPICAL ISLAND PORT AND ENVIRONS

In this example, in addition to the categories described in Table 2, the island has particular natural and historical assets that were considered essential to consider within the SIRA. The additional categories and levels were described as follows:

Level	Marine species	Heritage	Tourism	Cultural
1	Insignificant loss of the population or minor disturbance of one or more species in a small area	Miniscule destruction or loss of elements of a heritage site	Miniscule influence on volume of tourism in a small area	Miniscule influence on one or more features of a culture
2	Some reduction (<10%) of population or noticeable disturbance of one or more species in a small area	Some destruction or loss (<10%) of elements of a heritage site	Some influence (<10%) on volume of tourism in a small area	Difficulty in maintaining one or more cultural features
3	Noticeable reduction (>10%) in population and/or severe disturbance of one or more species in a limited area	Noticeable destruction (>10%) or loss of elements of a heritage site	Noticeable (>10%) reduction of volume of tourism in a limited area	Loss of one cultural feature
4	Over 50% reduction of population or extensive disturbance of one or more species in a limited area	Destruction or loss of over 50% of the elements of a heritage site	Over 50% reduction of volume of tourism in a limited area	Loss of several cultural features resulting in a threat to one or more cultural practices
5	Loss of the whole population of one or more species in a large area	Total loss of a heritage site or over 50% loss of elements of more than one heritage site	Total loss of tourism in a limited area or over 80% reduction in volume over a large area	Loss of several significant cultural features resulting in the termination of one or more cultural practices

C.2. E.G FOR SMALL LEISURE MARINA

In this example, the marina uses the standard categories in Table 2 and included the following descriptions of the *economic category* levels 1 to 5, reflecting its relatively small economic value and potential impact on the local economy:

Level	Description
1	None or minimal cost – less than $1000
2	Minor damage to berths or third-party vessel damage – above $1000 and less than $5,000
3	Significant damage to berths or third-party vessel damage or interference with operation of the marina – greater than $5,000 and less than $25,000
4	Major damage to berths or third-party vessel damage or interference with operation of the marina – greater than $25,000 and less than $100,000
5	Catastrophic loss of income from marina closure and/or cost of fines or clean up and/or third party vessel damage– greater than $100,000

C.3. E.G FOR COMMERCIAL PORT

In this example, the port uses the standard categories in Table 2 and included the following descriptions of the *economic category* levels 1 to 5, reflecting its larger economic value and potential impact on the regional economy:

Level	Description
1	Hull and machinery up to $750,000,000 or Protection and Indemnity (P&I) insurance of up to $100,000,000. Examples – Costa Concordia, Prestige and Erika
2	Hull and machinery up to $120,000,000 or P&I insurance of up to $100,000,000. Examples – total losses, wreck removals, rescue operations and collisions
3	Hull and machinery up to $1,000,000 or P&I insurance of up to $300,000. Examples: Basic dry docking due to grounding or slight environmental damages.
4	Cargo and liability $10,000 - $50,000 or hull and machine $30,000 - $100,000. Examples: Minor damages to ship, ships equipment or cargo
5	Any event which could not escalate into economical losses
Reference: OpenRisk Guideline for Regional Risk Management to Improve European Pollution Preparedness and Response at Sea	

ANNEX D EXAMPLE RISK ASSESSMENT MATRIX

							Current Situation (now)			New Mitigation	After Mitigation			Cost (US $)	
Ref	Type of scenario	Description of scenario/incident	Root Cause(s)	Existing Risk Control Measures	Reasoning behind Probability Score	Reasoning behind Consequence score (Short term and long term)	Probability Score 1-5	Consequence Score 1-5	Risk Value	Further Risk Control Options which could reduce either probability or consequence	Probability Score 1-5	Consequence Score 1-5	Risk Value	Investment cost (US $)	Annual cost (US $)
Hazard 1: Charted 9.8m patch in approach to port															
Scenario 2.1.1	Commercial vessel grounds on 9.8m charted patch.	Bulk carrier or container vessel with draft of 10.5m grounds on 9.8m patch	Lack of situational awareness/position monitoring. No AtoN marking the patch. Pattern of charted lateral marks naturally draws vessels to the hazard. Poor passage planning.	Leading line draws traffic away from the hazard.	No AtoN marking the patch. No known records over previous years but trade to the port is set to increase. The patch is clearly charted.	Charted nature of bottom is sand. Last survey c1985 by the US. Disruption to port access/operations.	3	3		Install AtoN to mark patch (3 on plan). Review utility of charted AtoN nearby as part of a system review. Survey to confirm existence of patch and update chart.	1	3	3	Buoy and light 38,000 plus tax (subject to survey) Survey estimate $20,000	8000 (individual cost, likely to be less if maintenance combined with other buoys in system)
Hazard 2: Charted 10.5m patch in approach to port															
Scenario 2.2.1	Commercial vessel grounds on 10.5m charted patch.	Outbound bulk carrier or container vessel with draft of 10.5m grounds on 10.5m patch	Lack of situational awareness/position monitoring, No AtoN marking the patch, Pattern of charted lateral marks naturally draws vessels to the hazard, Poor passage planning.	New mitigation	No known records over previous years. Potentially more of a hazard for outbound traffic. Trade to the port is set to increase but patch is clearly charted.	Based on worst credible outcome - charted nature of bottom is rock. Therefore a increased risk of a hull breach.	2	4	8	Install AtoN to mark patch (2 on plan). Review utility of charted AtoN nearby as part of a system review Survey to confirm existence of patch and update chart.	1	4	4	Buoy and light 38,000 plus tax (subject to survey) Survey cost included in Scenario 2.1.1 control measures.	8000 (individual cost, likely to be less if maintenance combined with other buoys in system)
Hazard 3: Shallow area north of turning circle															