Decision Support System for Marine Munitions

USER Manual

Version: 1.1 – June 2021

Interreg Baltic Sea Region

EUROPEAN UNION EUROPEAN REGIONAL DEVELOPMENT FUND

daimon Decision Aid for Marine Munitions

daimon Decision Aid for Marine Munitions PRACTICAL APPLICATION

AmuCad.org

Contents

1 Introduction to Marine Munitions

1.1 Historical Context of Marine Munitions

The military occupation and reconstruction of Germany after WWII were negotiated in Potsdam in 1945 by Joseph Stalin, Leader of the Soviet Union, Harry Truman, President of the United States of America and Clement Attlee, Prime Minister of the United Kingdom. Even though there were numerous disagreements, the three leaders agreed on the disarmament and demilitarization of Germany. In the resulting Potsdam agreement, the parties made terms that "The complete disarmament and demilitarization of Germany and the elimination or control of all German industry that could be used for military production" should be achieved and that "All arms, ammunition and implements of war and all specialized facilities for their production shall be held at the disposal of the Allies or destroyed. The maintenance and production of all aircraft and all arms, ammunition and implements of war shall be prevented."

With Germany divided into four zones (American, British, French and Soviet), the parties were individually responsible for tending to any chemical weapons (CW), chemical warfare agents (CWA) and production facilities within their respective areas of oversight, either by adding them to their own arsenals or by destroying them by any means they found to be suitable. This was primarily done by submerging them in oceans and seas. During the world wars the seas and oceans were areas of intense battles. Due to the strategic importance of the Baltic innumerable combat actions of great variety took place, all of which caused entry of munitions into the marine environment. These range from naval battle between war ships, submarine torpedo attacks, air raids, to complex mine laying operations. In addition, test sites for marine weapons and exercise shooting ranges were established.

Immediately before and after the conclusion of WWII, the dumping of ammunition constituted an additional mode of entry of warfare materials into the Baltic. Dumping of munitions was carried

out for a multitude of reasons. With the end of the war drawing closer, munitions were dumped by the German Armed Forces to remove hazardous munitions from areas subjected to imminent attacks, to prevent munitions from being seized by the advancing Allied troops and to demilitarize before the impending surrender. In the immediate post-war period, the Allies chose dumping at sea as modus operandi to conduct swift demilitarization and removal of warfare materials from German territory. The dumping activities that took place during the final stage of war and during the post-war period were conducted while being pressed for time, either by the attacking Allied forces or by agreed deadlines. In later years, dumping activities were considered an inexpensive and safe alternative to land-based disassembly and decontamination procedures.

In addition to the conventional ammunition, chemical ammunition and CWA were dumped as well. At the time it was believed that the vast amounts of water would neutralize the CWA. In contrast to the dumping operations in Skagerrak and Little Belt, where complete ships were sunk, the great majority of chemical munitions were dumped into the Baltic Sea containers.

For the purpose of this report the modes of ordnance entry into the Baltic Sea can be roughly categorized in naval warfare, military training (including various ordnance test site) and munitions dumping.

Naval Warfare

During both world wars the Baltic Sea was an area of conflict. Due to the strategic importance of the Baltic Sea, innumerable combat actions of great variety took place, all of them causing the entry of munitions into the marine environment. These range from naval battles between surface war ships, submarine torpedo attacks, air raids and coastal bombardment (including counter fire from coastal artillery batteries) to complex mine laying operations. All of those, except for coastal bombardment, were geographically widely spread and even coastal artillery batteries had a range of more than 40 km.

Military Training

In peacetime military live-fire training was and is conducted in training areas normally. Those training areas are bound to contain unexploded ordnance (UXO). In addition, test sites and firing ranges for weapon prototypes were established, e.g. at Peenemunde. Weapon prototypes in later stages of development often contained an explosive charge.

Munitions Dumping

Immediately before and after the conclusion of WWII, the dumping of ammunition constituted an additional mode of entry of warfare materials into the Baltic Sea. Dumping of munitions was carried out for a multitude of reasons. With the end of the war drawing closer, munitions were dumped by the German Wehrmacht (armed forces) to remove hazardous munitions from areas subjected to imminent attacks, to prevent munitions from being seized by the advancing Allied troops and to demilitarize before the impending surrender. In the immediate post-war period, the Allies chose dumping at sea as modus operandi to conduct swift demilitarization and removal of warfare materials from German territory. The dumping activities that took place during the final stage of war and during the post-war period were conducted while being pressed for time, either by the attacking Allied forces or by agreed deadlines. In later years, dumping activities were considered an inexpensive and safe alternative to land-based disassembly and decontamination procedures.

In addition to the conventional ammunition, chemical ammunition and CWA were dumped as well. At the time it was believed that the vast amounts of water would neutralize the CWA. In contrast to the dumping operations in Skagerrak and Little Belt, where complete ships were sunk, the great majority of chemical munitions were dumped into the Baltic Sea in containers.

2 The DAIMON DSS

The goal of the project DAIMON („Decision Aid for Marine Munitions“) is to analyze identified and localized objects with various method such as artificial intelligence, incorporating large amounts of spatial and non -spatial datasets based on latest scientific research. For each detected munition object, the software will formulate a risk assessment, incorporating information about the localization and overall state of the ammunition, the surrounding environment and state of biological pollution/damage. Furthermore, it will recommend possible actions, such as recovery & destruction, accumulation, encapsulation, capping, blasting or non-action, including monitoring and costs thereof. The DAIMON DSS is available via the international Ammunition Cadastre Sea (AmuCad.org).

2.1 Decision Support System overview

DAIMON has multiple functionalities which make up the Decision Support System. Each functionality is optional to use and is summarized in the DSS-report, delivering a ‘package’ of information including an overview of decision related information regarding hydrographic conditions, object properties, surveyed biological data, environmental parameters and human activities that are valid for the munition finding site.

2.1.1 List of functionalities

- Finding creation for any location in the Baltic Sea Region
- Object description
- Calculation of the statistical probability of release (VRAKA- CWA)
- Calculation of contaminant dispersion (Contamination Model)
- Risk assessments for individual protection goods
- Generation of a DSS report

2.2 DAIMON Layers

DAIMON contains dynamic spatial datasets that show the available measurements and ammunition findings. These data sets are shown as layers on the interactive AmuCad.org map and are dynamic because they display the current status of munition findings that are reported in the Baltic Sea Region.

2.3 Ammunition Cadastre Sea - AmuCad.org

The Ammunition Cadastre Sea (AMUCAD) is designed as the central data and hub in the global network of industry, science, authorities and NGOs regarding ammunition at sea. Numerous national and international research projects are bundled within AMUCAD and enormous amounts of historical and current data are additionally incorporated into the system. In combination with the use of artificial intelligence, modern sensor systems and web-based technologies, this creates a comprehensive platform that enables an understanding of the current state of the oceans, identifies hot spots and serves as a centralized tool for monitoring.

The DAIMON DSS is freely available to all registered AmuCad.org users. In order to register, you can follow the link on the top left of the opening page. Registration is free and gives you access to several functionalities and datasets that are available in AmuCad.org. The public version of the DAIMON DSS is also available via this registration.

Link: The Ammunition Cadaster Sea is available via AmuCad.org

3 Getting Started

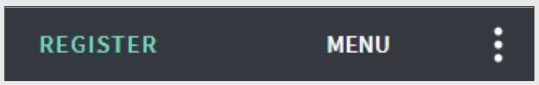
3.1 Registration and login

To get started, go to AmuCad.org via your web browser. We recommend the use of Chrome or Firefox. In case you do not have an account yet, you will have to register. This can be done via the registration button which can be found in the header of the web page or in the login modal.

Registration & Login

To be able to log in, you first have to register. Registration is free and access is granted immediately after registration.

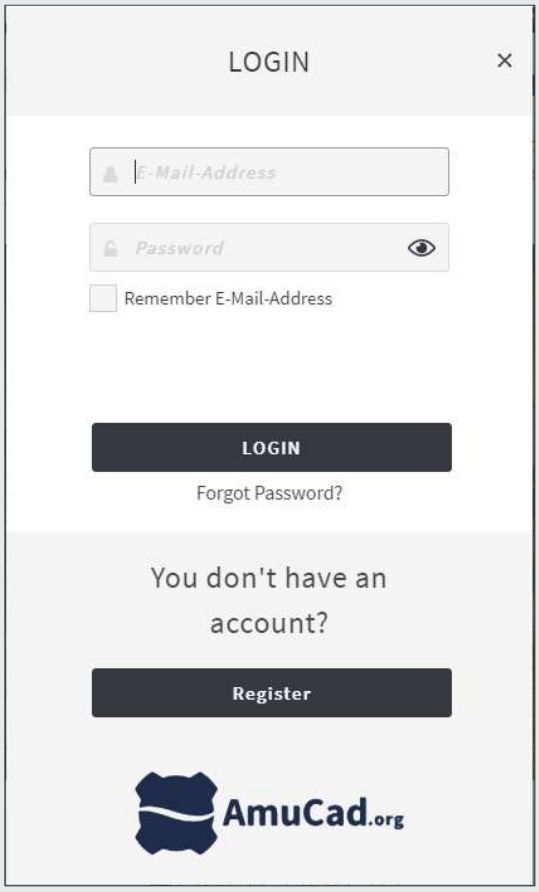
Direct registration can be done via the "register" buttons in the page header or in the login modal, as indicated in the figures on the right.



In order to register you will be asked to provide your First and Last names, Email address, Organization, City and Country as well as a self-chosen password.

Your password should contain at least a capital letter, a small letter, a number and a special character and at least 8 characters in total.

After registration, you will be asked to check your email inbox and verify your registration by clicking on the provided link in the email.



Login
You can login via menu >> login at the right top corner of the AmuCad.org page.

3.2 Opening the DAIMON DSS

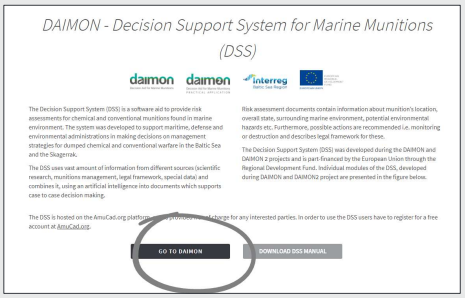
Once logged in, the DAIMON DSS can be opened via the Modules >> DAIMON. A side bar will open on the right side of your screen, which is the starting point of the DAIMON DSS. Alternatively you can access www.AmuCad.org/daimon to get redirected to the DAIMON DSS straight away.

Opening the DAIMON DSS

By accessing www.AmuCad.org/daimon, a short explanation of DAIMON will be shown.

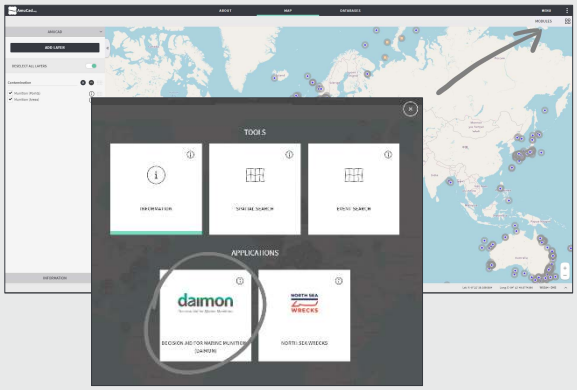
By clicking the button Login/Register, you will be guided through the login or registration process.

If you are already logged in, the button will show Go To DAIMON, from where you will be brought to the DAIMON DSS.



Alternatively, if you are logged into AmuCad.org you can find the DAIMON DSS as follows:

1. In the header choose “Maps”
2. At the right-top choose “Modules”
3. From the offered choices choose “DAIMON”



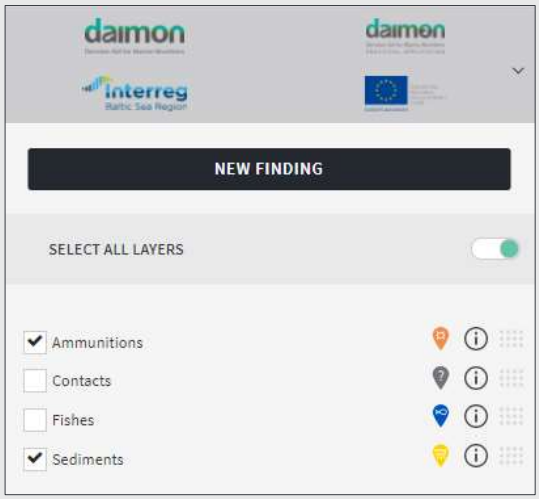
3.3 Create Marine Munition findings

Creating a finding, i.e. making report of a munition finding is the initial step for newly found munition objects. To create a finding a minimum of information needs to be given for the information groups as specified below. Once the minimum requirements are given, each group is marked with ✔. Once all requirements are met, the option to save your finding is activated.

3.3.1 Location

At first a location is needed. For this the pointer needs to be activated by clicking on the [pointer] button. Subsequently the user can click on a location on the map. Alternatively, coordinates can be given in the input fields in decimal degrees. Once the desired location is marked, [Confirm] leads you to the next step.

Create New Finding
By clicking the "New Finding" button, you will be able to click any point on the map. Alternatively you can enter the coordinates manually in the right



3.3.2 Metainformation

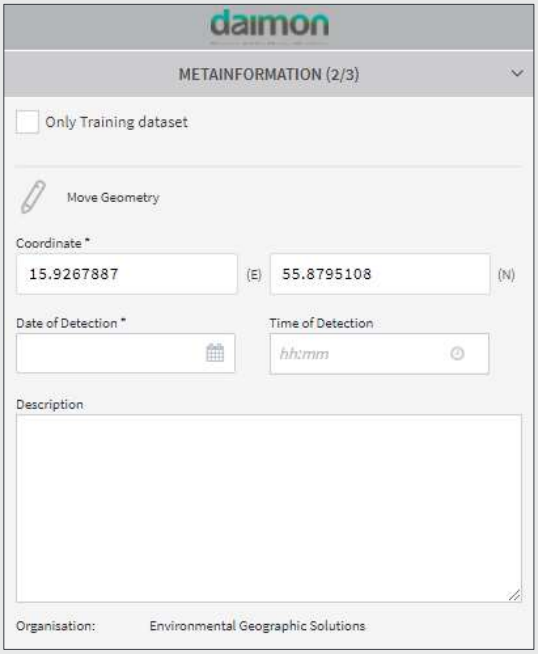
Meta information consist of some additional information that describes the circumstances under which the finding is made. The description can be used to add information describing the circumstances under which the object was found such as: ship/cruise number, technique used, or any descriptive term that is deemed relevant. The description is not used for the analysis directly, but will be shown throughout the decision making process.

Only Training Dataset
There is an option to mark the dataset as Training dataset. This tick is marked when the finding is fictional and can be used for manual risk assessments to train the AI module.

Move Geometry
This option can be activated to re-specify the finding location on the map.

Date and time of detection
Use the date picker to indicate when the finding discovered.

Description
Give the desired description and additional information that is worth mentioning.



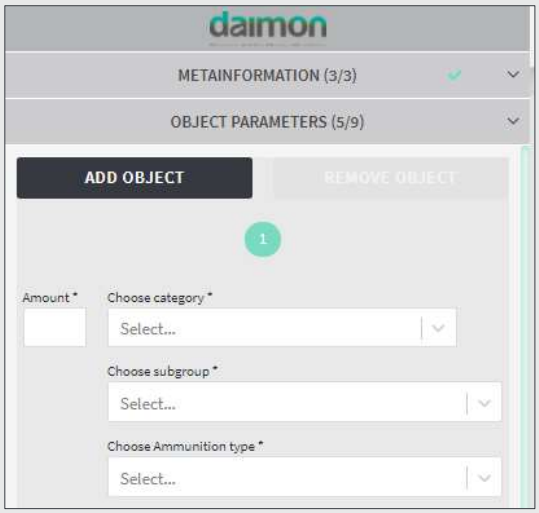
3.3.3 Object properties

Object properties describe the munition finding(s) as far possible. This judgement is optimally based on a visual contact from ROV, AUV or diving operation. The state of a finding can be described in a simplified manner by giving estimates for the level of corrosion, the sediment cover and degree of biofouling and vegetation. Also, it should be specified whether the finding lies freely or inside a shipwreck. Stepwise identification of the object is offered by filtering based on the category, sub-group and munition type.

Category, Subgroup & Ammunition type
Munition can be identified in three steps: Category, Sub-groups and Ammunition-type. Select these fields from top to bottom to increase the level of detail. Select unknown if requested information is not available.

Amount
Quantify the number of objects that have the same characteristics and a comparable state. In case different types and conditions of objects are required, you can add objects, using the designated buttons.

Add Object / Remove Objects
Multiple objects can be defined by adding or removing objects using the “add object” or “remove object”. You can switch between objects using the object number 1, 2, etc.



Link: To learn more of munition types that are typically found in the Baltic Region, please take a look at he munitions catalog via: https://www.daimonproject.com/catalogue-of-munitions-types.html

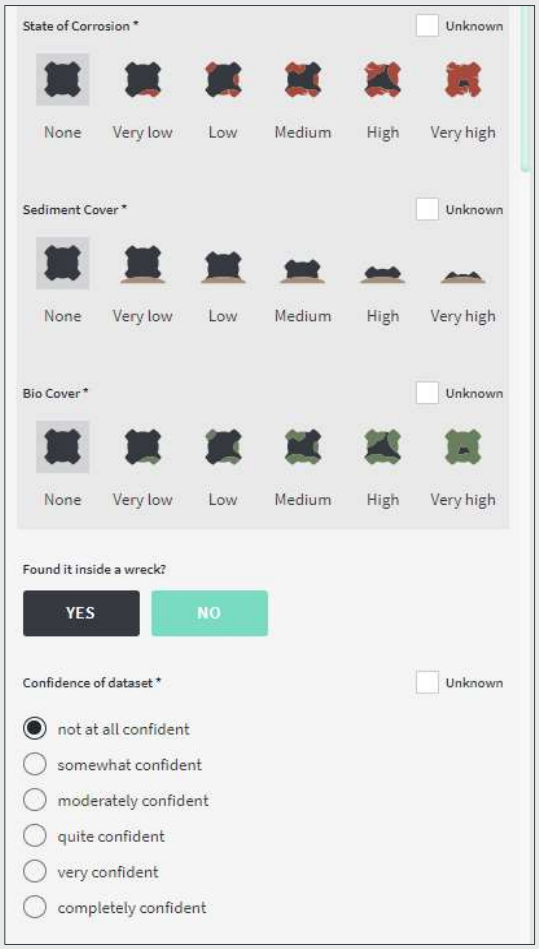
State of corrosion
Based on the available information, the corrosion can be classified to be in a very good condition showing no signs of corrosion (none) to a mostly deteriorated state of corrosion (very high).

Sediment cover
If the object is partly or entirely covered in sediments this can be indicate in a range from none to very high (cover).

Bio Cover
Bio cover refers to degree of cover by vegetation of other types of biofouling, ranging from none to very high, where it is covered in its entirety. The bio cover can be combined with the sediment cover.

Found inside wreck?
In case the finding lies inside a shipwreck, this can be specified using the inside wreck buttons (yes/no).

Unknown
If either of the states is unknown, the unknown box can be ticked. This deactivates the classifications and blocks the parameter for further consideration.



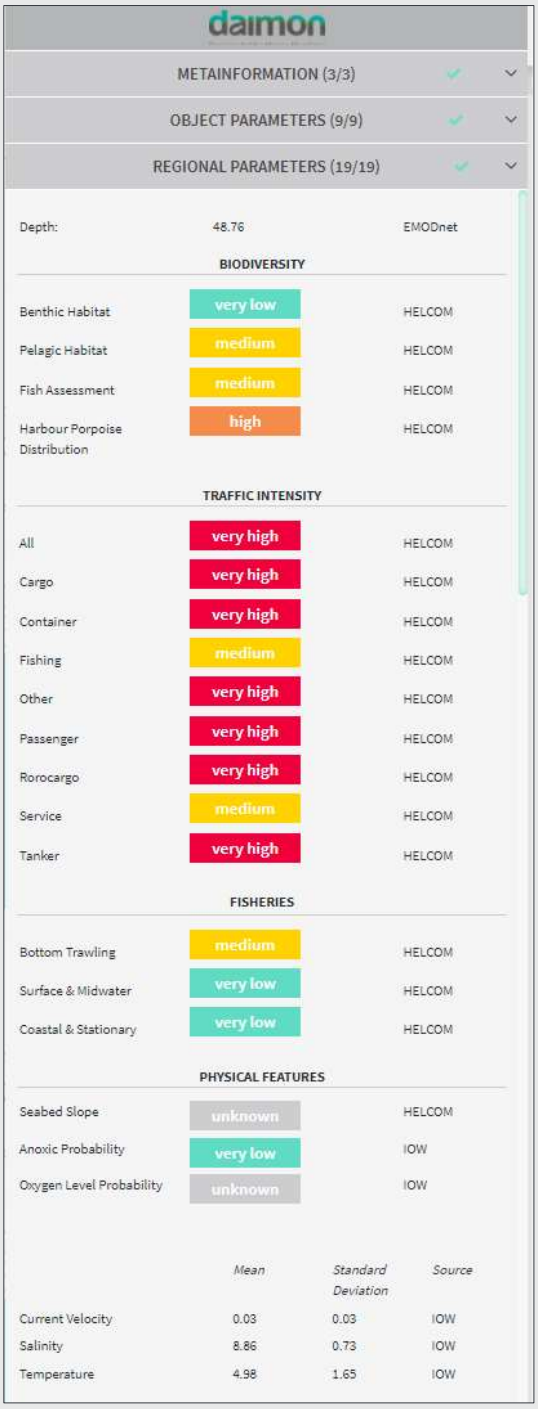
Given the difficulty that arises in making judgements regarding the identification and description the condition it is in, the confidence of the input will not always be as confident as hoped for. If there are circumstances, which affect the confidence of the given details, this can be indicated in the section:" Confidence of dataset".

Confidence of dataset
The confidence can be provided by clicking the desired option ranging from not confident to completely confident. If, for some reason no confidence level can be given, the unknown tick box can be marked.

3.3.4 Regional Parameters

The regional parameters provide a set of information regarding the human activities, environmental which is found in the AmuCad.org database. All values provided are valid for the location at which the munition object was found, and therefore is unique for each location.

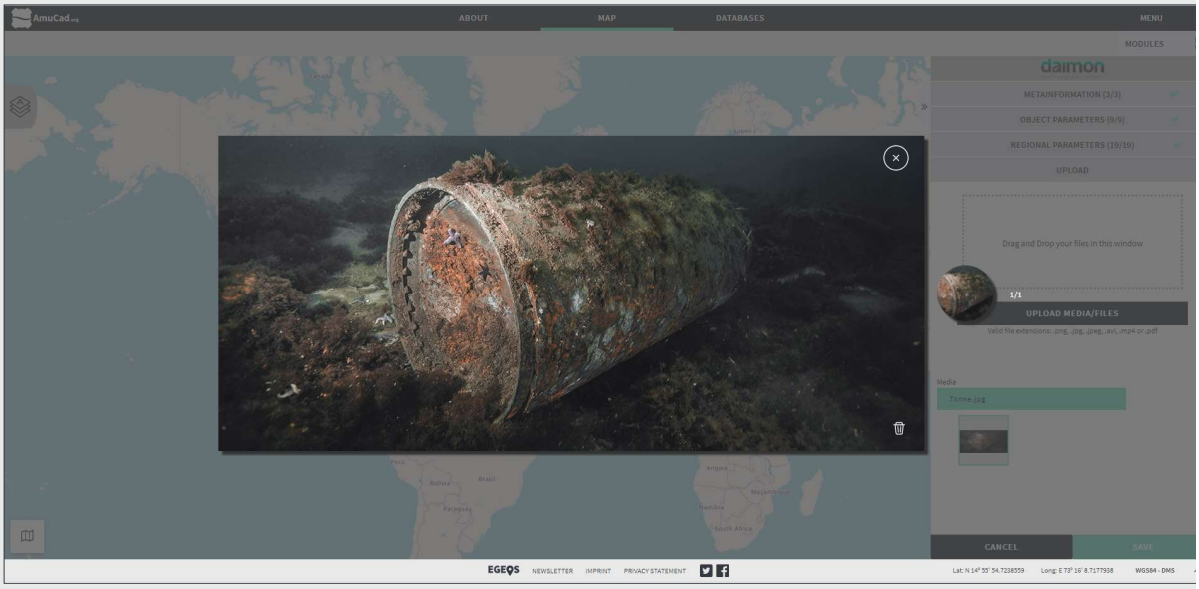
Regional parameters
The confidence can be provided by clicking the desired option ranging from not confident to completely confident. If, for some reason no confidence level can be given, the unknown tick box can be marked.



3.3.5 Media Upload

Media files and documents accompanying the finding can be uploaded to complete the dataset for the created finding.

Media files
Media files can be uploaded by pressing the button “Upload Media/Files”. Uploaded imagery can be viewed by clicking on the created thumbnail.

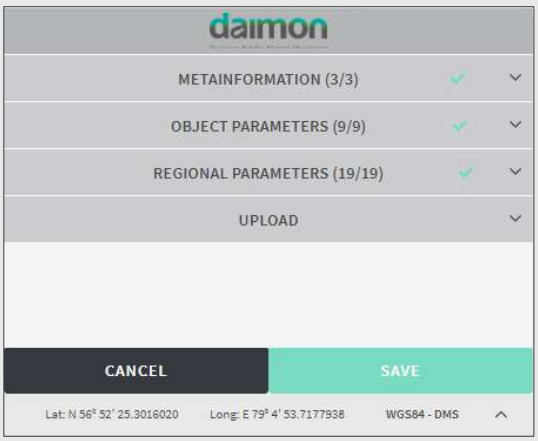


3.3.6 Saving your finding

Once all required information has been provided, check marks are indicated with each category, with exception for “upload” since media files are not mandatory. The save button is enabled. To save your finding, press the Save Button. After saving, changes are not possible anymore. Please check you inputs thoroughly before saving.

Saving the finding
When the required information is provided press save.

Rejecting the finding
The Cancel button can be pressed at any time and will reject your inputs. The finding creation process will be terminated, and you will return to the map.



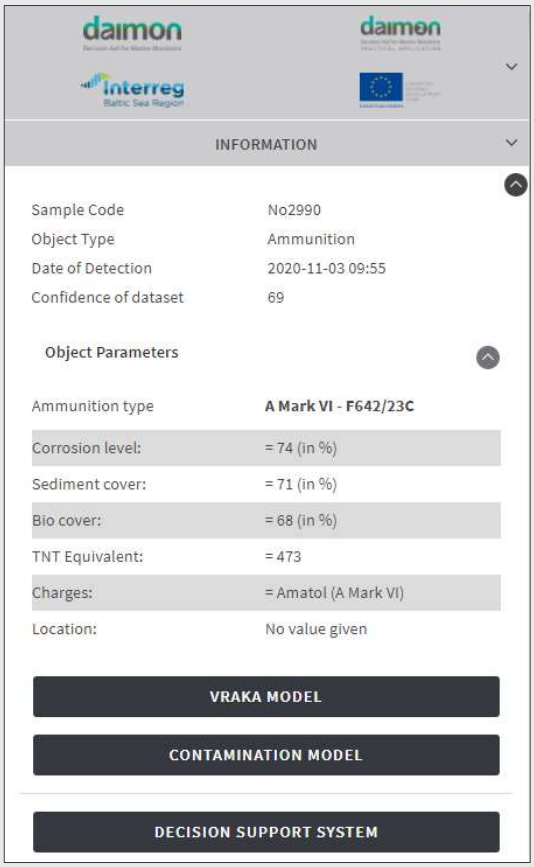
After saving your finding, the information will be processed, and your finding will appear on the map. Simultaneously, the DAIMON sidebar will change its appearance showing a summary of the finding and access three processing steps to commence decision support functionalities: VRAKA Model, Contamination Model, Decision Support System.

After saving, or by clicking on a finding on the map, a summary of the munition finding is shown together with additional user options:

- VRAKA Model
  Calculate statistical probability of release.

- Contamination Model
  Simulates spreading of a released substance

- Decision Support System
  Risk assessments for Protection Goods, based on Artificial Intelligence



3.4 VRAKA Conventional Munitions and Chemical Warfare Agents

VRAKA-CM & CWA is a statistical risk assessment model for dumped chemical warfare agents and conventional munitions at sea. The results presented indicate a probability of the period at which an opening and release of content can be expected. The model is based on statistical definitions made by experts in the field of marine munitions and shipwrecks. The analysis is based on the site-specific data for indicators, activities, and objects (munition) that have been given by the user.

Link: The model was developed by researchers at Chalmers University of Technology.
For further information and a description of the VRAKA model, please see:
https://www.chalmers.se/sv/institutioner/m2/forskning/maritimastudier/maritim-miljovetenskap/shipwreck/vraka/Sidor/default.aspx

State of corrosion
Based on the available information, the corrosion can be classified to be in a very good condition showing no signs of corrosion (none) to a mostly deteriorated state of corrosion (very high).

Sediment cover
If the object is partly or entirely covered in sediments this can be indicate in a range from none to very high (cover).

Bio Cover
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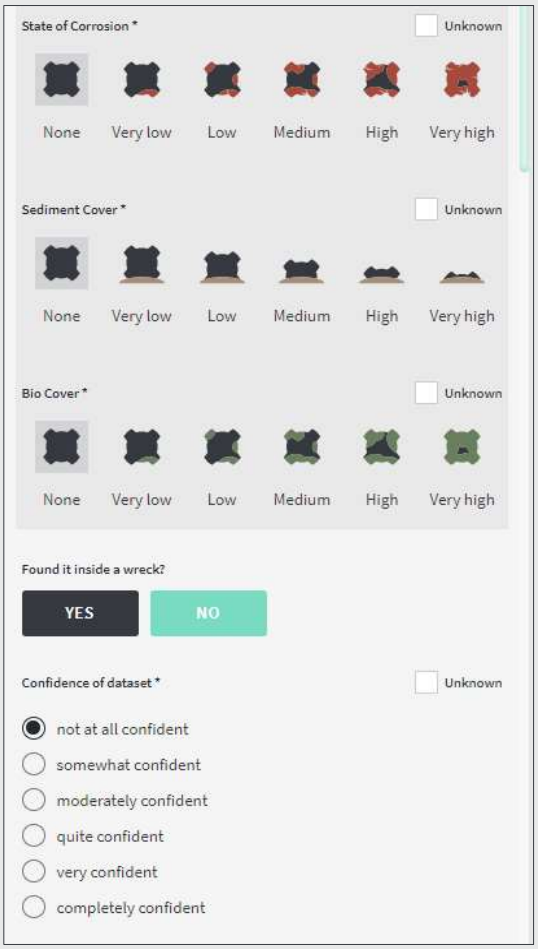
Found inside wreck?
In case the finding lies inside a shipwreck, this can be specified using the inside wreck buttons (yes/no).

Unknown
If either of the states is unknown, the unknown box can be ticked. This deactivates the classifications and blocks the parameter for further consideration.

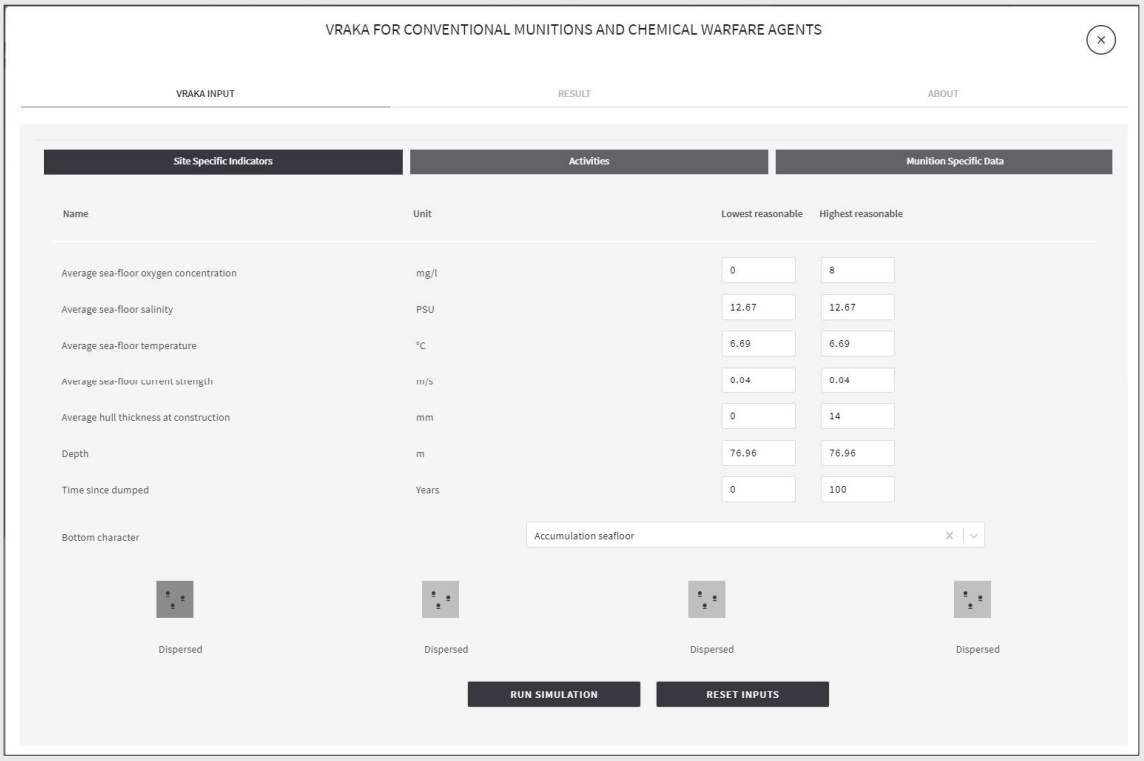


3.4.1 VRAKA Input

The VRAKA model requires inputs regarding site-specific indicators, activities and munition specific data. For each input, a range can be provided indicated as “lowest reasonable” and “highest reasonable”, respectively. These values are prefilled, when this information is available. Alternatively, the user can edit these values. Keep note of the units required for the inputs. In addition, the arrangement of objects should be selected by clicking on one of the icons (dispersed, clusters/single object), within the sediment or inside a wreck.

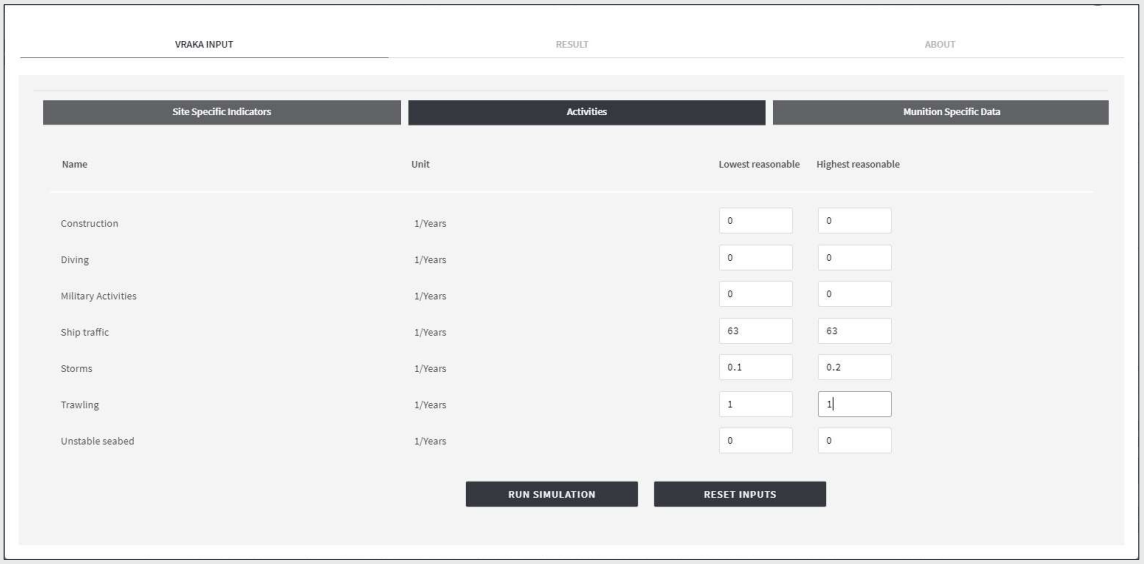
Site specific indicators

Verify and where needed adapt the ranges of the parameters listed, when additional information is available.



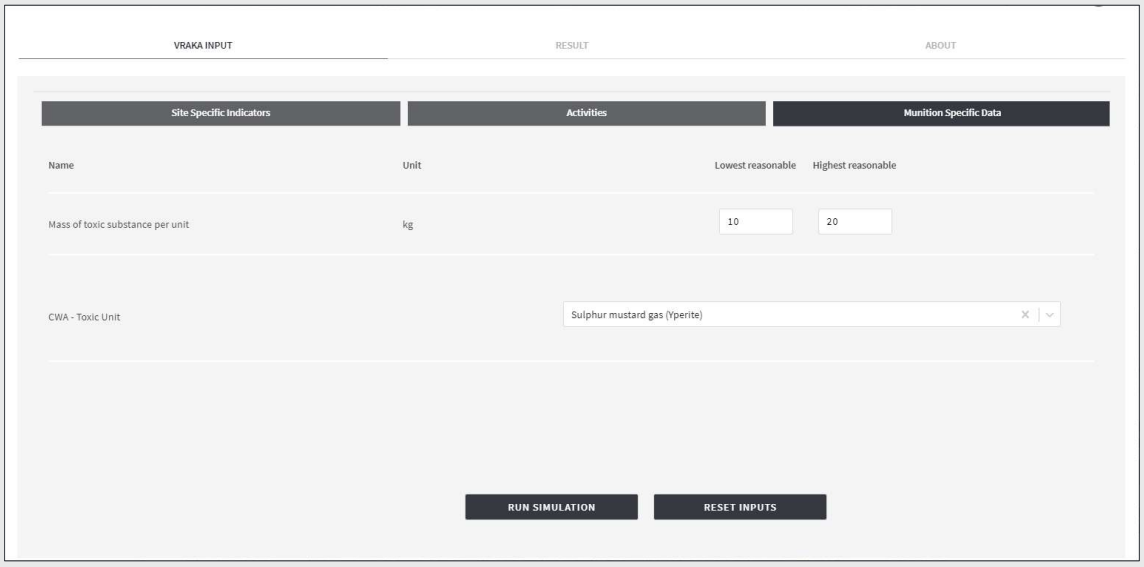
By switching the tabs on the top of the interface, you can switch between site specific indicators, activities and munition specific data. Activities are given as a frequency, being the number of *occurrences per year*, that an activity takes place. Numbers smaller than 1 indicate an occurring once every multitude of years E.g. once every five years would mean a value of 1/5 = *0.2 1/year*.

Activities
Verify and where needed adapt the ranges of the activities listed. Values are indicated as frequency per year. In case activities occur less than once a year, values < 1 are accepted.



When changing the tab to “Munition Specific Data”, you are asked to provide the mass of toxic substance and a selection of a prelisted set of Chemical substances.

Munition Specific Data
Select the mass of toxic, that is expected to be present for the finding. This is currently not automated. Select the Toxic Unit.



3.4.2 Running VRAKA simulations

Initially, the input tabs are accentuated with a red marking when not all required information is given. As soon as all required information is provided, these markings disappear and the “Run Simulation” button will be enabled. The VRAKA simulation can now be initiated. The calculation process takes several seconds. When the calculation process is completed, a “Results” tab will

appear at the top of the user interface.
You can now switch between results and inputs. In case you want to make changes to the inputs, this can be done. Do not forget to re-run the model to obtain updated results. When a new simulation is conducted, the previous simulation is overwritten.

Run Simulation
The "run simulation" button is by default disabled and will be enabled when all required inputs are specified and a VRAKA simulation can be processed.

Reset Inputs
The inputs of your previous simulation are remembered. In case you want to reset to default values, press the "reset inputs" button.

When your simulation is processed, which takes several seconds, a results tab will appear on the top.

3.4.3 Results

The results show a % probability (mean value) that the analyzed object will be damaged within the coming year and a hole created so that its content may be released. Due to natural variations and assumptions made, the indicated timespan is based on a 90% certainty the probability of opening release is within the 5th and 95th percentile of the calculated distribution. In addition, the activities that are most likely to affect this object are listed.

A potential indicated mass of the selected substance being potentially released into the water column and the sediment is indicated. Considering the probability of release, the mass and toxicity of the substance, the mean risk is calculated. The risk is expressed as a relative number and calculated as the product of the probability, mass and toxic unit i.e. the expected value of kg·toxic unit. Due to natural variations and the range of data there are uncertainties in the results, which are indicated with 90% certainty the calculated risk is within a given range.

Results

A report of the results is shown with an explanatory text and illustration graphs.

3.5 DAIMON Contamination Model

The contamination model is a high-resolution dispersion model, which simulates the spreading of toxic substances in the water column based on wind and density driven currents. The contamination model is developed by the Institute of Oceanology of the Polish Academy of Sciences (IOPAS). Additional information of the model can be found […]

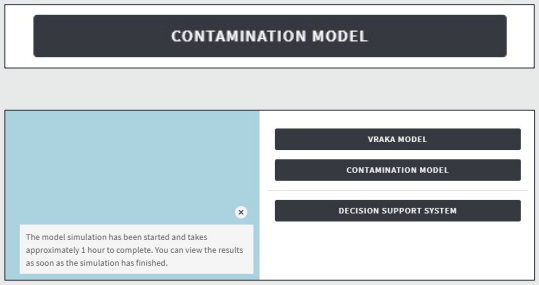
3.5.1 Starting the contamination Model

The contamination model simulation is not started automatically. The user needs to initiate the simulation by pressing the Contamination Model button. Since the simulation is run on an external server and is quite time consuming, the results will not show immediately. By pressing the

contamination model button again, a status is given whether it is still processing. When results become available, they can be shown on the map.

Start Contamination Model Simulation
To start the contamination model, the "Contamination Model" button must be pressed. This initiated the computation, which will take approximately one hour.

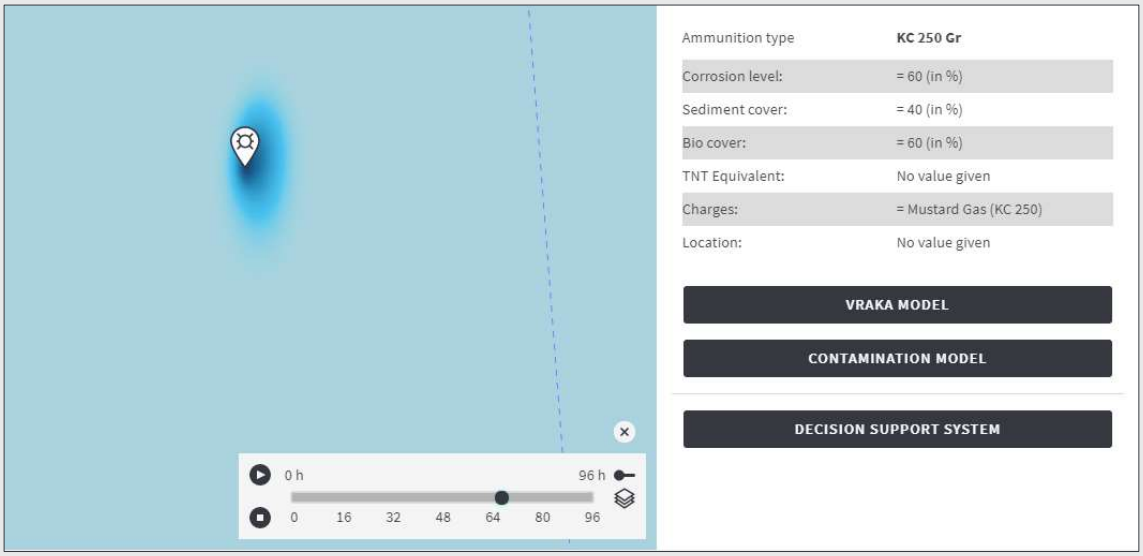
Model status
By pressing the "Contamination Model" button again, the status is shown.



3.5.2 Contamination Model Results

Once the simulation has finished and the results are available, another press on the Contamination Model button will show the results on the map. The results will show an animation of how a possible release from the munition object spreads through the water column. The simulation period covers a time span of 96 hours.

Viewing Results
If the model run is completed, a time bar will be shown which allows the user to navigate through the available simulation timesteps. The ▶ button will start an animation of the model results on the map.



Link: The model was developed by researchers of the Technical University Clausthal. For further information please visit: https://www.ifi.tu-clausthal.de/abteilungen/big-data-and-information-systems/research/daimon-baltic-sea-dumbed-munition-database

3.6 DAIMON Risk Assessment by Artificial Intelligence (AI)

The DAIMON AI is the artificial intelligence evaluates risks of newly found munition objects. The AI model is done based on manual expert risk assessments, which were made by a selected group of experts. These assessments also include an indication of suited measures and corresponding standard operation procedures. Their knowledge about known munition findings is used to evaluate new munition findings. The trained AI model "mimics" the risk assessments based on the information, which is collected for the finding. This is done for different protection goods combinations.

Link: The model was developed by researchers of the Technical University Clausthal. For further information please visit: https://www.ifi.tu-clausthal.de/abteilungen/big-data-and-information-systems/research/daimon-baltic-sea-dumbed-munition-database

3.6.1 Protection Goods & Actions

Protection Goods are categories that, in this context, constitute a given resources, use or value within the marine environment. Within DAIMON we consider the following protection goods:

- Flora & Fauna
- Shipping
- Fisheries
- Infrastructure
- Tourism
- Diving

Each protection goods can be exposed to two different "actions" being "Explosion" and "Corrosion". A protection goods combination is therefore assessed for the risk of, for example, "Flora & Fauna" in the case of an "explosion".

3.6.2 Measures

There are various options to deal with marine munitions, ranging from "no action" to "recovery and destruction". There are many factors playing part in the decision to assign the most suited and appropriate measure. The AI will provide those measures which will best suit the given conditions.

- No action
  The strategy "No action" can be defined as the intentional or unintentional absence of disposal action regarding munition management. Often the strategy of "no action" is only considered in situations in which the negative consequences of acting are higher than the probability of negative consequences when NOT acting. Not taking action to manage the presence of conventional and chemical munitions does not necessarily result in beneficial situations but is considered a viable option when considering water depth, munition type, location, and the likelihood of human exposure.
- Monitoring
  Monitoring dumpsites is the first and most important step in developing a munitions management strategy. There have been many international programs (such as MERCW, CHEMSEA, and MODUM) which have provided a great deal of information and baseline statistics about the behaviour of chemical weapons in the Baltic Sea. Monitoring operations

are conducted by autonomous underwater vehicles and remote operated vehicles launched from research vessels. Monitoring usually takes place in several phases, including test phases (to select the best technologies and methods for a given environment), survey phase (to locate dump sites and objects of concern), and a monitoring phase (which collects information). Monitoring studies include the evaluation of habitat status, fish health, and modelling of possible threats to adjacent areas.

- Limitation of certain actions
  Limiting certain actions at sea is a management strategy that leaves the conventional and chemical weapons undisturbed on the seafloor but restricts human activities and economic development in the area to limit the risk of exposure. A wide variety of scientific literature suggests that leaving munitions undisturbed is a safer option than attempting to recover and destroy them by some other method (Beddington and Kinloch, 2005). However, as more scientific studies are conducted about the toxicity of underwater munitions and as more technologies are developed to allow non-state actors to recover ordnance from the seabed, this strategy may become less viable in the future.
- Neutralization at Sea
  Neutralization at sea nullifies the contamination or potential disruptions caused by underwater munitions, usually without relocating the objects or hazards. This could involve concrete encasements or the introduction of new technologies or substances that will counteract the contamination. The choice between neutralization and other risk-averting management strategies depends on the result achieved per cost.
- Detonation in Situ
  Controlled detonations of chemical or conventional munitions destroys the dangers without having to invest significant money or labour in recovery, relocation, or destruction. This strategy is a viable option for munitions that are too dangerous to move or found in an area where human exposure is likely to occur or the risks to economic activity are high. However, it is also accompanied by some serious energetic risks to local infrastructure, fish populations, and can spread contamination over a wider area.
- Recovery and Destruction
  The recovery and destruction of conventional and chemical munitions is an essential step in decreasing the amount of underwater munitions. There is plenty of information regarding both the recovery of sea-dumped chemical weapons and the possibilities regarding on- and off-shore treatment. Many organizations, like UXB and DYNASAFE have been involved in munitions recovery operations and/or in the production of different types of transport chambers for both conventional and chemical munitions.
- Reassessment
  Identify a classified object. ROV/TEM/Diver etc.
- Relocation (temporary)
  Temporary relocation of the object
- Prohibiting access to area
  Limiting access to area of risk (prohibited area sea chart No. 1 N2.2)

3.6.3 Standard & Recommended Operation Procedures

DAIMON 2 project has worked out a set of state-of-art, time and cost-saving methodologies for the detection, impact analysis and monitoring of dumped munitions:

- Methods for munitions detection' and identification

- Chemical methods for detecting warfare agents (parent compounds and degradation products) in water, sediments and biota
- Biological methods for detecting effects of toxic warfare agents from chemical and conventional munitions in marine organisms (vertebrates, invertebrates)
- Guidelines for additional measurements e.g. addressing habitat condition
- Guidelines for data analysis and assessment

They are widely acknowledged in the international scientific community and already applied by members of the DAIMON network. For each measure designated SOP's & ROP's will be provided.

Link: A full list of Standard Operating Procedures (SOP), Recommended Operating Procedures (ROP) is available at: https://www.daimonproject.com/standard--recommended-operation-procedures.html

3.6.4 Expert Risk Analysis & Artificial Intelligence

The expert risk assessments are conducted with the same information as is shown to the user who creates the finding. Here a risk and an uncertainty are assigned. The expert risk assessments are done in the administration part of the DAIMON system and are not further discussed here.

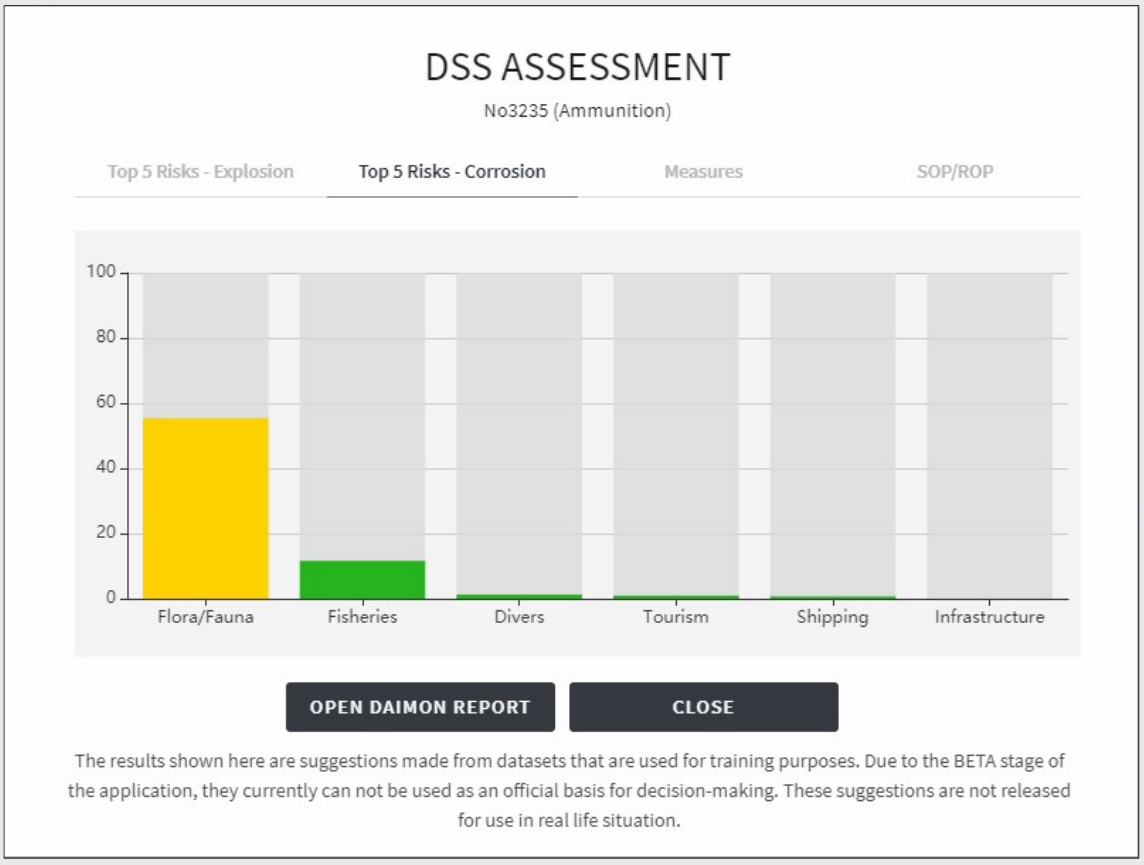
3.6.5 Starting Risk Assessment by Artificial Intelligence (AI)

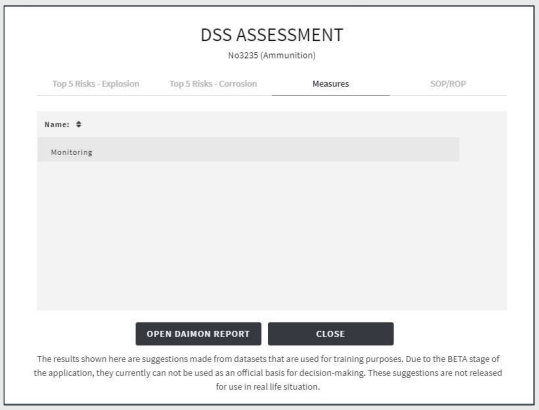
Since the AI runs independently and does not need any further inputs, pushing the "Decision Support System" button will trigger the evaluation.
The dataset of the finding is sent to the AI and it will evaluate the risk for each protection goods combination. After processing the result will be returned and shown on the screen.

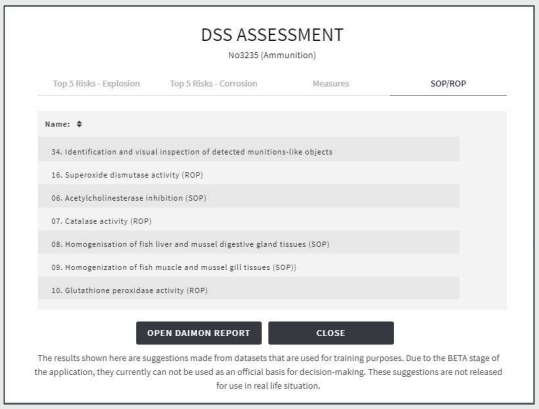
Starting the Evaluation
To evaluate a munition finding for its risk based on the AI model, the "Decision Support System" button needs to be used.

DSS Assessment

The Results will be shown in a modal, which appears. To switch between actions “Explosion” and “Corrosion” as well as the proposed measures and SOP’s, use the tabs at the top. The risks for each protection goods and action combination is shown on a scale of 0 to 100.







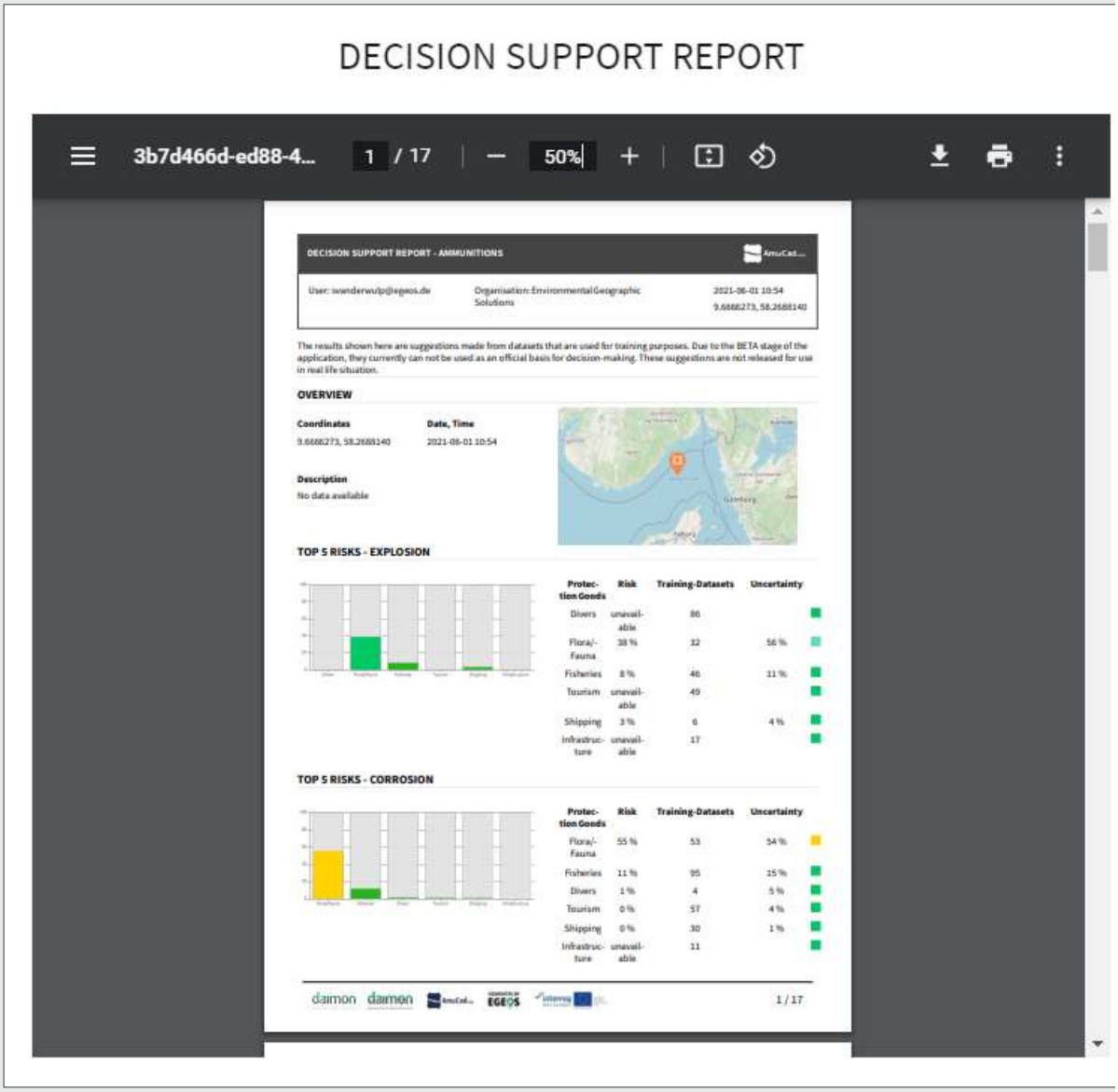
The recommended measure(s) are listed in the measures tab.

The recommended Standard Operating Procedures (SOP) and Recommended Operating Procedures (ROP) are listed in the SOP/ROP Tab. The full text can be opened and downloaded by clicking on the view icon behind each listed procedure.

3.7 DAIMON Munition findings report

The Decision Support System step also summarizes the munition finding. All collected information about the munition object, munition object properties and condition, regional parameters and analysis results of VRAKA, contamination model and risks to protection goods combinations, recommended measures and SOP's given in the report. The report can be downloaded as pdf document for further use during the decision-making process.

Decision Support System - Report
A report of the results the analysis, summary of the finding location, object properties, regional parameters, management options and recommended and standard operating procedures. The report can be downloaded and printed as desired.



4 Further Reading

- DAIMON project webpage: *http://www.daimonproject.com*
- Ammunition Cadaster Sea *AmuCad.org*
- A polish version of this manual within the scope of training is available via *https://www.amw.gdynia.pl/index.php/en/about-us/academy*