

Risk Categorization Matrix

DAIMON Project



EUROPEAN UNION

EUROPEAN
REGIONAL
DEVELOPMENT
FUND

Risk based on munitions type - 1I

Chemicals present in different classes

- Primary
- Propellants
- Bursters
- Explosives

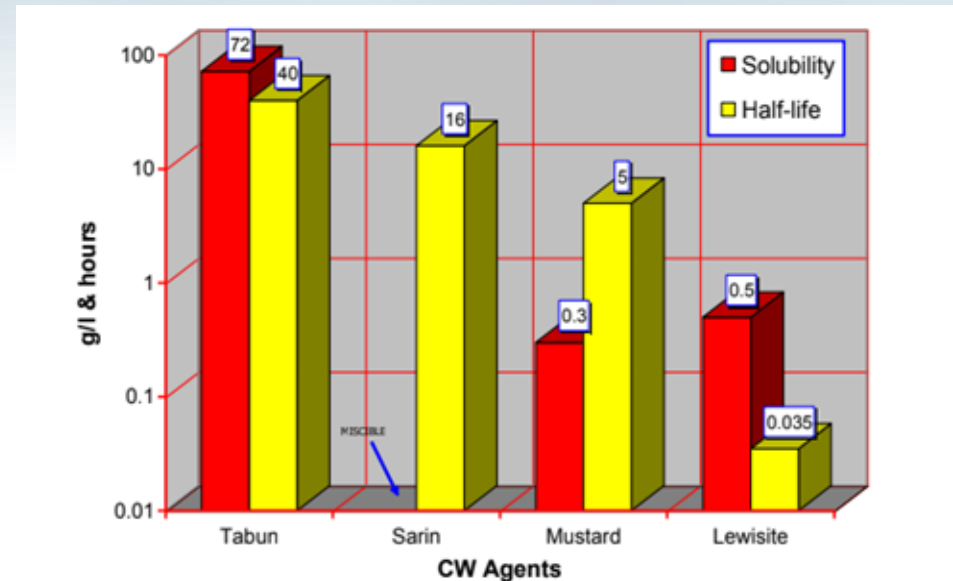
Explosive hazards

- Fuzes
- Reactivity

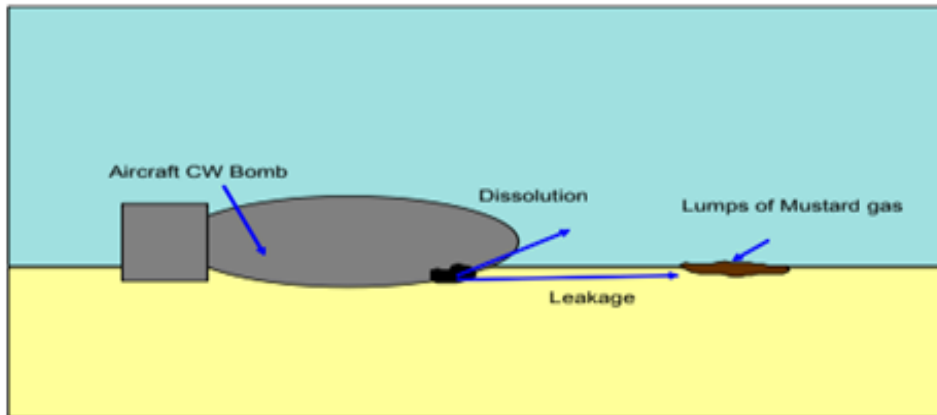
Toxic effects

Chemical warfare agents

- Toxicity
- List and characterization
- Degradation products
- Leakage



Solubility and half-life in sea water of four major CW agents



Munitions in the Baltic

Boxes (Explosives and Grenades) 1%

Mines 6%

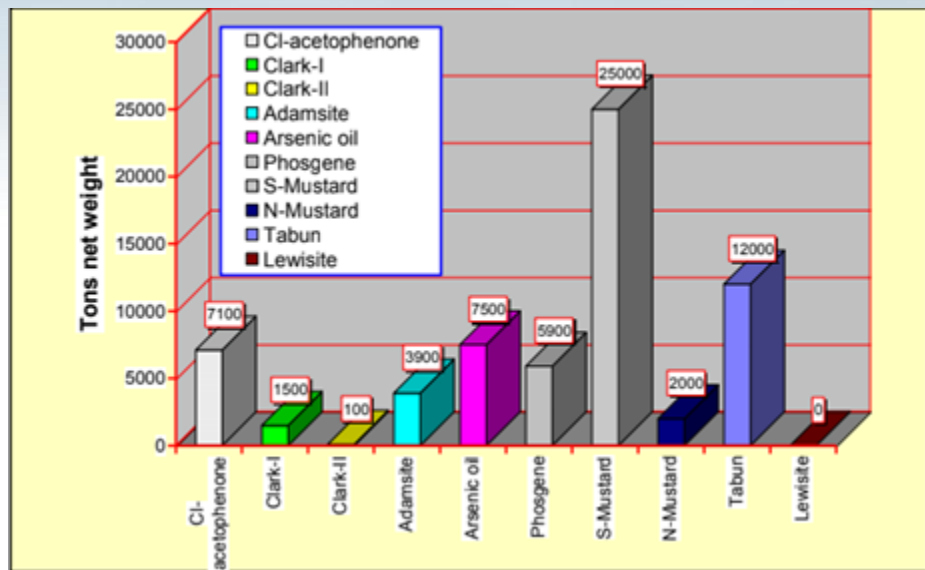
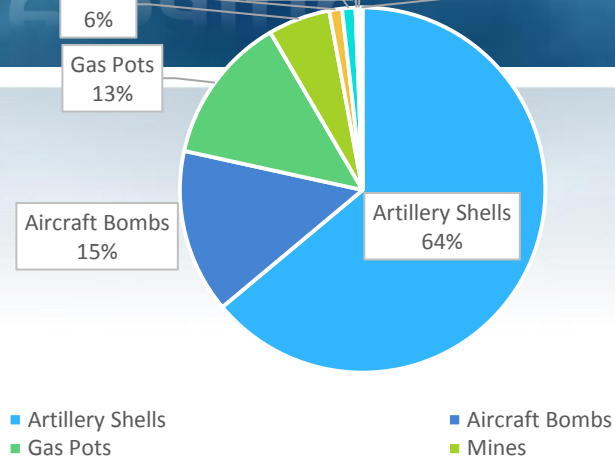
Gas Pots 13%

Containers 1%

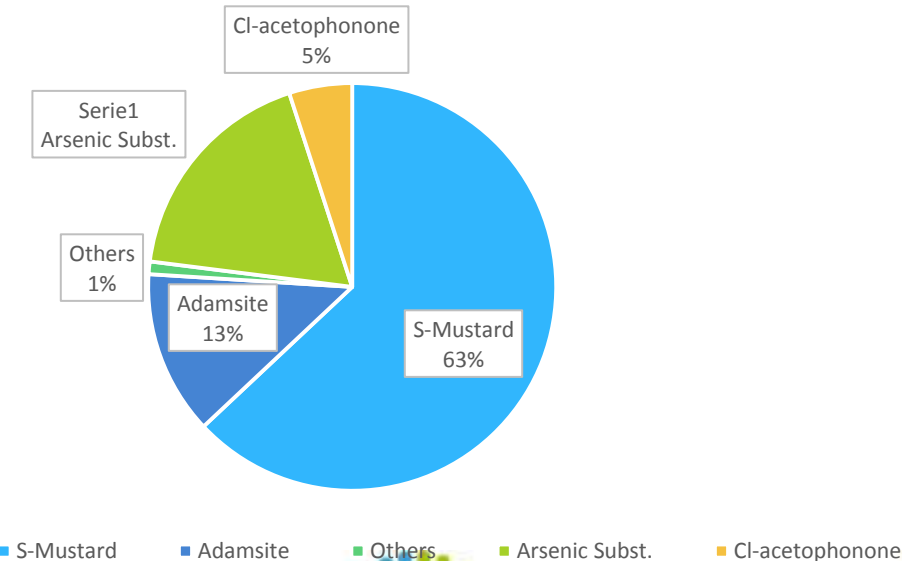
Cylinders 0%

Barrels 0%

Cans (Cyclone) 0%



Stocks of German chemical warfare (CW) agents produced and accumulated before and during WW-II

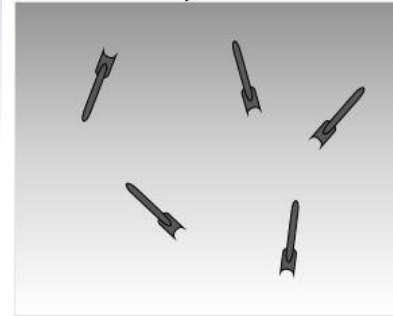


Types and compounds dumped in the Baltic [%]

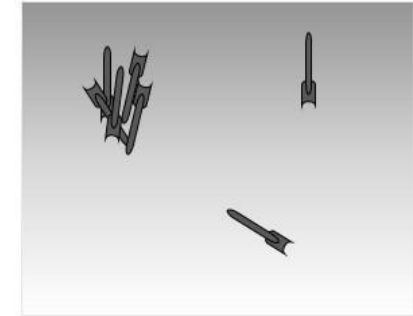
Environment pollution

- Metals
- Leakage scenarios
- Spreading

Dispersed



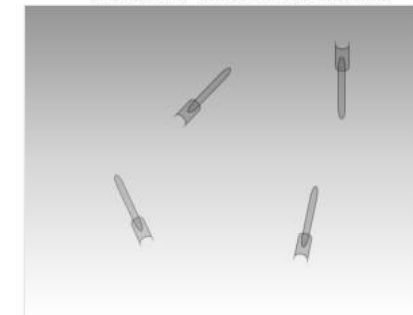
Clustered



Inside a wreck

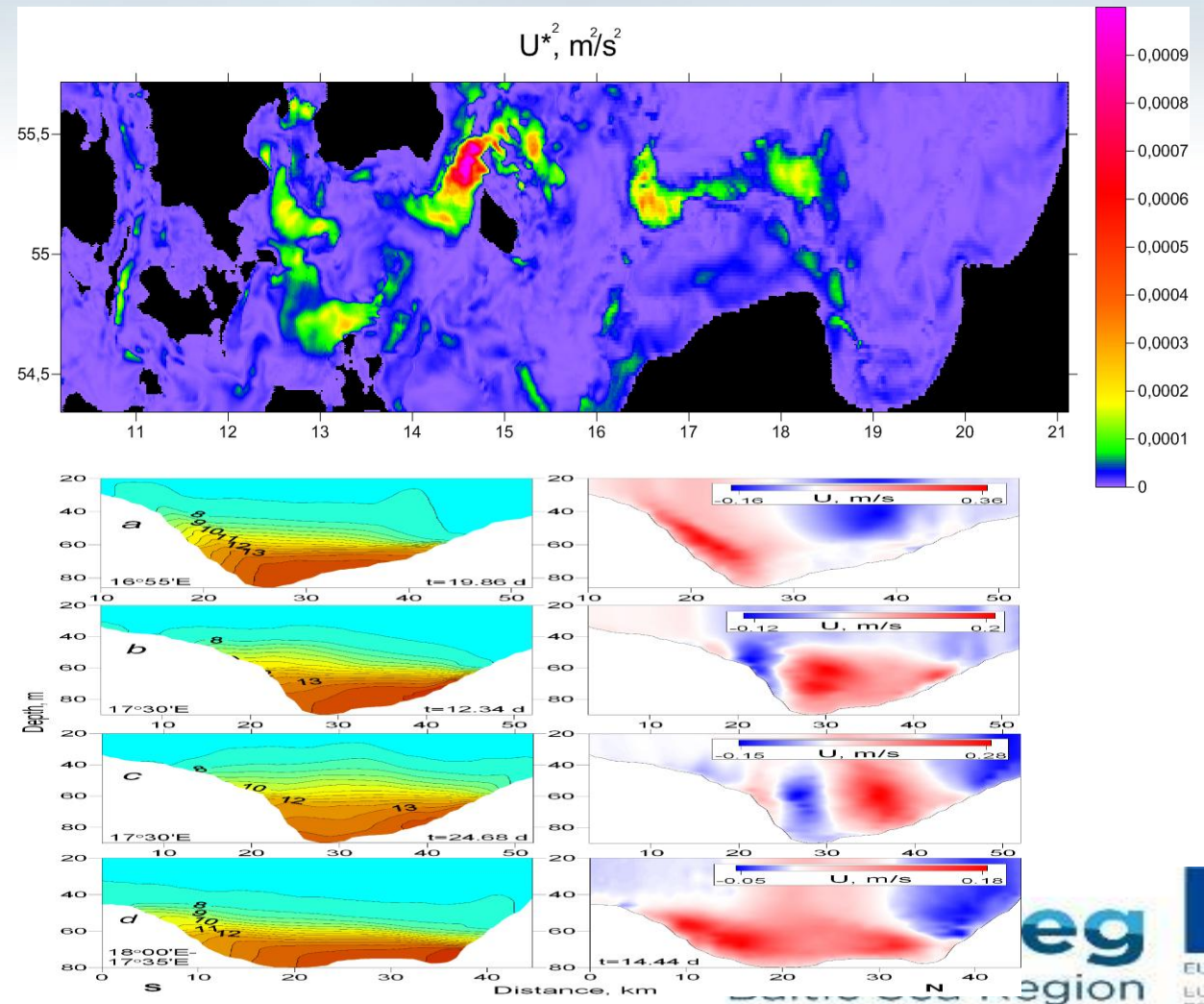


Within the sediment



Categorization of spreading parameters

- Importance of parameters
 - Bottom currents
 - Salt water inflows
- Models



Effects on biota

- Chemical by chemical – CWA
- Explosives and degradation products – effects
- Biomarkers – interpretation and risk scale

Parameter	Unit	No Effect Level	Effect level 1 cutoff	Effect level 1 interval low	Effect level 1 interval high	Effect level 2 cutoff	Effect level 2 interval low	Effect level 2 interval high
2-ADNT Mortality Mac.	mg/l	1	3			>33		
4-ADNT Mortality Mac.	mg/l	1	3			>33		
2-ADNT Physiology Mac.	mg/l	0.01	>0,33		3	>33		
4-ADNT Physiology Mac.	mg/l	0.01	>0,33		3	>33		
2-ADNT Behaviour Mac.	mg/l	0.01	>0,1		3	>33		
4-ADNT Behaviour Mac.	mg/l	0.01	>0,1		3	>33		
TNT Mortality Mac	mg/l	0.01	3			33		
TNT Physid Mac	mg/l	0.01	>0,33		3			
TNT Behaviour Mac.	mg/l	0.01	>0,33					
TNT Mortality Myt.	mg/L	10				30		
TNT Shell closure Myt.	mg/L	<1,25	>1,25			2,5		
TNT Spawning Myt.	mg/L	0	>0,33			unknown		
TNT Accumulation Lipofuscin Myt.	mg/L	<1,25	>1,25			unknown		
TNT Accumulation Neutral lipids Myt	mg/L	<1,25	>1,25			unknown		
2-ADNT Mortality DR	mg/L	2	>10			>15		
4-ADNT Mortality DR	mg/L	2	>10			>15		
TNT Mortality DR	mg/L	0,1	>2			>4		
2-ADNT Sublethal effects DR	mg/L	1	>7			>12		
4-ADNT Sublethal effects DR	mg/L	1	>7			>12		
TNT Sublethal effects DR	mg/L	0,1	>1			>2		
Catalase activity pos ME	umol/min/mg protein	20	>24			>28		
Catalase activity neg ME	umol/min/mg protein	20	<16			<12		
Lysosomal membrane stability ME	min	120	>80			>50		
Acetylcholinesterase activity ME	nmol/min/mg protein	25	>15			>10		
Fish Disease Index LL	Index value	≤1,55	>1,55		15,6			15,68
Macroscopic Liver Neoplasms LL	numeric	0			1			1
Liver histopathology LL	numeric	0	1		2			2
Hemoglobin LL	mg/dl	≥ 4,82	< 4,82		4,02			< 4,02
Erythrocytes LL	Index value	≥ 0,7025	< 0,7025		0,569			< 0,569
Hematocrit LL	%	≥ 22,4	< 22,4		15,5			< 15,5
Glucose LL	mmol/l	>1,57 ≤ 6,08	>0,85 ≤ 1,57	>6,08 ≤ 7,47			< 0,85	>7,47
Fulton's Condition Factor (total weight) LL	numeric	≥ 1	< 1					< 0,95
Fish Disease Index GM	Index value	≤ 0,34	> 0,34					16,19
Macroscopic Liver Neoplasms GM	numeric	0						1
Liver histopathology GM	numeric	0	1					2
Fulton's Condition Factor (total weight) GM	numeric	≥ 0,91	< 0,91					< 0,85
Hemoglobin GM	mg/dl	≥ 5,81	< 5,81					< 5,06
Erythrocytes GM	Index value	≥ 0,827	< 0,827					< 0,736
Hematocrit GM	%	≥ 33,6	< 33,6					< 29
Glucose GM	mmol/l	≥ 2,49 ≤ 6,71	> 0,7 ≤ 2,49	> 6,71 ≤ 9,02			< 0,7	> 9,02

Parameters	Units	No-Effect Level	Effect-level-1 cutoff	Effect-level-1 Interval How	Effect-level-1 Interval all-high	Effect-level-2 cutoff	Effect-level-2 interval all-low	Effect-level-2 interval all-high
TNT-Accumulation-Lipofuscin-Myt.a	mg/L	<1.25a	>1.25a	1a	1a	unknown	1a	1a
TNT-Accumulation-Neutral-lipids-Myt.a	mg/L	<1.25a	>1.25a	1a	1a	unknown	1a	1a
2-ADNT-Mortality-DRa	mg/L	2a	>10a	1a	1a	>15a	1a	1a
4-ADNT-Mortality-DRa	mg/L	2a	>10a	1a	1a	>15a	1a	1a
TNT-Mortality-DRa	mg/L	0.1a	>2a	1a	1a	>4a	1a	1a
2-ADNT-Sublethal-effects-DRa	mg/L	1a	>7a	1a	1a	>12a	1a	1a
4-ADNT-Sublethal-effects-DRa	mg/L	1a	>7a	1a	1a	>12a	1a	1a
TNT-Sublethal-effects-DRa	mg/L	0.1a	>1a	1a	1a	>2a	1a	1a
Catalase activity-pos-MEa	umol/min/mg-proteins	20a	>24a	1a	1a	>28a	1a	1a
Catalase activity-neg-MEa	umol/min/mg-proteins	20a	<16a	1a	1a	<12a	1a	1a

Parameters	Units	No-Effect Level	Effect-level-1 cutoff	Effect-level-1 Interval How	Effect-level-1 Interval all-high	Effect-level-2 cutoff	Effect-level-2 interval all-low	Effect-level-2 interval all-high
Lysosomal-membrane-stability-MEa	min	120a	>80a	1a	1a	>50a	1a	1a
Acetylcholinesterase-activity-MEa	nmol/min/mg-proteins	25a	>15a	1a	1a	>10a	1a	1a
Fish-Disease-Index-LLa	Index-value	≤1,55a	>1,55a	1a	1a	15,6	1a	1a
Macroscopic-Liver-Neoplasms-LLa	numeric	0a		1a	1a	1	1a	1a
Liver-histopathology-LLa	numeric	0a	1a	1a	1a	2	1a	1a
Hemoglobin-LLa	mg/dl	≥ 4,82a	< 4,82a	1a	1a	4,02a	1a	1a
Erythrocytes-LLa	Index-value	≥ 0,7025a	< 0,7025a	1a	1a	0,569a	1a	1a
Hematocrit-LLa	%	≥ 22,4a	< 22,4a	1a	1a	15,5a	1a	1a
Glucose-LLa	mmol/l	>1,57 ≤ 6,08a	>0,85 ≤ 1,57a	>6,08 ≤ 7,47a			< 0,85a	>7,47a
Fulton's-Condition-Factor-(total-weight)-LLa	numeric	≥ 1a	< 1a	1a	1a	< 0,95a	1a	1a

Human Exposure

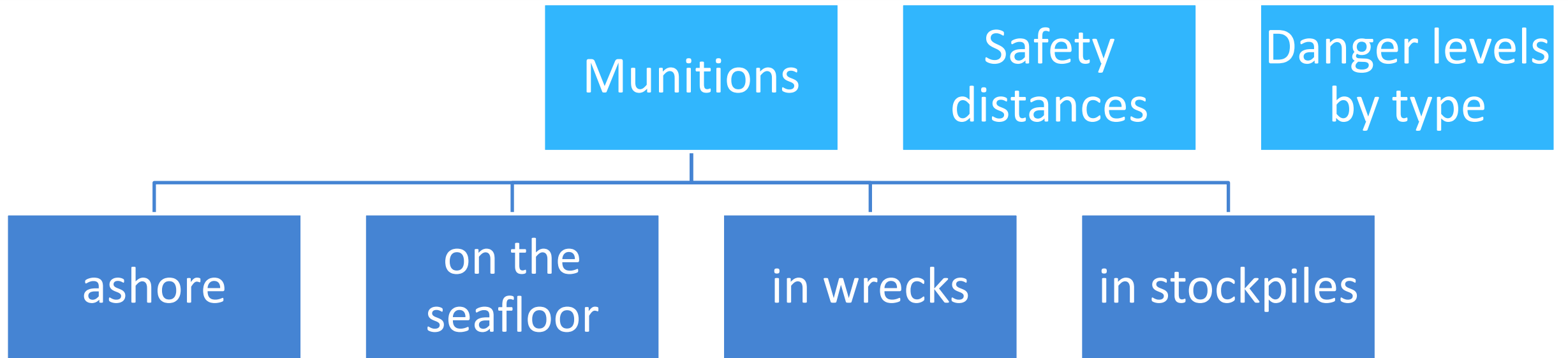
Toxicity vs humans

Threat for Fisheries

Offshore construction

Tourism

Risk levels



Risk categorization procedure

How to apply DSS

How to Apply VRAKA

How to use both tools in tandem

End users

Maritime administration

Environmental protection agencies

Maritime Spatial Planners

Offshore industry