RISK-BASED DECISION-MAKING GUIDELINES

Volume 3
Procedures for Assessing Risks

Applying Risk Assessment Tools

Chapter 5 — Relative Ranking/Risk Indexing

Chapter Contents

This chapter provides a basic overview of the risk ranking/risk indexing analysis technique and includes fundamental step-by-step instructions for using this methodology to calculate index numbers that are useful for making relative comparisons of various alternatives. Following are the major topics in this chapter:

See an example of relative ranking/risk indexing in Volume 4 in the Relative Ranking/Risk Indexing directory under Tool-specific Resources.

Summary of Relative Ranking/Risk Indexing

$$\text{Ranking Index} = \text{Fn}\left(\text{Factor}_1, \text{Factor}_2, \ldots\right)$$

Some example ranking index factors:

- **vessel owner**
- **flag state**
- **class society**
- **vessel inspection and boarding history**
- **vessel type**
- **etc.**

Summary of Relative Ranking/Risk Indexing

The relative ranking/risk indexing technique assesses the attributes of a vessel, shore facility, or operation to calculate index numbers. These index numbers are useful for making relative comparisons of various alternatives and can, in some cases, be correlated to actual performance estimates. As illustrated in the figure above, this method scores vessels, facilities, or operations in a number of categories, called factors, to generate the index values. Of course, the factors and scoring process are very different for various applications.

Brief summary of characteristics

- A systematic process built on the experience of the ranking system developers
- Generally performed by a small group who are not necessarily risk experts but who have been trained to understand the ranking system. Sometimes performed by an individual.
- Based mostly on interviews, documentation reviews, and field inspections
- Used most often as a top-level risk assessment technique
- Applicable to almost any vessel or facility
- A technique that generates:
  - index numbers that provide ordered lists of priorities
  - lists of attributes that are the dominant contributors to problems
- A technique in which the quality of evaluation is determined primarily by the relevance and quality of the ranking tool that is used and the training of the users

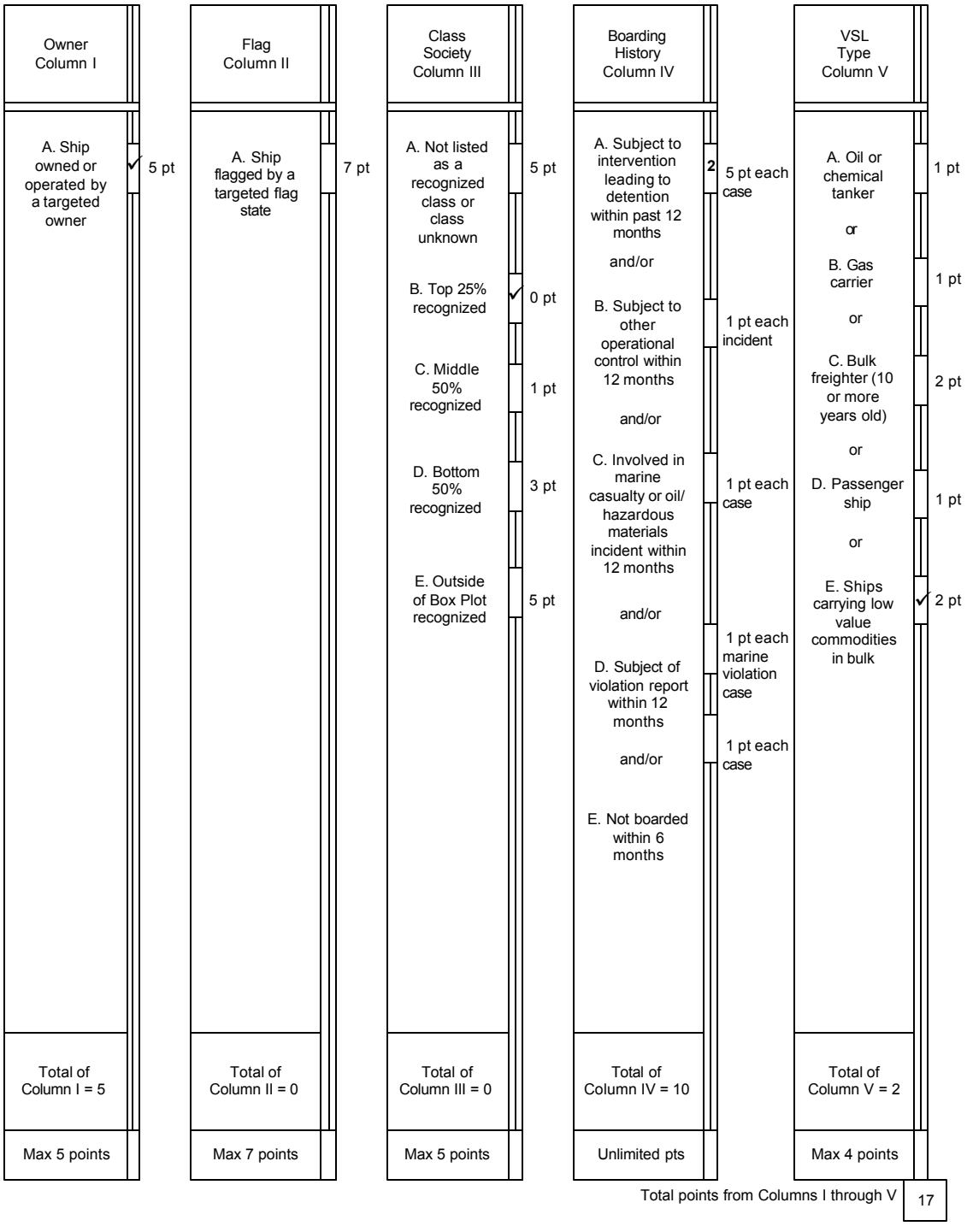
Most common uses

- Used primarily to establish priorities for boarding and inspecting foreign flagged vessels
- Can be used to compare various options for vessel or shoreside facility modifications

Example

The Coast Guard's Port State Control targeting matrix is an example of a relative ranking/risk indexing tool. The following figure illustrates the basic structure of the targeting matrix, and the table on the following page summarizes applications for a few vessels, including the one analyzed in the following figure.

Foreign Vessel Targeting Matrix — Vessel 1



Vessel	Factor Scores						Vessel Boarding Score
	Owner	Flag	Class Society	Boarding History	Vessel Type	. . .	
1	5	0	0	10	2		17
2	0	7	0	1	0		8
3	0	0	5	0	0		5

Based on this table, resources should be prioritized so that Vessel 1 receives adequate boarding and inspection to help ensure it is in compliance with the appropriate standards.

Limitations of the Relative Ranking/Risk Indexing Technique

- **Results can be difficult to tie to absolute risks**
- **Appropriate ranking tool may not exist**
- **Does not account for unique situations**

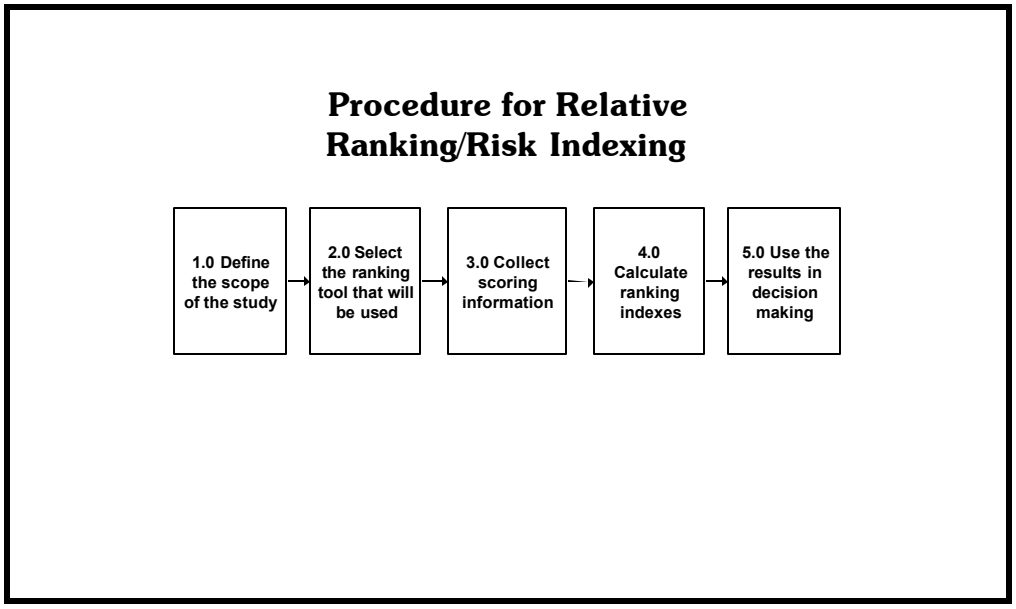
Limitations of the Relative Ranking/Risk Indexing Technique

The relative ranking/risk indexing technique can provide a high-level assessment of the risks associated with a range of activities; however, the following are a number of limitations that should be considered before selecting this method:

Results can be difficult to tie to absolute risks. The relative ranking/risk indexing technique uses various indexing tools to derive risk scores for particular activities; however, these scores are used only for relative comparisons of one activity to another. The scores do not provide information about the absolute risk associated with activities.

Appropriate ranking tool may not exist. Each relative ranking/risk indexing tool provides a structured methodology for (1) collecting risk-related data, (2) performing specific, often arithmetic, calculations on it, and (3) assessing the resulting index scores derived from the calculations. The tools are typically well documented to allow personnel who are not experts in risk assessment to use them effectively. However, the tools are typically focused on a particular type of risk to be evaluated; if an applicable tool does not exist, resources must be invested to develop one. For simple applications on one unit, custom development of a tool may be relatively inexpensive, possibly a day or two of development time. For broader, standardized applications, such as for use across the Coast Guard, considerably more development and validation time may be needed.

Does not account for unique situations. Relative ranking/risk indexing tools are specifically designed to focus on a particular type of risk. They are typically well-documented and very structured to allow personnel who are not expert in risk assessment to effectively use the tools. However, the rigid structure and necessity to comply with the structure of a tool makes it difficult to account for situations outside the scope of the particular tool. This may make it necessary to develop a new tool.



Procedure for Relative Ranking/Risk Indexing

1.0 Define the scope of the study. Clearly define the activity that will be analyzed and the desired decisions or outcomes expected from the study.

2.0 Select the ranking tool that will be used. The tools used to conduct a relative ranking review vary widely in form and complexity. The analyst can select from among existing tools or may choose to develop one specifically suited for a particular type of application.

3.0 Collect scoring information. Each ranking tool will use different types of information about vessels, facilities, or operations to calculate index values. This information must be reliably collected by the analysis team.

4.0 Calculate ranking indexes. Following the instructions for the tool selected, the analyst calculates risk index numbers and summarizes the results to facilitate comparisons among reviewed areas.

5.0 Use the results in decision making. The results for the study may be used alone or in conjunction with other factors, such as cost. The results may identify the most important contributors to the index numbers and will help the analyst determine if corrective actions or design modifications should be undertaken to reduce the anticipated risk.

The following pages describe each of these steps in detail.

1.0 Define the scope of the study

- **Vessel**
- **Activity**
- **System**
- **Facility**
- **Desired outcomes**

1.0 Define the scope of the study

Because the quality of the relative ranking study is strongly dependent on the relevance of the tool used, it is important to clearly define the activity that will be analyzed as well as the desired decisions or outcomes expected from the study. Examples of ways relative ranking studies can be used include:

- Establishing priorities for conducting inspections of foreign-flagged vessels that enter a port
- Identifying the individual onboard systems expected to contribute most to the accidents aboard a vessel
- Identifying the attributes that discriminate among competing design, siting, and operating options
- Comparing the anticipated hazards of a vessel, system, or facility to others whose attributes are better understood or commonly accepted

2.0 Select the ranking tool that will be used

- **Coast Guard tools**
- **Other industrial tools**
- **Custom tools**

2.0 Select the ranking tool that will be used

Generally, a relative ranking tool attempts to distinguish between several alternatives based on the magnitude of the hazards, likelihood of accidents, or severity of potential accidents. The available methods vary widely in form and complexity and can be both qualitative and quantitative.

Analysts electing to use a relative ranking approach may choose from a variety of relative ranking tools. The information on the following pages summarizes some of the most well-known methods, including the following:

Coast Guard tools. The Coast Guard has developed, tested, and, in some cases, extensively used indexing tools to compare the risk of certain activities or the safety of waterways.

Examples of Coast Guard tools:

- Foreign Vessel Targeting Matrix
- Ports and Waterways Safety Assessment (PAWSA)
- Waterways Evaluation Tool (WET)
- Rank Risk, Target Risk (R2TAR)
- Ecological Risk Assessment Principles Applied to Oil Spill Response Planning

More information on these Coast Guard tools can be found in the Relative Ranking/Risk Indexing directory of Tool-specific Resources in Volume 4 of these *Guidelines*.

Other industrial tools. Many indexing tools have been developed for other industries that handle large quantities of flammable and toxic materials and whose risk can be evaluated through the relative hazards associated with quantities and toxicity of materials.

Examples of other industrial tools:

- Dow Fire and Explosion Index
- Mond Index
- Substance Hazard Index
- Material Hazard Index
- Chemical Exposure Index

More information on these industrial tools can be found in Volume 4 of these *Guidelines*.

Custom tools. Many relative ranking tools currently exist, but an analyst or decision maker is sometimes presented with situations that are not effectively addressed by one of the existing tools. In these situations, you may need to develop custom indexing tools. Guidance on developing custom tools begins on page 5-18.

> **CAUTION:** Developing a customized relative ranking/risk indexing tool requires a substantial experience base. A poorly designed relative ranking/risk indexing tool can easily lead to a wrong decision, even if the right data are available.

3.0 Collect scoring information

- **Vessel history**
- **Hazards**
- **Equipment arrangement**
- **Other relevant information**

3.0 Collect scoring information

Each ranking tool will use different types of information about vessels, facilities, or operations to calculate index values. This information must be reliably collected by the analysis team.

Vessel history. For relative ranking studies that compare the risks among different vessels entering a port, the following types of information may be useful:

Owner: Is the ship owned or operated by someone targeted for tighter scrutiny?

Flag: Is the vessel flagged by a targeted flag state?

Class society: Is the vessel listed as a recognized class?

Boarding history: Has the vessel been recently boarded, or has recent boarding resulted in intervention or detention in port?

Vessel type: What type of cargo does the vessel carry (hazardous material, liquid, bulk, etc.)?

Chemical hazard information. Characteristics of a vessel or shore facility that indicate the presence and severity of various types of hazards, as described in Volume 2, Chapter 2 of these *Guidelines,* is important for applying most relative ranking tools. A particular tool may be targeted toward a single type of hazard, such as flammability, or many types of hazards.

Equipment arrangement drawings. Drawings identify the location of the hazards to be analyzed and positions of the following:

- Other systems
- Population centers, such as crew quarters, bridge, or residential areas for shore or port facilities

- Safety systems, such as firewater header, hydrants, monitors, hose reels, toxic gas or flammable material detectors, etc.

Other relevant information. Following is other information that may be useful to the team:

- Toxicity information
- Permissible exposure limits
- Physical data
- Reactivity data
- Corrosivity data
- Thermal and chemical stability data
- Vulnerability data for people or equipment to various kinds of hazardous exposures
- Hazards of inadvertent mixing
- Inventory limits
- Consequences of upsets
- Materials of construction
- Piping and instrumentation diagrams
- Electrical classification
- Relief system design and basis
- Ventilation system design
- Safety systems, such as detection, containment, and mitigation systems
- Design codes and standards used
- Compliance with good engineering practices
- Determination of safety for existing equipment built to older specifications
- Description of project objectives
- Pertinent codes, standards, and guidelines
- Equipment arrangement drawing
- Control strategies and alarms and shutdowns
- Procedures
- Previous accidents
- Maintenance and inspection records

4.0 Calculate ranking indexes

- **Review and understand analysis technique**
- **Collect data**
- **Calculate indexes**
- **Summarize results**

4.0 Calculate ranking indexes

If a published relative ranking method is chosen, the analyst should follow the instructions in the technique guide to perform the evaluation. Site visits and interviews to verify information and to answer questions may be helpful. The calculated risk index numbers should be summarized to facilitate comparisons among areas that have been reviewed.

In most cases, the risk index numbers generated by the evaluation should not be considered accurate reflections of the absolute risks posed by the vessel or facility being studied. Instead, these results should be considered estimates for comparing the relative risk of each.

5.0 Use the results in decision making

- **Use alone or with other data**
- **Identify dominant risk contributors**
- **Develop recommendations for improvement**

5.0 Use the results in decision making

The results of the study may be used alone or in conjunction with other factors, such as cost. In addition, the analyst may determine the most important contributors to the index numbers by reviewing the analysis documentation. This should help determine if corrective actions or design modifications should be undertaken to reduce the anticipated risk. In this way, the analyst may identify the specific areas where the safety weaknesses exist and develop a list of action items to correct the problems.

Custom Tools

Custom Tools

Although a number of relative ranking tools currently exist, there will be situations in which an analyst or decision maker needs a custom tool. The cost of developing an effective tool may be substantial, so consider the tool's potential future use; will it be used one time only, or are there many opportunities to use it? The following factors should be considered when developing a relative ranking tool:

Identify decisions to be made. Every risk assessment activity, regardless of how simple or complex, requires information to aid in the decision-making process. This crucial step is important when developing a relative ranking tool. The analysts and decision makers must clearly identify the types of decisions to be made and the level of information detail necessary to support them.

Decision criteria. The method should provide guidance on interpreting the numerical indexes generated from the data. Relative ranking tools will most often be used to compare the risks of one option to another. These comparisons may be used to (1) rank the risks of selected waterways in order to prioritize risk assessment resources for more detailed analyses, (2) prioritize boarding and inspection activities within a port, or (3) assess the relative risks of locating a toxic material handling dock. After the indexes are calculated, the decision maker should be provided with some guidance on how to interpret the results, with particular attention on how to differentiate between two options if the indexes are similar in value.

Practicality of use. Finally, the method should be practical. Costly data collection efforts can discourage participation in the analysis. Simple data collection efforts, such as compiling information from existing databases, make a tool more practical and efficient to use.

Procedure for Developing a Relative Ranking/Risk Indexing Tool

Procedure for Developing a Relative Ranking/Risk Indexing Tool

CAUTION: Developing a customized relative ranking/risk indexing tool requires a substantial experience base. A poorly designed tool can easily lead to a wrong decision, even if the right data are available.

Developing a custom relative ranking/risk indexing tool involves a nine-step process.

1.0 Define what the index will represent

2.0 Identify a list of factors that could affect the index values

3.0 Identify specific situations for which specific actions are required

4.0 Characterize the sensitivity and selectivity of measurements for each factor

5.0 Select a basic scoring or indexing scheme

6.0 Develop scoring scales for each factor based on each factor's sensitivity and selectivity

7.0 Set action thresholds for the index

8.0 Organize the scoring scales, index calculations, and action thresholds into a job aid

9.0 Validate the job aid through test applications and refine it as needed

The following pages describe each of these steps in detail.

1.0 Define what the index will represent

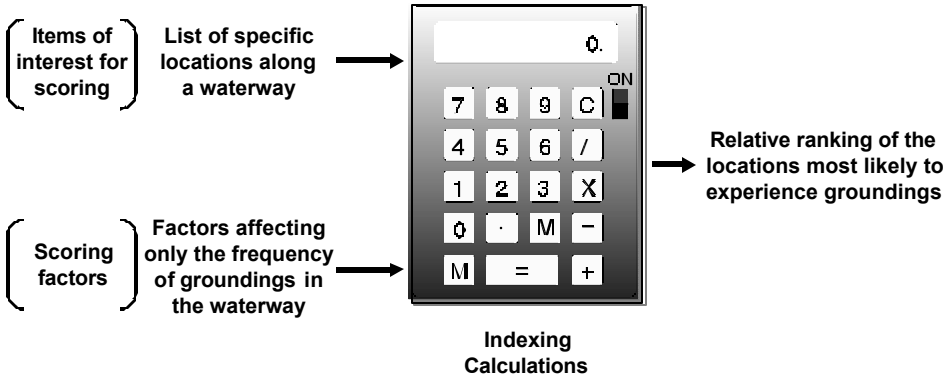
- **Frequency of events only**
- **Consequence of events only**
- **Risk of events**

1.0 Define what the index will represent

A relative ranking/risk index is designed to approximate some measure of risk with a simple scoring process rather than complex risk calculations. Although such scoring systems are relatively simple, the index must represent some meaningful value that will influence the decision maker. Following are the most common types of measures, but other types are often used:

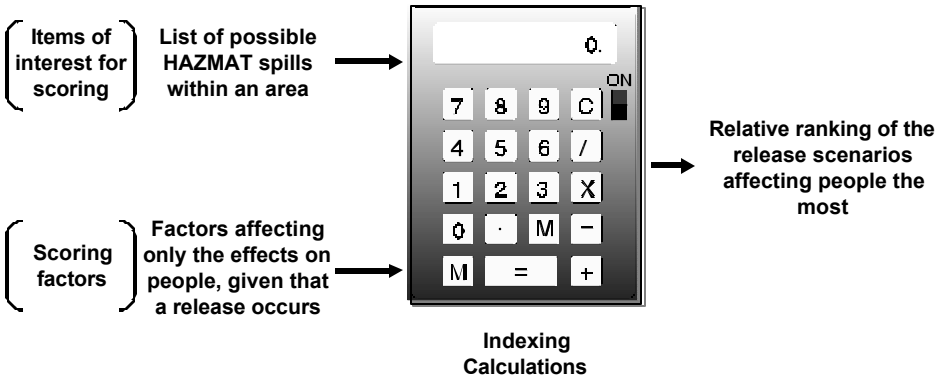
Frequency (or likelihood) of events. The index number could represent the expected frequency or likelihood of certain events or situations. In this case, only factors affecting the occurrence of the events or situations would be included in the scoring process. Examples might be vulnerabilities for key equipment, error-likely situations for people, and exposure to external events or conditions. The following figure provides a simple example.

Frequency-based Scoring

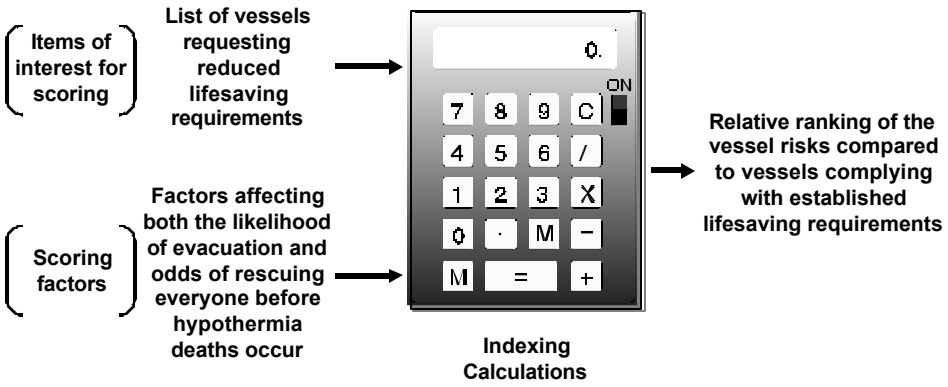


Consequence of events. The index number could represent the magnitude of the expected effects from consequences of interest. In this case, only factors affecting the severity of the effects would be included in the scoring process. Examples might be the number of people exposed, the intensity of the hazard, environmental sensitivities, effects of mitigation devices, etc. The following figure provides a simple example.

Consequence-based Scoring



Risk of events. The index number could be a combination of frequency and consequence (i.e., risk). The following figure provides a simple example.



Risk-based Scoring

This last example application will be used as the basis for completed examples throughout the rest of this chapter.

2.0 Identify a list of factors that could affect the index values

- **Historical and precursor events**
- **Subjective judgments from experts**
- **Insights from risk models**

2.0 Identify a list of factors that could affect the index values

The relative ranking/risk indexing approach combines scores for various factors into an overall index score. Of course, for the index value to be useful, the scoring process must take into account all of the key factors. And, to make the process manageable, the scoring process must be simple, including only the factors that will actually influence the decision.

A list of candidate factors for a custom tool can come from any of the following:

Historical and precursor events. An understanding of factors that have and have not contributed to past accidents and near misses provides great insight into factors that should be included in a relative ranking/risk indexing tool. This information can also help identify the relative importance, or weights, of these factors based on their contributions to past accidents.

Example

The following two tables indicate factors found to be important in deciding whether small passenger vessels should be allowed to meet reduced lifesaving requirements under an alternative compliance strategy. The tables identify relative contributions of various factors for vessel evacuation incidents that (1) actually resulted in hypothermia deaths and (2) did not result in hypothermia deaths because of key actions or conditions.

Factors Cited as Contributing Events in Cases Where Vessel Evacuation has Resulted in Hypothermia Deaths Among Passengers	
Insufficient protection from cold while using primary lifesaving devices	10% of cases
Insufficient primary lifesaving capacity	15% of cases
Difficulty locating persons in water because of:	
– nighttime rescue	5% of cases
– poor sea or weather conditions	15% of cases
Delayed response from assets because of:	
– remoteness	20% of cases
– delayed notification	25% of cases
– unavailability	5% of cases
• • •	• • •

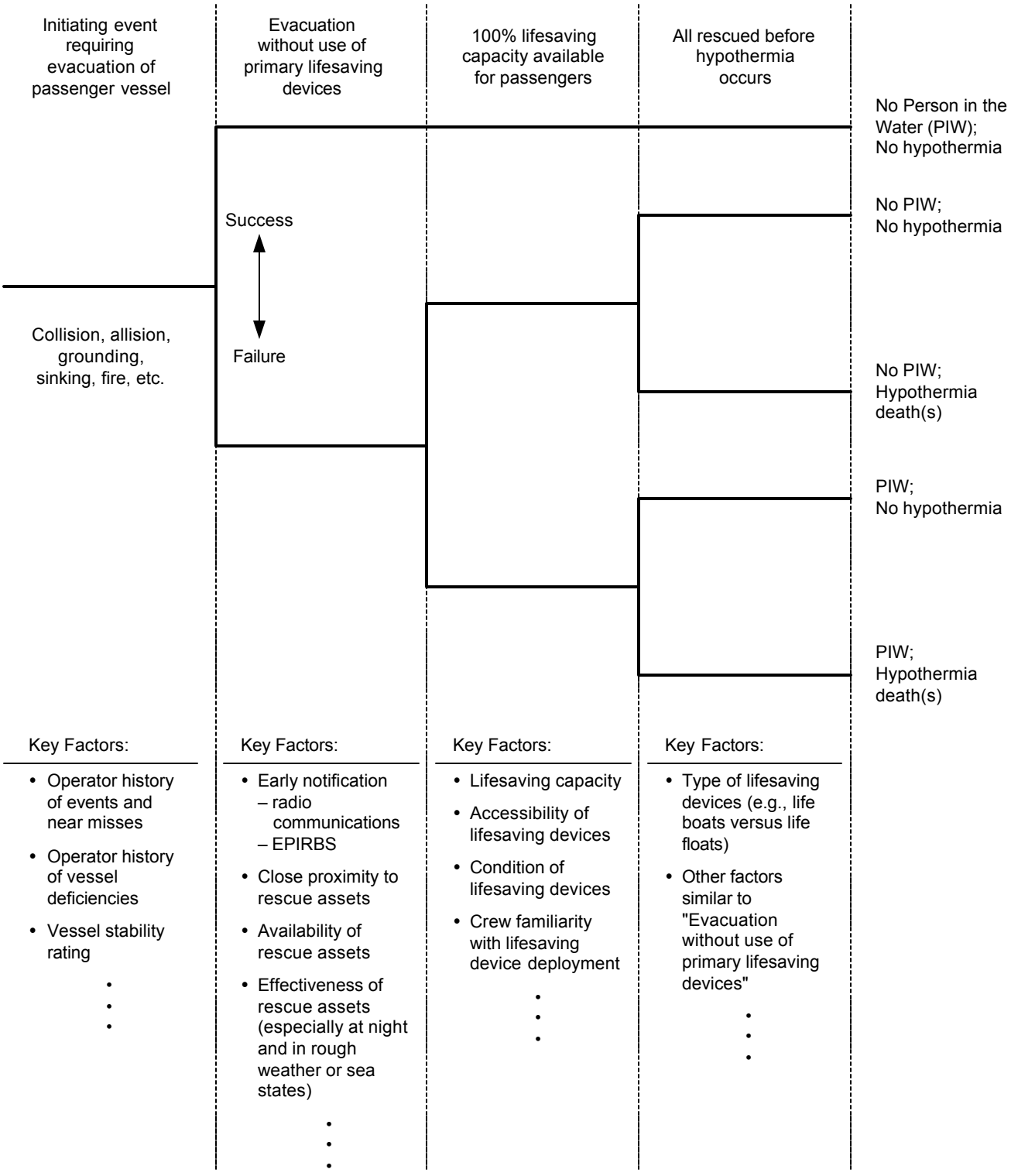
Factors Cited as Keys to Successful Passenger Vessel Evacuations without Hypothermia Deaths	
100% primary lifesaving capacity	10% of cases
Life boats instead of life floats	30% of cases
Mobilization of evacuation resources before evacuation was needed	90% of cases
Close proximity to rescue assets	25% of cases
Redundant rescue capability	0%
• • •	• • •

Subjective judgments from experts. People familiar with the issue of concern can make expert assessments of the factors affecting the index. Such listings of factors are subjective, but they are an excellent complement to lists of factors developed from accident history. This may, in fact, be the only source needed to put together a list of factors if a simple, quick tool is needed.

Insights from risk models. Structured risk assessment tools can also identify factors for a relative ranking/risk indexing tool. The systematic nature of tools such as what-if analysis, HAZOP analysis, FMEA, and event tree analysis help developers discern important factors that may have otherwise been overlooked. In this case, an analysis benefits from both the systematic, qualitative use of risk assessment tools and the simplicity of a simple scoring model.

Example

The following example shows how a simple event tree analysis can model accident scenarios and then explore key factors associated with each step in the accident sequence chains. These key factors could be included in the relative ranking/risk indexing tool.



3.0 Identify specific situations for which specific actions are required

- **Regulatory requirements**
- **Unacceptable risks**

3.0 Identify specific situations for which specific actions are required

Some conditions are so important that they do not need scoring; they evoke specific responses directly. Developers should identify these conditions early to ensure that these critical events and conditions are not inadvertently masked in a numerical scoring system.

Regulatory requirements. Regulatory requirements demand a specific response to certain conditions or events. Therefore, no matter what index number is calculated, the decision will be the same because of the regulatory requirements.

Unacceptable risk. Internal policies sometimes require that certain situations or events evoke specific actions regardless of the calculated index number. This is sometimes based on public perception of the risk and the sensitivity of the organization to these perceptions.

Example

The following are situations that might disqualify a small passenger vessel from consideration for approval of reduced lifesaving requirements under an alternative compliance strategy:

- Wood boats
- High speed craft
- Vessels with no subdivision
- Vessels with no stability letter

4.0 Characterize the sensitivity and selectivity of measurements for each factor

- **Subjective judgment of experts**
- **Simple benchmark comparisons**
- **Statistical evaluations**

4.0 Characterize the sensitivity and selectivity of measurements for each factor

An understanding of the relative importance of various factors and their effectiveness as measurement tools is the heart of a valid and useful relative ranking/risk indexing tool. Failure to address the sensitivity and selectivity of each factor adequately may cause the tool to be unusable. It may even lead to incorrect decisions based on the index value. Each factor should have a high sensitivity and selectivity.

Sensitivity. Sensitivity is a measure of how well a factor reward or penalty will be applied to all of the targeted entities. For example, will all "good performers" receive a positive score in regard to a specific factor.

Selectivity. Selectivity is a measure of how well a factor reward or penalty will ***not*** be applied to all of the untargeted entities. For example, will any "bad performers" receive the positive score intended only for "good performers."

Factor sensitivity and selectivity can be characterized using subjective expert judgment, benchmark comparisons, and statistical evaluations. The best factor characterizations will combine all three of these. These characterizations can be formally recorded or simply discussed among an analysis team.

Example

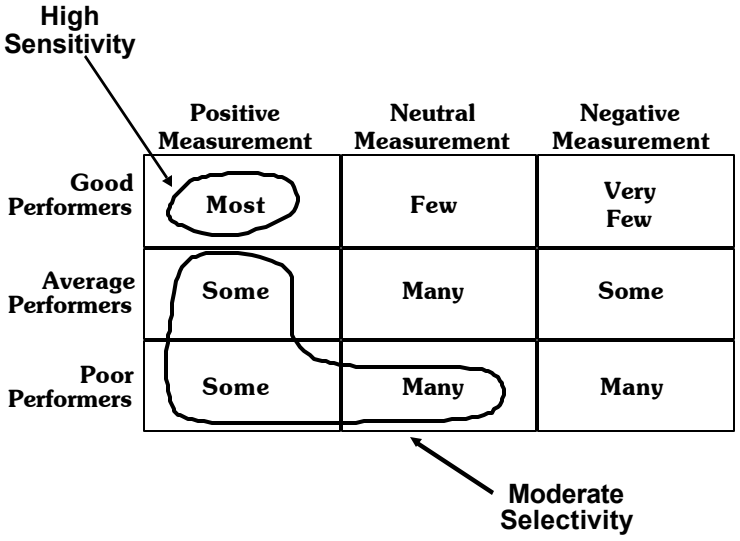
The following example discusses the sensitivity and selectivity of one factor important for deciding whether to grant approval for a small passenger vessel to meet reduced lifesaving requirements under an alternative compliance strategy. A similar assessment would be undertaken for each factor included in the relative ranking/risk indexing tool.

Factor: Operator Casualty or Major Deficiency Experience Over the Past Two Years

Sensitivity: All of the good operators who should receive special consideration will have at most an isolated casualty or serious deficiency on their record over the past two years. Operators with multiple casualties or serious deficiencies clearly are not performing at the desired level.

Measurement against this factor is highly sensitive because a negative measurement clearly identifies poor performers, and it is unlikely that any good performers would be mistakenly penalized.

Selectivity: While a positive measurement against this factor is likely to include all good performers, it is also likely to include some poorer performers as well. A few poorer performers may be lucky enough to avoid a major accident over two years. This factor could mistakenly reward a poorer performer, but lengthening the period of performance (e.g., from two to five years) could improve the measurement. As defined, this factor would have only moderate selectivity.



5.0 Select a basic scoring or indexing scheme

- **0-to-X weighted factor scoring**
- **+/- factor scoring**

5.0 Select a basic scoring or indexing scheme

Before developing a scoring scale for each factor in a relative ranking/risk indexing tool, developers must decide what fundamental type of scoring scheme is most appropriate. Two of the most common scoring schemes are the following:

0-to-X weighted factor scoring. In this scheme, each factor can receive a score from 0 to some maximum number of points (X). The maximum number is often 10 or 100. In this scheme, each factor also has a weight, or relative importance; for example, Factor 1 may be weighted at 10%, Factor 2 at 35%, and Factor 3 at 55%. The sum of the weights equals 100%. The overall index value is the sum of the weighted scores for each factor: Factor 1's score * Factor 1's weight + Factor 2's score * Factor 2's weight + Factor 3's score * Factor 3's weight. Thus, the calculated index value can range from 0 to X.

Example

	Maximum Score	Actual Score	Weight	Weighted Score
Operator history	**10**	**5**	**20%**	**1**
Early notification likelihood	**10**	**7**	**10%**	**0.7**
Type of lifesaving equipment	**10**	**4**	**30%**	**1.2**
	•	•	•	•
	•	•	•	•
	•	•	•	•
	Total Weighted Score			**4.5**

+/- factor scoring. In this scheme, each factor can receive positive or negative scores of any value. The magnitude of the scores reflects the relative importance of each factor, and the range of scores for a factor do not have to center around 0. The overall index value is simply the sum of the scores for each factor. This scoring scheme works particularly well when risks will be compared to some "base case" such as current operations, regulatory requirements, etc.

Example

	Scoring Range	Actual Score
Operator history	**-5 to +5**	**-3**
Early notification likelihood	**0 to +2**	**+1**
Type of lifesaving equipment	**-1 to +3**	**+1**
	•	•
	•	•
	•	•
	Total Score	**-1**

6.0 Develop scoring scales for each factor

- **0-to-X weighted factor scoring**
- **+/- factor scoring**

6.0 Develop scoring scales for each factor based on each factor's sensitivity and selectivity

Once the scoring scheme for the relative ranking/risk indexing application is established, scoring scales for each factor must be developed. Factors with both high sensitivity and selectivity should receive the most weight because they produce the most effective rankings.

0-to-X weighted factor scoring. Developers establish benchmarks along scoring scales that help users of the relative ranking/risk indexing tool decide how many points to award each factor, within the maximum number. The value "0" on the scales should reflect either the best or worst condition for all factors in the tool. Whichever convention is chosen, each scoring scale needs to be consistent. This will determine whether higher or lower scores are most desirable.

Example

The following is a scoring scale for a 0-to-10 weighted factor scoring scheme. The factor is an operator's past accident and deficiency performance. In this case, 0 represents a lower risk situation, and 10 represents a higher risk situation. Thus, in the final index score, lower scores are most desirable.

Example Scoring Scale for a Factor in a "0-to-10" Scoring Scheme

Factor	Incident and Deficiency Performance	Score	Degree of Risk
Operator's past accident and deficiency performance	No marine violations, marine casualties, or Priority 1 deficiencies (i.e., no sails or restrictions) over the past 2 years	**0**	Less Risk 
	No marine casualties or Priority 1 deficiencies **and** fewer than 10 overall deficiencies over the past 2 years	**2**	
	No more than two marine casualties or Priority 1 deficiencies, **and** fewer than 10 Priority 2 deficiencies over the past 2 years	**5**	
	No more than two marine casualties or Priority 1 deficiencies, **and** more than 10 Priority 2 deficiencies over the past 2 years	**7**	
	Multiple marine violations, marine casualties, Priority 1 deficiencies, or numerous Priority 2 deficiencies over the past 2 years	**10**	More Risk

Similar scoring scales would be developed for each factor built into the relative ranking/risk scoring tool. Relative weights, as explained and illustrated in section 5.5, would also be developed for each factor.

+/- factor scoring. Developers establish benchmarks along scoring scales that help users of the relative ranking/risk indexing tool decide how many points to award to each factor. Positive scores should always have the same meaning across all of the factors, either risk penalties or risk credits. This will determine whether higher or lower scores are most desirable.

Example

Following is a scoring scale for a +/- factor scoring scheme. The factor is an operator's past accident and deficiency performance. In this case, positive scores accumulate risk reduction credits. Thus, in the final index score, higher scores are most desirable.

Example Scoring Scale for a Factor in a +/- Scoring Scheme

Factor	Incident and Deficiency Performance	Score	Degree of Risk
Operator's past accident and deficiency performance	No marine violations, marine casualties, or Priority 1 deficiencies (i.e., no sails or restrictions) over the past 2 years	**2**	Less Risk 
	No marine casualties or Priority 1 deficiencies, **and** fewer than 10 overall deficiencies over the past 2 years	**1**	
	No more than two marine casualties or Priority 1 deficiencies, **and** fewer than 10 Priority 2 deficiencies over the past 2 years	**0**	
	No more than two marine casualties or Priority 1 deficiencies, **and** more than 10 Priority 2 deficiencies over the past 2 years	**-1**	
	Multiple marine violations, marine casualties, Priority 1 deficiencies, or numerous Priority 2 deficiencies over the past 2 years	**-3**	More Risk

Similar scales would be developed for each factor that is built into the relative ranking/risk indexing tool. In this case, relative weights among factors are already addressed by the range of scores possible for each factor. For example, one factor may be able to contribute -5 to +5 to the index value, while another factor may only be able to contribute 0 or +1. Clearly, the factor with the -5 to +5 range can have much greater impact on the index value.

7.0 Set action thresholds for the index

Threshold Value = Action

7.0 Set action thresholds for the index

Alone, the index values are simply numbers. Decision makers must understand the relative ranking/risk indexing tool in order to define levels of concern or action to go with calculated values. The action threshold is the decision-making part of the index tool and deserves careful consideration.

Examples

Following are example action thresholds for a relative ranking/risk indexing tool that helps decide whether to approve reduced lifesaving requirements for small passenger vessels under an alternative compliance strategy. Different thresholds are presented for both a 0-to-X weighted factor scoring approach and a +/- scoring approach.

Example 1
(0-to-X weighted factor scoring)

Weighted Score	Action
0 to 3	Good candidate for alternative compliance approval
3 to 5	Marginal candidate for alternative compliance approval
5 to 10	Not a candidate for alternative compliance approval

Example 2
(+/- scoring)

Criteria	Action
Risk credit score ≥ 0 (compared to regulatory compliance case)	Consider approving reduced lifesaving requirements as long as the alternative compliance plan is implemented
Risk credit score < 0 (compared to regulatory compliance case)	Deny request for reduced lifesaving requirements under an alternative compliance strategy

8.0 Organize the scoring scales, index calculations, and action thresholds into a job aid

- **Paper-based**
- **Electronic**

8.0 Organize the scoring scales, index calculations, and action thresholds into a job aid

For field use, an easily implemented job aid for applying the relative ranking/risk indexing tool is highly desirable. This type of job aid generally takes the form of a checklist with the scoring criteria built directly into the checklist. For paper-based job aids, care must be taken to ensure that the calculations are easy to perform. This reduces the potential for calculation errors. Computer-based job aids should make it easy to navigate and enter information.

Example

The following is an example job aid for applying a relative ranking/risk indexing tool that helps decide whether to approve reduced lifesaving requirements for small passenger vessels under an alternative compliance strategy.

Worksheet for Evaluating Equivalency of Lifesaving Requirements for Small Passenger Vessels Operating in Lakes, Bays, and Sounds

Any of the following criteria would disqualify a vessel from operating with reduced lifesaving capacity requirements in cold water operations:

- ❑ Wood boats
- ❑ High-speed craft
- ❑ No subdivision
- ❑ No stability letter

If the sum of the risk credit scores for the following restrictions and conditions affecting lifesaving requirements is greater than or equal to "0," the OCMI may consider allowing the vessel to comply with warm water lifesaving requirements instead of cold water requirements. However, the decision rests with the OCMI, and the OCMI is not obligated to approve reduced lifesaving requirements.

Restrictions and Conditions Affecting Lifesaving Requirements	Specific Criteria for Requirements of Conditions	Risk Credit Scoring	Notes
Rescue Capability	Route will result in Coast Guard (or other jurisdictional authority) on-scene response within 30 minutes of initial notification		Significant additional requirements in regulations for boats carrying more than 49 people provided substantial risk reductions in addition to Coast Guard rescue capability
	<50 passenger capacity	**3**	
	50 to 150 passenger capacity	**2**	
	151 to 299 passenger capacity	**1**	
	>300 passenger capacity	**0**	
	Other on-scene response within 30 minutes of initial notification		Requires an operator to have a written plan, contractual agreements with any outside organizations, and demonstration drills
	Capable of rescuing 100% of vessel capacity within 30 minutes	**2**	
	Capable of rescuing at least 50% of vessel capacity within 30 minutes	**1**	
	Capable of rescuing less than 50% of vessel capacity within 30 minutes	**0**	
Period of Operations	Day only	**1**	Restriction must be documented in the COI
	At least some nighttime operations	**0**	
	May through October (on the south side of Cape Cod)	**0**	Restriction must be documented in the COI
	May through October (on the north side of Cape Cod)	**-1**	
	Year-round	**-2**	
Stability Letter	Certified for exposed routes	**1**	
	Certified for partially protected routes	**0**	
EPIRB	Operating <3 miles from shore (not currently required by regulation)	**2**	EPIRBs that are already required have already been credited in the regulatory lifesaving requirements
	Operating ≥ 3 miles from shore (already required by regulation)	**0**	

Worksheet for Evaluating Equivalency of Lifesaving Requirements for Small Passenger Vessels Operating in Lakes, Bays, and Sounds (cont.)

Restrictions and Conditions Affecting Lifesaving Requirements	Specific Criteria for Requirements of Conditions	Risk Credit Scoring	Notes
Primary Lifesaving Device Types	Life rafts of IBAs provide primary lifesaving for at least 50% of passenger capacity	**2**	
	Other than the above	**0**	
Operator Performance	**Incident/Deficiency Performance**		
	No marine violations, marine casualties, or Priority 1 deficiencies (i.e., no sails or restrictions) over the past 2 years	**2**	
	No marine casualties or Priority 1 deficiencies, **and** fewer than 10 overall deficiencies over the past 2 years	**1**	
	No more than two marine casualties or Priority 1 deficiencies, **and** fewer than 10 Priority 2 deficiencies over the past 2 years	**0**	
	No more than two marine casualties or Priority 1 deficiencies, **and** more than 10 Priority 2 deficiencies over the past 2 years	**-1**	
	Multiple marine violations, marine casualties, Priority 1 deficiencies, or numerous Priority 2 deficiencies over the past 2 years	**-3**	
	15-minute Communication Program Performance		A score of 0 points should be assigned for a new program that is not yet operational
	Conformance with only minor deficiencies	**0**	
	Serious but isolated problems	**-1**	
	Serious systemic problems	**-3**	
Sum of Risk Credits *If the sum of risk credits is less than 0, the equivalency test fails, and the prescriptive regulatory requirements must be met.* *If the sum of risk credits is greater than or equal to 0, the equivalency test is positive, and the OCMI may authorize the vessel to meet only warm water lifesaving requirements (instead of cold water requirements). However, the decision rests with the OCMI, and the OCMI is not obligated to approve reduced lifesaving requirements.*			

9.0 Validate the job aid through test applications and refine it as needed

- **Simple consensus**
- **Statistical evaluations**

9.0 Validate the job aid through test applications and refine it as needed

Once the job aid is completed, an effort should be taken to ensure the validity of the new customized indexing tool. The importance of the tool's results should determine the level of validation. The tool should be modified based on the results of the validation process to ensure that it confidently provides adequate rankings.

Simple consensus. A group of subject matter experts can perform a validation of the indexing tool by creating scenarios and evaluating whether the tool generates an appropriate index number or action.

Statistical evaluations. A more detailed validation process involves using historical data to create several scenarios for testing the indexing tool. The results of the tool can then be compared with the actual historical outcomes.

Example

In the following example, the example job aid from Step 8 is applied to several vessels. The results (the next to last column) are compared to intuitive guesses (the last column) that the development team would have made if it had not used the systematic process. This exercise provides a reality check that helps identify necessary improvements to the tool.

Input Data											Index Results	Reality Checks	
Vessel	Disqualify?	Rescue Capability: USCG	Rescue Capability: Other	Period of Operations: Day/Night	Period of Operations: Months	Stability Letter	EPIRB	Primary Lifesaving Device Types	Operator Performance: Accidents	Operator Performance: Communica-tions	Sum or Risk Credits	Test Pass/ Fail?	Intuition Pass/ Fail?
A		0	0	0	-2	0	0	0	2	0	0	Pass	Pass
B		2	0	0	-2	1	0	0	0	0	1	Pass	?
C		0	0	0	-2	0	0	0	1	0	-1	Fail	Pass
D	Y	3	0	1	-2	0	0	0	2	0	4	Fail*	?
E		0	0	0	-2	0	0	0	-1	0	-3	Fail	Fail
F		2	0	0	-2	1	0	0	1	0	2	Pass	?
G		2	0	0	-2	0	0	0	1	0	1	Pass	Pass

* Failed because the vessel was disqualified