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VRAKA

A Risk Assessment Method for Potentially Polluting Shipwrecks

Wrecks of the World
Gothenburg, October 2015

Hanna Landquist, Lars Rosén, Ida-Maja Hassellöv, Andreas Lindhe, Tommy Norberg

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Shipwrecks in Sweden

- Pre-study, Wreck remediation. (I-M. Hassellöv, 2007)
- Environmental risks from Shipwrecks. (SMA, 2011)
- VRAKA-project and cooperation within SWERA and with SMA

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Decision support

on potentially polluting **shipwrecks**

Risk assessment

- Probabilistic approach
- Probability of release
- Environmental consequences

(Disney, 1951)

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The concept of risk

Risk

Is a function of **probability**
and **consequence**

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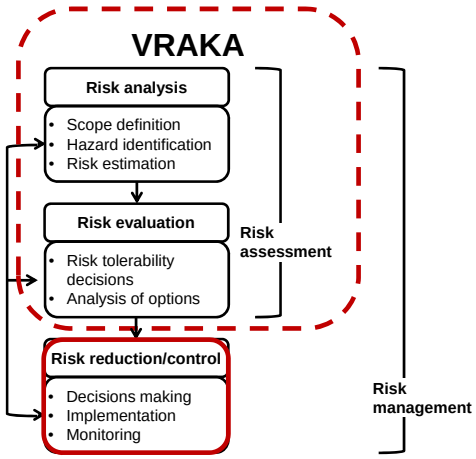

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Tool for estimation of the **probability of release**

Method for estimation of **environmental consequences**

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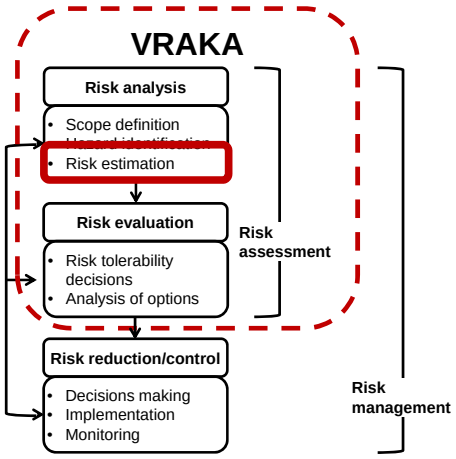
Part 1

Tool for estimation of the **probability of release**



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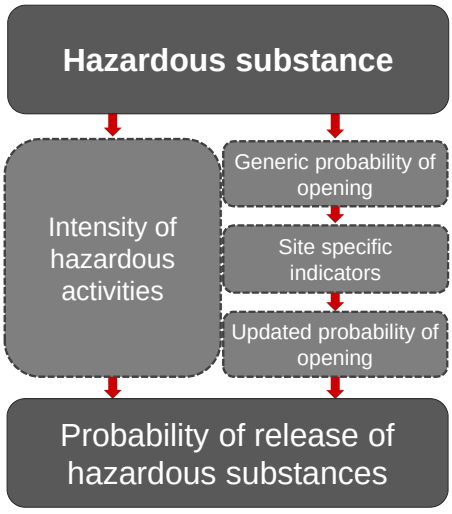
The tool

- Activities identified
- Indicators identified
- Expert elicitation of information about the activities
- Expert elicitation of information about relations of activities an indicators.



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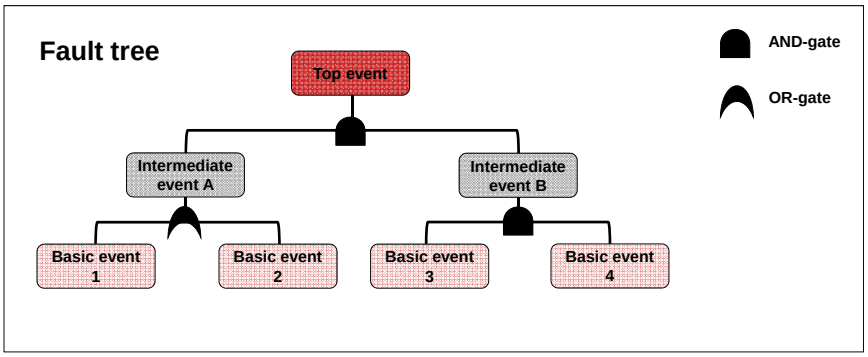
The tool



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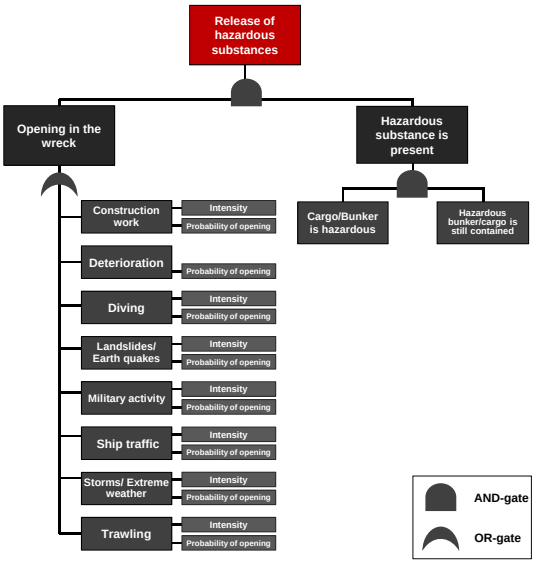
The tool

An **opening** in the wreck needs to occur **AND** there has has to be **oil** still contained in the wreck



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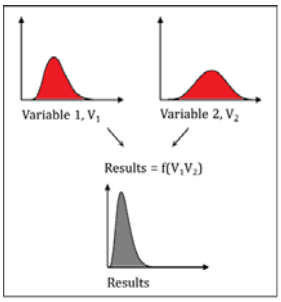
The tool



- Uncertainties can be accounted for
- Distributions rather than point values
- Range of results

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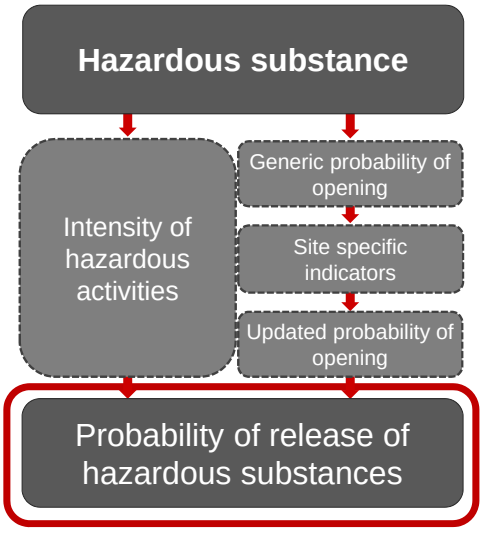
The tool

- **Assessor input**
  - Intensity of hazarouds events
  - Indicator information
  - Bunker/cargo information



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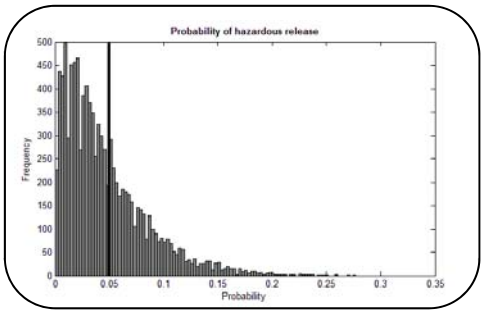
The tool

- Results as a probability distribution
- Analysis of indata
  - more information needed?



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Tool for estimation of the **probability of release**

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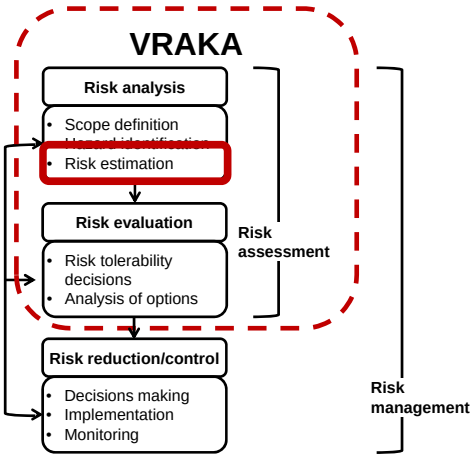
Part 2

- **Method** for estimation of **environmental consequences**



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Consequence assessment

4 Tiers available

- Depending on available resources
- Adaption to country and tools availabe

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Consequence assessment
Tier 1

$P_{Release}$ x **Expected amount of oil** = **$Risk_{Total}$**

or

Separate comparative analysis of
$P_{release}$ and **Expected amount of oil**

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Consequence assessment
Tier 2

- Expected volume from VRAKA
- Probability of release from VRAKA

	Low severity	Moderate severity	High severity
Volume	<100 m^3	10 – 500 m^3	> 500 m^3
Distance to shore	< 10 nm	1 – 10 nm	< 1 nm
Sensitivity	Nearest shore is: Sand, steep cliffs or rock walls or facilities.	Nearest shore is: Cliff beaches, pebble, boulder or gravel beaches.	Nearest shore is: Reedbeds, meadows, fine sediment beaches. or mixed beaches

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Consequence assessment
Tier 3

- **Tools for oil spill trajectory modelling and sensitivity of receptors**
- **SeaTrack Web**
  - The Swedish Meteorological and Hydrological Institute
- **Digital Environmental Atlas**
  - County Administrative Board Västra Götaland, IVL Swedish Environmental Research Institute, Swedish Environmental Protection agency

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Consequence assessment
Tier 3

- SeaTrack Web
- Oil spill trajectory simulation
- Release from the sea bottom

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Consequence assessment
Tier 3

- Digital Environmental Atlas
- Funcitional for Swedish coast
- Ongoing work for the Baltic sea

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Consequence assessment
Tier 3

- Combine the two visually
- Obtain an idea of how much oil will end up where
- Compare to other wrecks, with the probability of a release

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Consequence assessment
Tier 4 – The future

- A Digital Environmental Atlas for the Baltic Sea
- Probability mapping in SeaTrack Web

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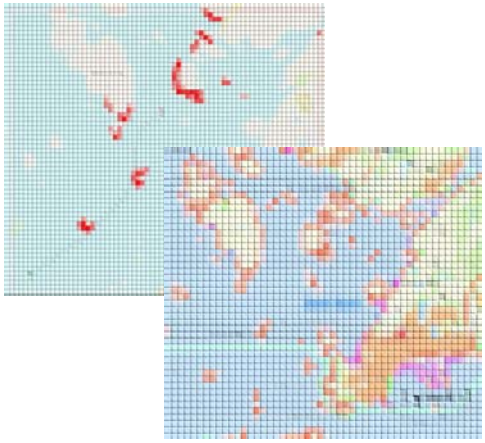
Consequence assessment
Tier 4 – The future

- Combined GIS-based tool
- Efficient risk assessment tool.



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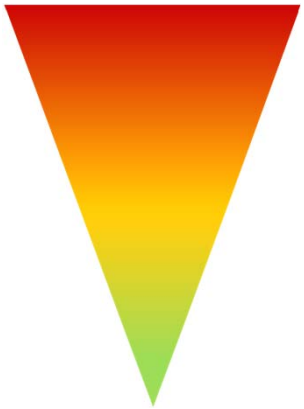
Application of the results

- **Results depend on in-data**
  - Type
  - Quality
- **Adquate application of results**
- **Decision support**
  - Mitigation measures
  - Efficient solution



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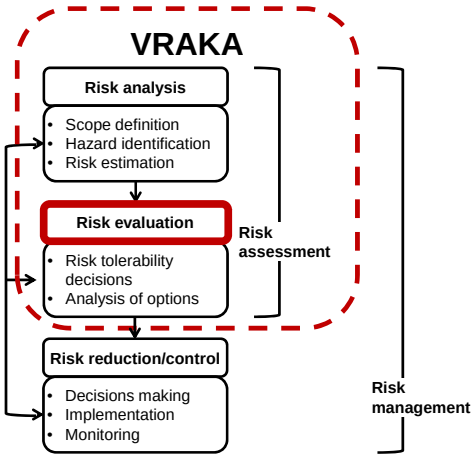
VRAKA – Further work



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Publications

- Report SWERA
- First and second report from Environmental risks from sunken shipwrecks
- Paper to the conference

- Evaluating the needs of risk assessment methods of potentially polluting Shipwrecks. (Landquist et al., 2013)
- A fault tree model to assess probability of contaminant discharge from Shipwrecks. (Landquist et al., 2014)

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SYKE

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BONUS
SCIENCE FOR A BETTER FUTURE OF THE BALTIC SEA REGION

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Thank you

Hanna Landquist
hanna.landquist@chalmers.se