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| IALA Guideline |

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Risk Management

Edition 1.0

Document date

Revisions to this IALA Document are to be noted in the table prior to the issue of a revised document.

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# INTRODUCTION (< 1 page)

## SCOPE

This Guideline provides an outline of the risk management cycle as used by AtoN authorities. Tools that can be used to support parts of this process are described in depth in separate Guidelines as indicated.

The intended audience of this Guideline is AtoN authorities.

## OBJECTIVES

This Guideline has following objectives:

1. To provide a broad understanding of the risk management process
2. To give some general considerations for implementing this process in organizations
3. To offer general guidance for the choice of appropriate tools to execute the risk management process

Objective i. is described in Section xx.

Objective ii. Is described in Section xx.

Objective iii. Is described in Section xx.

## RATIONALE OF THIS GUIDELINE

We adapt the generic guidelines from the ISO 310000:2018 standard for the specific context of the IALA members.

It must be pointed out that there are similar guidelines aimed at other fields of work also; in particular the excellent Formal Safety Assessment (FSA) guideline from IMO is worth thorough reading. Attention is also drawn to results of the Open Risk project (<http://www.helcom.fi/Lists/Publications/OpenRisk-Guideline-for-pollution-response-at-sea.pdf>), where a large number of tool has been evaluated.

## relation with other IALA guidelines

The purpose of this document is to provide an overview of risk management and available tools. For more elaborate descriptions of these tools, reference is made to IALA guidelines throughout the text. Figure xx illustrates the structure of the IALA guidelines, particularly the guidelines for the IALA toolbox.

R1002

Risk Management for Aids to Navigation

G1123

IWRAP

G1018

Risk Management

G1124

PAWSA

G1138

SIRA

G1058

G1097

Simulation

Training syllabus

Risk Management – PAWSA, IWRAP Mk2, SIRA & SIMULATION

# Risk management process (1-1.5 page)

(The seven different elements: establish context, risk identification, risk analysis, risk evaluation, risktreatment, communication, review.)

More detailed description is to be found in the ISO 31000:2018

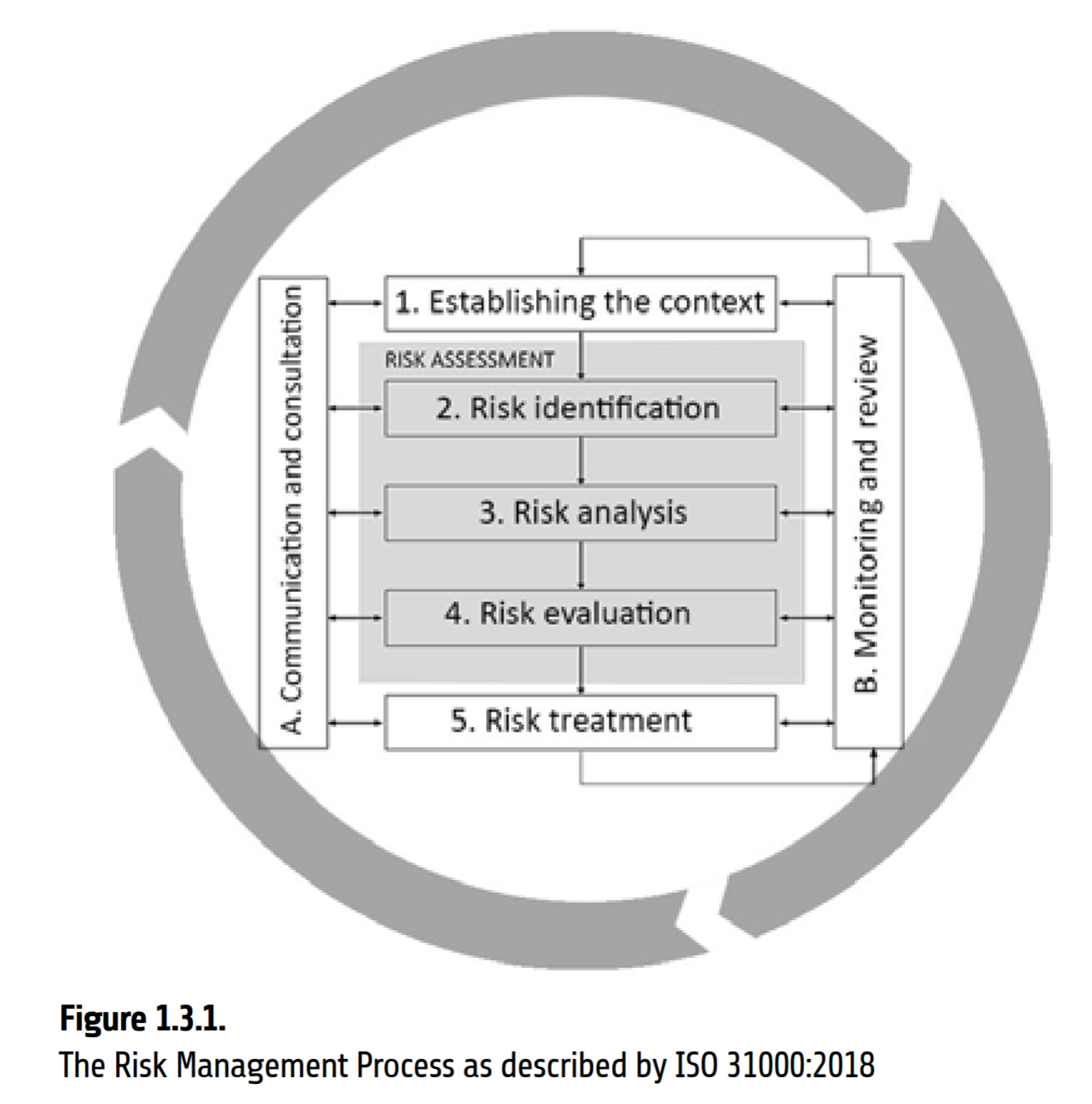


Figure 1. The Risk Management process as described by ISO 31000:2018

# General considerations of implementing risk mgmt process in organizations

## GENERAL PRINCIPLES

* Some words about the ISO31000:2018 Principles:
* Continues process, available data, considerations of uncertainties, etc… (quote from ISO, in lay terminology) – describing some general considerations in performing risk assessment in a decision making context Link the risk management process with organizational process of leadership, decision making, quality management, availability of resources, responsibilities, roles, ….
* Importance of tailoring should be stressed

**1. Integrated**, i.e. it is part of all organizational activities;

**2. Structured and comprehensive**, aimed to lead to consistent

and comparable results;

**3. Customized**, i.e. it is tailored and proportionate to the organization’s

context and objectives;

**4. Inclusive**, i.e. it involves internal and external stakeholders, to

consider their knowledge and views, and to facilitate awareness and

information;

**5. Dynamic**, i.e. it anticipates, detects, acknowledges and responds

to changes in the organization’s internal and external context;

**6. Based on the best available information**, i.e. historic and current

information is used, and future expectations are considered,

accounting also for associated limitations and uncertainties;

**7. Considerate of human and cultural factors**, as human behaviour

and culture influence all aspects of risk management at

each level and stage;

**8. Continuously improved**, through learning and experience.

Risk management is never finished: it implies continuous monitoring whether the safety standards are met or whether the situation seems to lag behind the desired improvement. Monitoring is usually not easily based on statistical evidence, as the frequency of accidents is too low to provide enough data within reasonable time. Observations of pilots, VTS personnel, mariners, fishermen, yachtsmen and others of potentially dangerous situations can be a valuable indication that action might be needed.

## THE NEED FOR IMPLEMENTING THE RISK MGMT PROCESS IN ORGANIZATIONAL PROCESSES

* Some words about the ISO 31000 Framework
* In particular the need to link the risk mgmt. process to organizational decision making processes (roles, responsibilities, quality assurance, resources, **documentation**, accountability, etc)

# Tools for analysing system risk

* Failure modes of the system: Technical, Organizational and Human Factors, contextual
* Half a page description of TECHNICAL, ORGANIZATIONAL, HUMAN FACTORS and CONTEXTUAL failures.

## 

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## Tools table

* Introductory text about the tools in the tables, indicating what kind of information is shown
  + What the tools are for and how they link with the risk mgmt. process (Table 4.1.1)
  + Contextual attributes of the tools, to guide selection of the tools used in a particular organization based on the available time, resources etc (Table 4.1.2)
  + Insight in the tools, from a viewpoint of which issues in the waterway system are covered by the tools (technical, human, etc), and whether the tools need additional interpretation of the results (and hence need to be used in tandem with other tools, e.g. IWRAP + focus group vs PAWSA)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Name** | **What is it?** | **Risk assessment stages** | | | |
|  |  | **Risk identification** | **Risk analysis** | **Risk evaluation** | **Risk treatment** |
| ALARP |  |  |  |  |  |
| Bayesian networks |  |  |  |  |  |
| Brain-storming |  |  |  |  |  |
| Cost-benefit analysis |  |  |  |  |  |
| Delphi |  |  |  |  |  |
| IWRAP |  |  |  |  |  |
| PAWSA |  |  |  |  |  |
| Root-cause analysis |  |  |  |  |  |
| SIRA |  |  |  |  |  |
| Structured interviews |  |  |  |  |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Name** | **Is there an IALA training course** | **Use of resources** | **Level of expertise needed** | **Duration** |
| ALARP |  |  |  |  |
| Bayesian networks |  |  |  |  |
| Brain-storming |  |  |  |  |
| Cost-benefit analysis |  |  |  |  |
| Delphi |  |  |  |  |
| IWRAP |  |  |  |  |
| PAWSA |  |  |  |  |
| Root-cause analysis |  |  |  |  |
| SIRA |  |  |  |  |
| Structured interviews |  |  |  |  |
|  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Name** | **What is the tool good for?** | | | | **Function** | | | **Good use cases (examples)** |
|  | **Tech** | **Org** | **Con-text** | **HF** | **Collection** | **Process** | **Interpreting** |  |
| Bayesian networks |  |  |  |  |  |  |  |  |
| PAWSA |  |  |  |  | x | x | x |  |
| IWRAP |  |  |  |  |  | x |  |  |

# The IALA toolbox

For supporting risk assessment, IALA suggests the use of a number of supportive tools: Ports and Waterways Safety Assessment (PAWSA), IALA Waterway Risk Assessment Program (IWRAP), Simplified IALA Risk Assessment method (SIRA) and simulation. These are described in more detail below. Some tools may be characterised as ‘quantitative’ when they result in numeric risk figures, whereas a tool that produces results in terms of acceptability may be called qualitative. However, it can be argued that no numerical result can be accepted as ‘the truth’ but instead is a starting point for expert evaluation.

## PAWSA

PAWSA (ref$$) provides a (strict) framework for performing an expert session on navigational risks. Originally developed by USCG to evaluate the benefit of coastal VTS’s the method has matured to a generic tool for the evaluation of navigational risk and effectiveness of mitigating measures.

Typically a PAWSA session involves a group of about 30 experts, led by an experienced facilitator assisted by an operator, taking 2 days. The tool includes a mathematical engine to weigh the experts’ opinions against each other, resulting in a qualification of risk categories in terms of acceptability.

* The PAWSA risk assessment process identifies major waterway safety hazards, estimates risk levels and consequences, evaluates potential mitigation measures, and sets the stage for implementation of selected measures to reduce risk.
* PAWSA can provide an accurate risk assessment of an existing port or waterway in a short time frame and with limited expenditure. It is undertaken by carrying out a subjective assessment of the probability of risk in a waterway, based on the experience and expert opinion of stakeholders.

The assessment by this tool indicates whether the existing risk level in the waterway is:

* + **Acceptable** and no further work is needed unless changes occur in important criteria, such as the traffic pattern or the types of ships using the waterway;
  + **Not Acceptable** but the risk control options necessary to make the risk level of the waterway acceptable have been identified adequately;
  + **Not Acceptable** and more detailed study is necessary to enable the risk control options that will make the risk level of the waterway acceptable to be identified adequately.

The PAWSA process has been completed in many ports/waterways in the US. The process has generally been well received by local maritime communities and resulted in some resounding successes. PAWSA is an effective process for evaluating risk and enabling local authorities and waterway communities to work toward long term solutions tailored to suit local circumstances. The aim of the process is to find solutions that are both cost effective and meet the needs of waterway users and stakeholders.

* What is it used for?
* What kind of results do you get?
* What data do you need to do it?
* What are its strengths?
* What are its weaknesses?

## IWRAP

Starting from AIS data, IWRAP (ref$$) can be used to reveal ‘hotspots’ in an area where the traffic density distribution leads to relatively high risk levels. Moreover, considering changes (being it mitigating measures or external claims) in the traffic layout, the resulting change in risk level and risk distribution is clearly shown. However, expertise is still needed to interpret the results, appreciating the limitations of the manual input and the calculation model itself.

* The IWRAP Mk II risk assessment process involves developing a model of the waterways to be analysed. The model describes the geometry of the relevant routes, the traffic volume and composition, as well as the bathymetry of the waterways in question. Once the model has been defined, IWRAP Mk II calculates the average annual number of collisions and groundings likely to occur. This calculation is based on the abovementioned model and a set of so-called Causation Factors which can be thought of as the probability that the vessel fails to make an evasive action in order to avoid the grounding or collision. IWRAP Mk II only addresses the *frequency* of collisions and groundings, it does not consider the consequences associated with these incidents. It is left to the Analyst and the authority performing the analysis to assess the possible consequences of the incidents, however, the output of IWRAP Mk II tool is well suited for such analysis to be performed subsequently once the calculation has been performed.
* What is it used for?
* What kind of results do you get?
* What data do you need to do it?
* What are its strengths?
* What are its weaknesses?

## SIRA

Compared to PAWSA, SIRA (ref$$) provides a much easier applicable tool to structure an expert panel risk assessment. The basis of the method is the risk matrix, in which the probabilities and consequences of the most relevant accident scenarios have to be filled in. When using PAWSA or IWRAP is beyond the possibilities of an administration, application of SIRA may provide a suitable alternative. In other cases SIRA can also be used as additional tool….

* What is it used for?
* What kind of results do you get?
* What data do you need to do it?
* What are its strengths?
* What are its weaknesses?

## Simulation

Simulation (ref$$, ) may be useful in different stages of the risk management process:

1. Revealing unsafe situations

The channel layout, with traffic flow (which can be based on AIS data) and available AtoN, the

1. Evaluation of effectiveness of measures
2. Validation of proposed mitigation

Demonstration and Documentation

By providing a simulation tool to the user, an overall improvement in safe and efficient operation can be realised by assisting in demonstrating the operation of the waterway, channel design and associated AtoN, before the reality of navigating a vessel in the area. Simulations can provide a high level of realism as long as the purpose of the simulation is matched by the accuracy of the models and the simulation facility. Hence, accuracy of manoeuvring models of vessels, environment and associated Aids to Navigation, together with appropriate planning and setup of simulated scenarios, should be carefully considered.

* What is it used for?
* What kind of results do you get?
* What data do you need to do it?
* What are its strengths?
* What are its weaknesses?

## Selection of suitable tools

Some thoughts:

* If AIS data is not available, using IWRAP is difficult.
* For PAWSA a large group of experts and an experienced facilitator are necessary
* Simulation is not always capable of capturing the desired level of detail and accuracy (w.r.t. AtoN simulation)
* Expertise is always needed. Tools provide support and a means to document decisions.











# DEFINITIONS

*Suggested text:* The definitions of terms used in this IALA Guideline can be found in the International Dictionary of Marine Aids to Navigation (IALA Dictionary) at <http://www.iala-aism.org/wiki/dictionary> and were checked as correct at the time of going to print. Where conflict arises, the IALA Dictionary should be considered as the authoritative source of definitions used in IALA documents.

# ACRONYMS

IMO International Maritime Organization (Acronym style)

# REFERENCES

1. Abcd
2. Efgh