

# MANIFESTS

MANaging risks and Impacts From Evaporating and gaseous Substances To population Safety



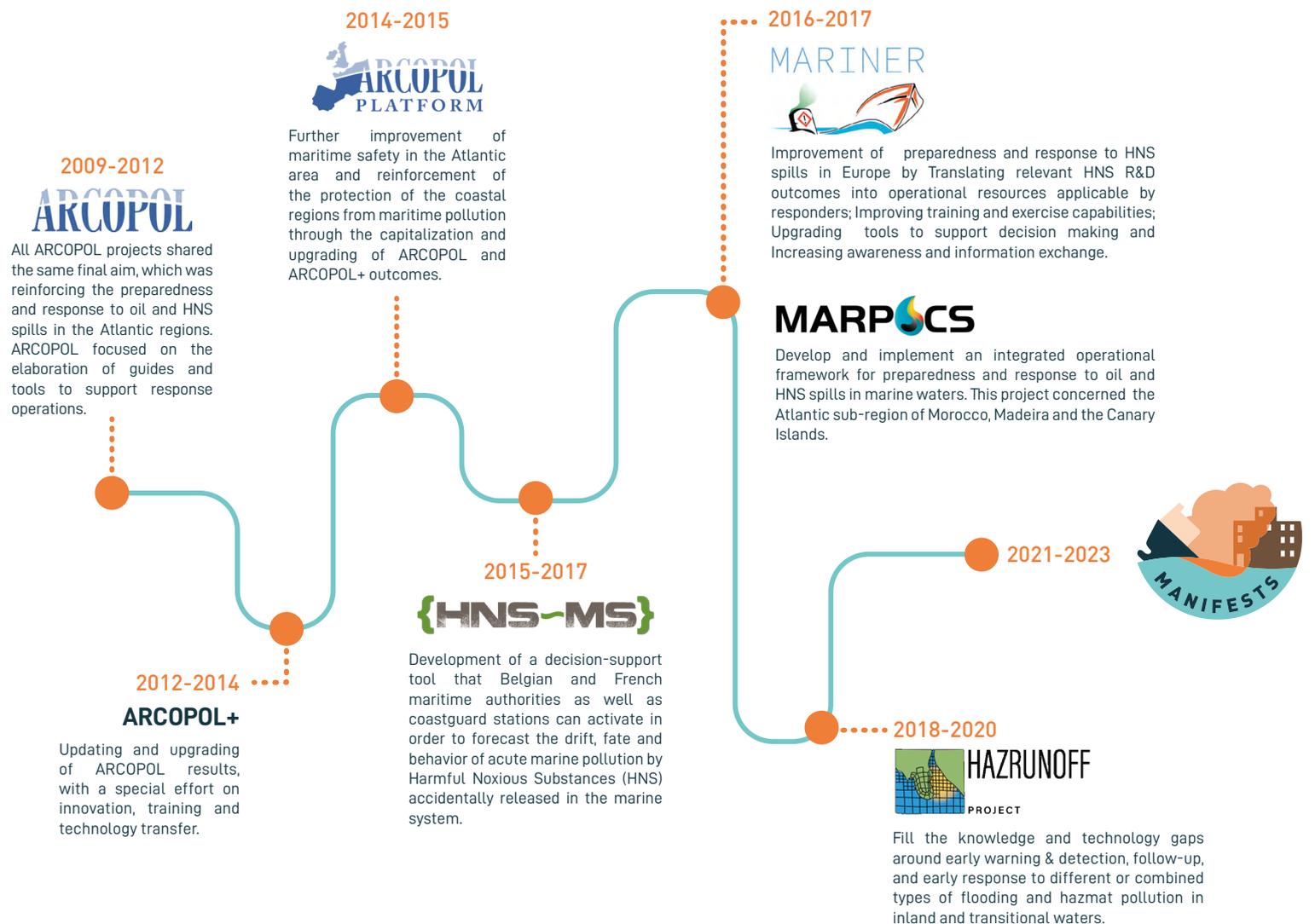
Co-funded by the European Union

## MANIFESTS in a nutshell

MANIFESTS aims to address gaps in current guidance for responding to accidental releases of volatile and gaseous HNS (Hazardous and Noxious Substances) at sea. Such releases can lead to the formation of gas clouds that are potentially toxic, flammable or explosive, posing risks to responders, nearby populations and the environment. The project's objective is to enhance the capabilities of marine pollution responders by developing innovative decision support and training tools, operational guidelines, and improving access to relevant knowledge and databases.

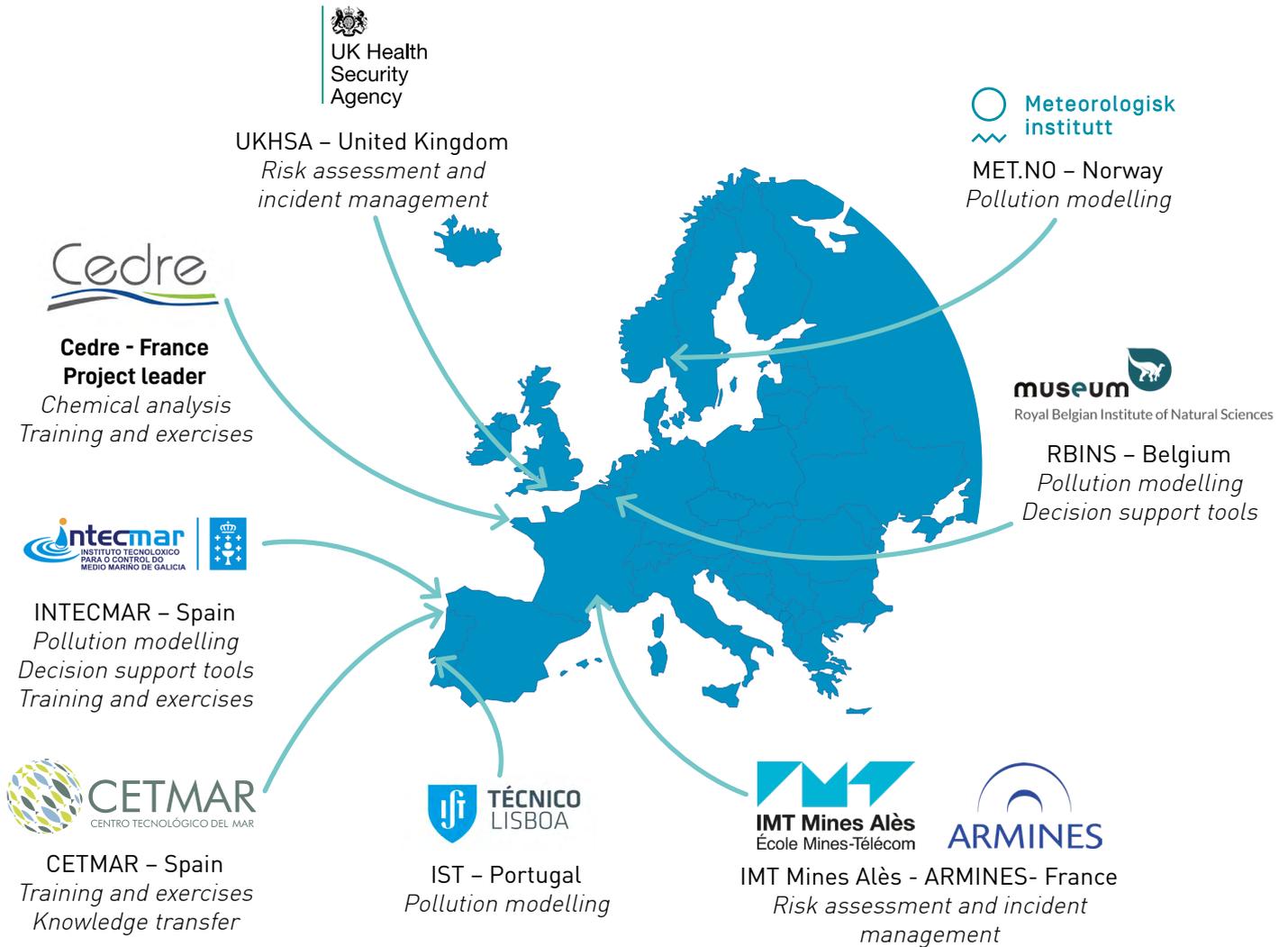
MANIFESTS ran from January 2021 to April 2023. This document highlights the project outputs available publicly. To learn more about the project please visit the [project website](#).

## History of past projects on HNS



## Partnership

The MANIFESTS partnership involves 9 institutes and administrations from 6 countries with strong and complementary expertise in the field of marine pollution.



The MANIFESTS Consortium is also sincerely grateful for the valuable benefits derived from the in-kind contribution of an Advisory Board. This board consists of six national maritime authorities who serve as the primary end-users of the project results.



France  
French navy - CEPPOL



Belgium  
Federal Public Service – Health, Food Chain Safety and Environment (DG-ENV)



Norway  
Norwegian Coastal Administration



Portugal  
General Directorate of Maritime Authority – Marine Pollution Response Directorate (DGAM)



Spain  
General Directorate of the Merchant Marine (DGMM)



United Kingdom  
Maritime Coast guard Agency (MCA)



## Project outputs

### Experimental data on evaporation, fire and explosion



#### Evaporation

The mechanisms involved in the evaporation of a chemical spill on the surface of water were investigated using a wind tunnel. This new experimental tool allowed to study the impact of wind speed on the evaporation process of volatile organic products and to assess the corresponding evaporation rates. [See the results here.](#)

#### Fire

The radiative heat flux represents the amount of energy emitted by flames that cause burns. Experimental measurements were conducted to determine the radiative heat fluxes at various distances from a 80 cm diameter vegetable oil fire. Ten different vegetable oils were tested, revealing significant underestimation of the experimental values by existing models.

## Explosion

Measurements were conducted to determine the air overpressures resulting from the explosion of a mixture of propane and oxygen. These air overpressures highlight the sudden increase of the ambient pressure, posing serious risks to people, structures, and buildings. The experimental data demonstrated excellent alignment with theoretical models. These tests highlight the necessity of establishing safety margins to safeguard response services and vulnerable populations.



## Field trial, Table-top and Port exercises



### Field trial

Cedre and the French Navy's CEPPOL conducted a sea trial to test new sensors for detecting gas clouds. The Belgian Coast Guard and the French Customs were involved in this international test. The trial included the evaluation of the SIMAGAZ and SIGIS 2 multispectral IR cameras from ONERA and the Belgian Civil protection. Drift models were compared by monitoring a vegetable oil slick's movement using drifting buoys and aerial observations. Additionally, processing infrared images of chemical spills allowed to validate the evaporation model.

### Table-top exercise

INTECMAR and CETMAR conducted a table-top exercise based on a real incident that occurred in Galicia in 2019 when the chemical tanker "Blue Star" ran aground on the rocks. For the exercise, the real scenario was modified to address the situation of a ship carrying a load of Xylene that generates a toxic cloud. The main objective of the exercise was to identify the best operations that could be carried out by all incident response teams involved. The participation of all competent institutions allowed to have a global analysis of the response given by each group and the high number of contingency plans involved in the exercise was a good opportunity to assess the interaction between at-sea and land-based responses.

### Port exercise

In the event of a maritime or port incident involving HNS, authorities in charge of contingency planning must take numerous decisions to organise the best response strategy. In such a rapidly changing situation, an efficient exchange of information between competent decision-making authorities and response teams on the ground can greatly facilitate both decision-making and organisational processes. INTECMAR developed the Common Operational Picture (COP) tool integrated in the MANIFESTS Decision Support System (DSS) to facilitate the sharing of useful information with response teams deployed at sea, in the air or on the shoreline. To test the utility of the COPTool, an exercise was carried out in Punta Langosteira in collaboration with the Coruña Port Authority and REPSOL PETROLEO S.A. The exercise simulated a 2 m<sup>3</sup> Maya crude oil spill that produced a toxic cloud of hydrogen sulfide (H<sub>2</sub>S).

The possibility of centralising all kinds of information in the COPTool in a quick and easy way and customising the access to information according to the needs and role of the user makes the tool useful for all responders.

## Tools developed

### Update of the Chemical database HNS-MS

Ecotoxicity	
Lowest median lethal concentration (LC50) on algae	3.64 [mg/l]
Lowest median lethal concentration (LC50) on crustacean	0.5 [mg/l]
Lowest median lethal concentration (LC50) on fishes	5 [mg/l]
Highest no observed effect concentration (NOEC) on algae	1.77 [mg/l]
Highest no observed effect concentration (NOEC) on crustacean	0.51 [mg/l]
Highest no observed effect concentration (NOEC) on fishes	1.99 [mg/l]
Assessment factor (AF)	100 on the short term 100 on the long term
Predicted No Effect Concentration (PNEC)	36.4 [µg/l] on the short term 5.1 [µg/l] on the long term

Hazards	
 Warning	

The HNS database was updated in the framework of the project and now contains more than 600 chemicals with more than 100 parameters by chemical. All chemicals are from the MIDSIS-TROCS database (from REMPEC) and from the HNS-MS database (from Cedre). It is accessible to any user looking to retrieve data for a chemical or can be accessed from an API.

### Guidance on sheltering or evacuation



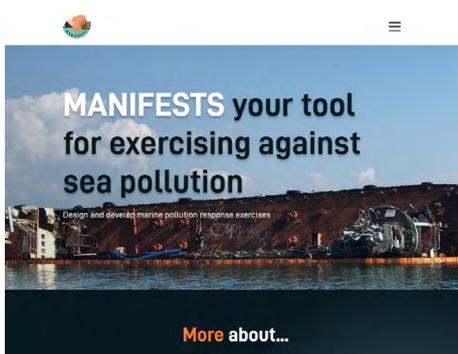
Incidents involving release of gases or volatile chemicals can produce clouds that can quickly travel and pose risks across a wide area. It is therefore important to consider actions to protect communities. Evidence-based guidance has been developed to aid planners and responders in decision-making for protection of the public in the immediate aftermath of such an incident. The guidance comprises a comprehensive report detailing decision-making factors and approaches, together with a field guide for use in training and response. Both can be downloaded from the project website. The guidance was trialled with a training exercise for response stakeholders in 2023 with very positive feedback.

### The MARINER-MANIFESTS Knowledge tool



The MARINER-MANIFESTS Knowledge Tool is an online repository that includes a comprehensive compilation of marine research and technical resources focused on the preparedness and response to HNS spills. This database was developed in the framework of the MARINER project and it was updated and improved during the MANIFESTS project to address specifically knowledge related with gaseous and volatile substances, and to compile information on marine pollution exercising, to facilitate access to this knowledge to marine pollution responders. The database currently stores information about 130 European and national projects, and 70 organisations working in the field of maritime pollution and 741 resources extracted from these projects and organisations. Resources (including exercising) were analysed and classified according to 12 areas of knowledge.

### The MANIFESTS Exercise Package



The MANIFESTS Exercise package has been developed by CETMAR in collaboration with INTECMAR and with the technical advice of the Spanish Centre of Maritime Safety Jovellanos (part of the Spanish Maritime Safety and Rescue Service, SASEMAR). The objective is to strengthen training and exercise capacities of response organisations by providing knowledge, guidance and resources to prepare, develop and evaluate marine pollution response exercises. It also facilitates scheduling exercise programmes, and enables replication of exercises and standardisation of all the documentation produced during exercises.

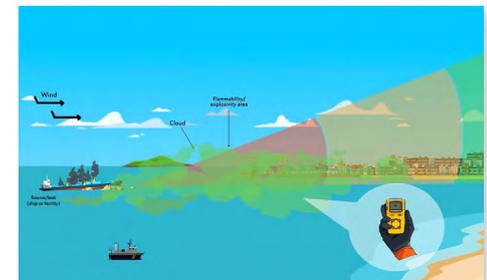
The exercise package consists of four functionalities: 1) Basic principles, 2) Exercises database that stores documentation of more than 150 exercises of various levels of complexity, types and geographical scope, and also guides, manuals and other support documentation (linked with the MARINER-MANIFESTS Knowledge Tool), 3) Agenda to schedule a programme of exercises and, for each exercise, milestones and email alerts, and 4) Exercise Tool to guide users in the formulation of their own exercises.

### Niovelius Serious Game



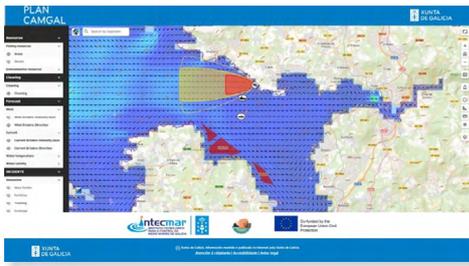
The Niovelius serious game was designed to assist crisis managers in effectively handling accidental HNS pollution incidents. By immersing trainees in a team of investigators specialised in combating pollu-criminals who commit severe crimes against marine waters and ecosystems, the game aims to foster an understanding of the complex challenges associated with pollutants released into the marine environment. Additionally, it provides an opportunity to acquire comprehensive knowledge of crisis management through collaborative work. Niovelius is an innovative hybrid game that combines physical elements and a digital application, enabling diverse learning approaches and promoting an engaging and playful experience.

### Video on HNS spills



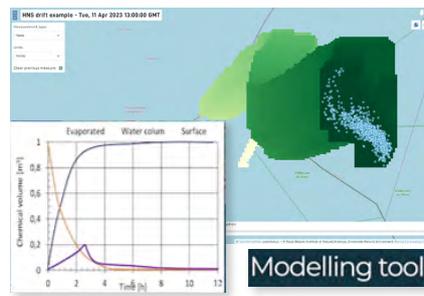
This video highlights some of the most important aspects to consider when dealing with an episode of accidental marine pollution by gaseous substances.

## COPtool

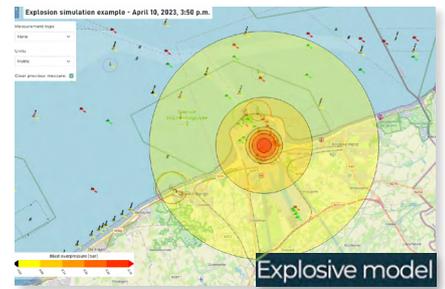


Taking advantage of the experience gained and the development carried out during the previous HNS-MS and MARINER projects, the MANIFESTS-DSS will integrate several services, including the COPtool and a COP Viewer. The MANIFESTS-DSS is a system designed to exchange information between maritime authorities and response teams (sea, shoreline, air) in the event of a marine pollution incident. It ensures that all stakeholders involved in the crisis centre and response teams have access to the same data, enabling them to carry out the response as efficiently as possible.

## Modelling modules



The OSERIT (Oil Spill Evaluation and Response Integrated Tool) can forecast the drift of pollutants at sea. Significant improvements have been made to the model, including the addition of modules to assess fire and explosion risks, along with an atmospheric dispersion module that enhances the accuracy of evaporation process simulations. These new modules were validated against experimental tests and a sea trial. The model can be used in the event of oil or HNS accidents to estimate pollution trajectory and provide fundamental insights into its behaviour and fate at sea.



The service offers 5 types of modelling:

1. Fire
2. Explosion
3. Drifting object or person
4. Drifting oil slick
5. HNS released at sea



## List of deliverables

### WORK PACKAGE 2

- D2.1 - Literature survey on past accidents
- D2.3 - Enhancing knowledge and data on gases and evaporators

### WORK PACKAGE 3

- D3.1 - Literature review on incidents and pollutants behaviour
- D3.2 - Guidance for protecting communities from maritime incidents involving airborne pollutants
- D3.3 - MANIFESTS sea trial: catalogue of sensors and their HNS detection capacity
- D3.4 - Desktop exercise "Blue Star"
- D3.5 - Port exercise report: Sharing information through the MANIFESTS COPtool
- D3.7 - MANIFESTS Exercise Tool

### WORK PACKAGE 4

- D4.1 - Explosive and fire risk module
- D4.2 - Improving the prediction of HNS concentration in the atmosphere
- D4.3 - Model intercomparison
- D4.4 - Model validation

### WORK PACKAGE 5

- D5.1 - MANIFESTS DSS: Implementation reports
- D5.2 - MANIFESTS DSS: Installation guides
- D5.3 - MANIFESTS DSS: User guides
- D5.4 - MANIFESTS DSS: Proof of concept

### WORK PACKAGE 6

- D6.1 - Communication and capitalisation plan
- D6.2 - Poster
- D6.2 - Leaflet
- D6.4 - Serious game: Proof of concept
- D6.6 - Upgrading the HNS Knowledge Tool

## Presentation video



### ACKNOWLEDGEMENT

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