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DIRECTORATE GENERAL FOR  
ENVIRONMENTAL QUALITY AND ASSESSMENT

# ENVIRONMENTAL LIABILITY INFORMATION SYSTEM (SIRMA)

## USER'S GUIDE



TECHNICAL COMMISSION OF PREVENTION AND REMEDIATION OF  
ENVIRONMENTAL DAMAGES



## INDEX

1.	INTRODUCTION.....	1
2.	STRUCTURE OF THE USER'S GUIDE.....	4
3.	GENERAL CONTEXT AND FUNCTIONALITIES OF SIRMA .....	6
	<b>PART I.....</b>	<b>10</b>
4.	ACCESS TO SIRMA.....	10
5.	SIRMA BROWSER .....	12
6.	MY PROFILE FUNCIONALITIES .....	14
6.1.	Edit Personal Data.....	14
6.2.	Change Password .....	14
6.3.	Cancel account.....	15
7.	INFORMATION AND DOCUMENTS AVAILABLE IN SIRMA.....	16
	<b>PART II.....</b>	<b>18</b>
8.	CREATION OF ARM-IDM-MORA GLOBAL PROJECTS.....	18
8.1.	Access to ARM-IDM-MORA Global Projects.....	18
8.2.	General functionalities of ARM-IDM-MORA Global Projects .....	19
8.2.1.	Navigation panel –project management and consultation .....	19
8.3.	Conduct a new ARM-IDM-MORA Global Project.....	22
8.3.1.	Registration of ARM, IDM and MORA Reports. ....	25
8.3.2.	Importing data between the ARM, IDM and MORA modules in Global Projects ....	27
8.3.3.	Completion of the ARM-IDM-MORA Global Project.....	28
9.	ENVIRNOMENTAL RISK ANALYSIS (ARM) MODULE.....	29
9.1.	Theoretical Principles .....	29
9.2.	Access to the ARM Module .....	31
9.3.	ARM Module General Funcionalities.....	32
9.3.1.	Navigation Panel – Reports Management.....	32
9.3.2.	Report Tools .....	35
9.4.	Create a new report.....	36
9.4.1.	Sources of danger .....	37

9.4.2. Basic events .....	38
9.4.3. Initiating events of the basic event .....	42
9.4.4. Conditioning factors data.....	45
9.4.5. Accident scenarios generation .....	49
9.4.6. Report completion.....	51
9.5. User's bibliographical sources .....	51
9.5.1. Registration of bibliographic sources .....	54
9.5.2. Diagram for browsing bibliographic sources entered by the user .....	56
9.5.3. Introduction of sources of danger.....	56
9.5.3.1. Category of source of danger .....	56
9.5.3.2. Sources of danger .....	58
9.5.3.3. Basic events.....	60
9.5.3.4. Initiating events .....	67
9.5.4. Introduction of conditioning factors .....	69
9.5.4.1. Category of conditioning factors.....	69
9.5.4.2. Conditioning factors .....	71
9.6. Prevention and avoidance measures.....	73
9.6.1. Rationale and Methodology of P&A Measurement Functionality .....	73
9.6.2. Access to P&A Measurement Feature .....	75
9.6.3. Prevention and Avoidance Measure .....	75
9.6.4. P&A Measures Budget.....	79
9.6.5. Printable report.....	80
9.7. Prevention and avoidance measures bibliographic sources .....	82
9.7.1. Prevention and avoidance measures bibliographic source registration .....	82
9.7.2. Introduction of prevention and avoidance measures .....	83
10. IDM MODULE .....	87
10.1. Principles and basic information.....	87
10.1.1. Theoretical Principles .....	87
10.1.2. Input parameters .....	94
10.1.3. IDM in the context of the Standard UNE 150008 .....	94

10.1.4. Precautions in the Application of the Environmental Damage Index .....	96
10.2. Access to the IDM Module.....	97
10.3. Create a New Report .....	98
10.3.1. General operation.....	98
10.3.2. General Data Report IDM .....	98
10.3.3. Consultation of scenarios included in the IDM report .....	99
10.3.4. Entry data of Scenario .....	100
10.3.4.1. Scenario general data .....	100
10.3.4.2. Damaging agents .....	102
10.3.4.3. Resources Affected by Each Agent .....	105
10.3.4.4. Parameters for the IDM Estimation.....	109
10.3.4.5. Access Cost Estimation .....	110
10.3.4.6. IDM of an scenario .....	111
10.3.5. Creating new scenarios .....	111
10.3.6. Completing the report.....	112
10.3.7. Export to Excel .....	113
10.3.8. Export to PDF .....	114
10.4. Reports repository .....	115
10.5. FAQs on the IDM Module.....	116
11. MODULE OF DAMAGE ECONOMIC EVALUATION (MORA).....	119
11.1. MORA rationale and methodology .....	119
11.2. Access to the MORA module .....	119
11.3. Creating a New MORA Report.....	121
11.3.1. General operation.....	121
11.3.2. General data Report.....	121
11.3.3. Damage location.....	122
11.3.4. Selection of agents and resources.....	125
11.3.4.1. Selection of agents .....	125
11.3.4.2. Resources affected by the agent .....	126
11.3.5. Agent-resource Combination: Damage Data.....	135

11.3.6. Evaluation of the environmental damage .....	139
11.3.7. Road construction budget.....	150
11.3.8. Financial Security.....	151
11.3.9. Final report.....	152
11.4. Reports Repository .....	154
11.5. Frequently asked questions on the MORA module.....	156
12. TRANSPORT MODULE .....	163
12.1. Transport Module Rationale and Methodology.....	163
12.2. Access to the transport module .....	163
12.3. Event trees .....	165
12.3.1. Constructing an event tree and estimating probabilities.....	165
12.3.1.1. Estimation of the probability of the initiating event .....	166
12.3.1.2. Conditioning factors of the outcome .....	172
12.3.1.3. Accident scenarios (ACCORDING TO outcome and action of conditioning factors).....	174
12.4. Printable report.....	178
13. GEOGRAPHIC VIEWER.....	183
13.1. Description and Basics of the Geographic Viewer .....	183
13.2. Access to the Geographic Viewer .....	183
13.3. Geographic Viewer User Guide .....	185
14. BIBLIOGRAFHY .....	186

## **ANNEXES**

**ANNEX I:** Bibliographical References - ARM Probabilities

**ANNEX II:** Clarifications on the affected natural resource - damaging agent groups in the IDM module.

**ANNEX III:** Description of the modifiers of the IDM equation.

**ANNEX IV:** Application of the different calculation modules (ARM-IDM-MORA) in a practical example.

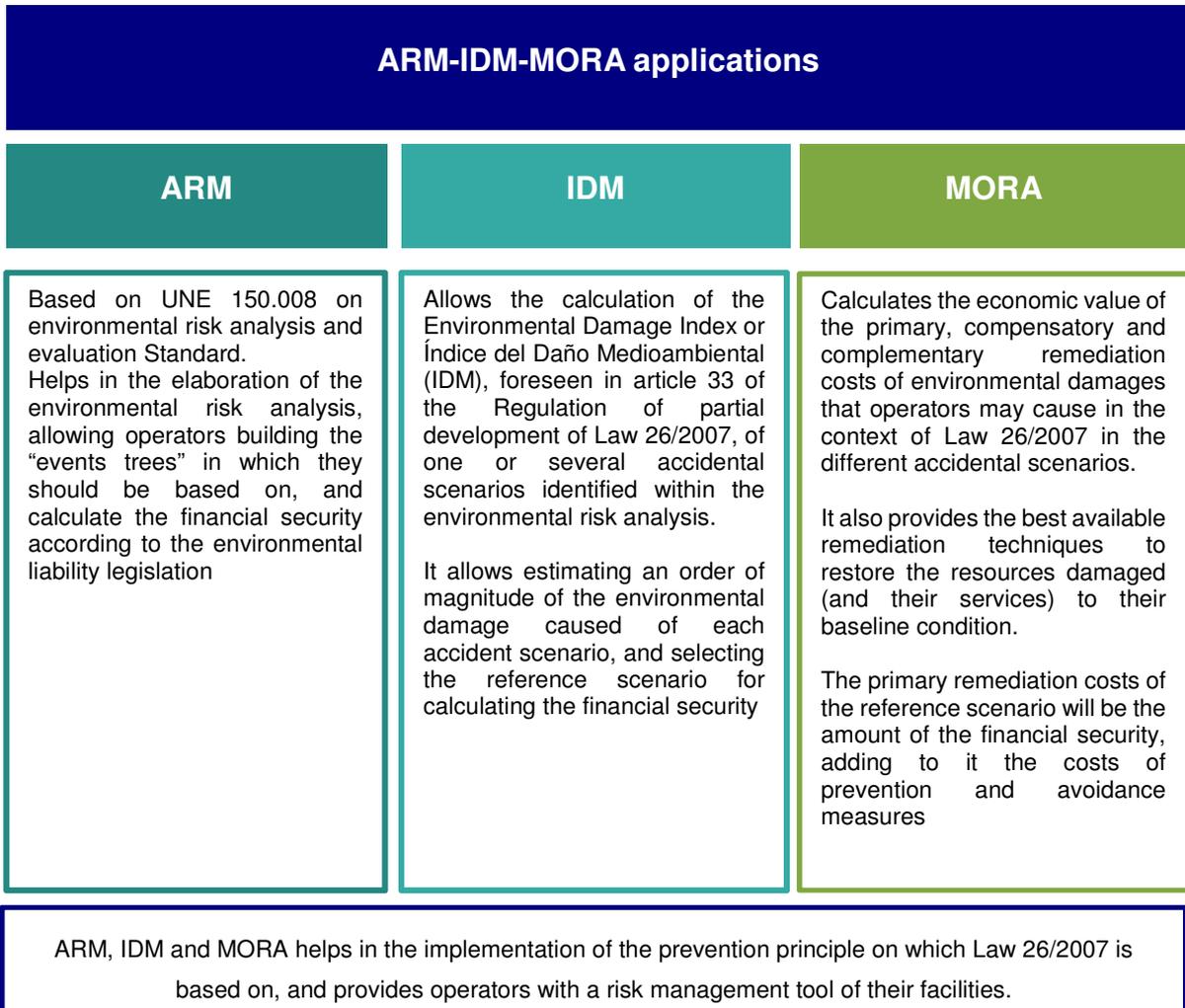


## 1. INTRODUCTION

This User's Guide describes how the Environmental Liability Information System (SIRMA) Works. It includes on the one hand the ARM-IDM-MORA modules, that have been developed by the Ministry for the Ecological Transition and the Demographic Challenge (MITERD) to help operators fulfil their obligations as established in the environmental liability legislation. And on the other hand, SIRMA includes all the information and documents drafted for helping in the implementation of the normative.

More specifically, the application includes three functional, autonomous and clearly-differentiated modules which, if desired, may be used jointly through the Global Projects functionality:

- I. **ARM module.** This module helps in the elaboration of the environmental risk analysis (ARM for its acronym in Spanish), allowing operators building the "events trees" in which they should be based on, as established in the UNE 150.008:2008 on environmental risk analysis and evaluation Standard.
- II. **IDM module.** This module allows the calculation of the Environmental Damage Index (IDM for its acronym in Spanish), foreseen in article 33 of the Regulation of partial development of Law 26/2007, of one or several accidental scenarios identified within the environmental risk analysis.
- III. **MORA module.** This module calculates the economic value of the environmental damages that operators may cause in the context of Law 26/2007 in the different accidental scenarios, using the Environmental Liability Supply Model (MORA for its acronym in Spanish) methodology.



**Figure 1-1.** Modules in the ARM-IDM-MORA tool and basic functionalities. Source: Prepared by the authors.

In addition to the three modules described, from April 2023 SIRMA will include a computer module that supports the calculation of probabilities of accident scenarios in connection with the Model Environmental Risk Report Template (MIRAT according to its initials in Spanish) for road freight transport activities.

In January 2024, a geographic viewer was integrated into the system, providing a series of general and specific reports with thematic information on the application of environmental liability legislation in Spain.

Moreover hand, SIRMA includes different reports drafted by the Ministry for the Ecological Transition and the Demographic Challenge that describe the methodology behind the three modules. Therefore, this user’s guide focuses on the description of the software tools developed. In this sense it is recommended to read those documents, specially:

- a) The environmental liability legislation, in order to understand the framework in which the ARM, IDM and MORA tools have been developed.
- b) The examples of sectoral environmental risk analysis developed by the Ministry for the Ecological Transition and the Demographic Challenge for different industrial sectors, and the individual environmental risk analysis.
- c) UNE 150.008:2008 Standard for the environmental damage risk analysis and evaluation.
- d) Annex III of the Regulation that develops Law 26/2007, where IDM procedure is established.
- e) MORA methodological document

## 2. STRUCTURE OF THE USER'S GUIDE

This User's guide includes the instructions to use SIRMA, and is divided into three parts:

**Part I:** Includes sections 4 to 7 and describes the information on how SIRMA works as well as how to access it, the navigator and the functionalities of the user's profile. This part is structured as follows:

- 1) A description of the screens that give access to the tools and the navigation menu of SIRMA. This is covered in sections 4 and 5.
- 2) A description of the options offered by the tool to manage the information on the profile of the user (personal information, password, etc.). This is covered in section 6.
- 3) A description of the sections on the information and documents related with the environmental liability legislation available. This is described in section 7 of this user's guide.

**Part II:** includes a section specifically focused on setting out how the tool works to create Global Projects ARM-IDM-MORA, section 8, which links to the description of the functionalities of each module, specifically the explanation of how the ARM module works is in section 9, that concerning the calculation of the IDM is covered in section 10; and a last section focuses on the MORA calculation module, section 11. The Guide has sought to make these sections - sections 9, 10 and 11 - self-explanatory so that users who require only one module need not consult the instructions for the rest of them. However, to ensure the user's knowledge is as full as possible, it is recommendable to read the entire Guide, which is essential if undertaking a global Project.

Next, section 12 describes the functionality called the "Transport Module", which supports the use of the tool to calculate accident scenario probabilities associated with the Model Environmental Risk Report Template (MIRAT) for road freight transport activities.

Finally, section 13 shows how to access the geographic viewer associated with SIRMA.

The User's Guide includes also four annexes. The last (annex IV) includes a case study in which the whole ARM-IDM-MORA tool is applied to a hypothetical installation.

The User's Guide content and the specific heading in which it can be found is shown schematically in the following Visual.

Access to SIRMA	Section 4	PART I
SIRMA browser	Section 5	
User profile management functionalities	Section 6	
Information and documentation	Section 7	
ARM-IDM-MORA Global Project	Section 8	PART II
ARM calculation module	Section 9	
IDM calculation module	Section 10	
MORA calculation module	Section 11	
Transport module	Section 12	
Geographic viewer	Section 13	
ARM-IDM-MORA case study	Appendix IV	

**Figure 2-1.** Notable content of the User Guide. Source: Prepared by the authors.

### 3. GENERAL CONTEXT AND FUNCTIONALITIES OF SIRMA

SIRMA integrates all the information related to the environmental liability available at the Ministry for the Ecological Transition and the Demographic Challenge webpage, as well as the tools to help in the elaboration of the events trees, the calculation of the IDM and the economic evaluation of environmental damages. One of its main functionalities is helping operators to carry out the steps foreseen in article 33 of the Regulation of partial development of Law 26/2007, to determine the amount of the mandatory financial security.

As established in this article, operators under the obligation of having a mandatory financial security must follow this procedure starting from the environmental risk analysis:

- a) Identify the accidental scenarios of the facility and establish their probability of occurrence.
- b) Estimate the Environmental Damage Index (Índice de Daño Medioambiental, IDM) of each accidental scenario.
- c) Calculate the risk associated to each accidental scenario as the product of the probability of occurrence and the IDM.
- d) Select the scenarios with the lowest IDM that includes 95% of the total risk.
- e) Establish the amount of the financial security as the value of the environmental damage with the highest IDM among the risk scenarios selected, following these steps:
  - 1) Firstly, the environmental damage caused by the scenario selected will be quantified in terms of extension, intensity and temporal scale.
  - 2) Secondly, the environmental damage caused by that reference scenario will be calculated as the cost of the primary remediation project.

In case the primary remediation of this reference scenario consists fully on natural remediation, the amount of financial security will be the environmental damage caused by the risk scenarios with the highest IDM having a primary remediation other than natural remediation.

Once this amount is calculated it is necessary to add to it the prevention and avoidance costs, having the operator two options:

- a) Apply a percentage on the total amount of the financial security.
- b) Estimate them in the environmental risk analysis.

In any case, these prevention and avoidance costs will be as a minimum 10% of the financial security calculated according to the previous steps.

SIRMA provides assistance to operators on the following aspects:

- I. Identify the risk sources, basic events, initiating events and the accident scenarios of their facilities, as well as the establishment of the probability of occurrence associated to each of them (ARM module).
- II. Estimate the Environmental Damage Index (IDM) of each risk scenario following the steps of annex III of the Regulation of partial development of Law 26/2007. In the case of a global Project, some of this data will come directly pre-uploaded from the ARM Module.
- III. Calculate the risk associated to each scenario and select the reference scenario for the determination of the financial security (IDM module). It is necessary to clarify that the probability of each scenario must be provided by the operator, using the results of the environmental risk analysis.
- IV. Calculating the value of the environmental damage of the reference scenario. Specifically, the operator may use the MORA module to calculate the financial value of the environmental damage associated with the reference scenario for establishing the financial security. Using the MORA module requires a series of input data that, in general, must be gathered in the operator's environmental risk analysis - quantification of damage, mainly. Based on this data, the module estimates the cost of the primary, compensatory and, where appropriate, complementary repair of the damage set out in the benchmark accident scenario. Note that the IDM module is disconnected from the MORA module, therefore, to financially assess a scenario it is not necessary to make a prior calculation of the IDM and select the reference scenario in the framework of ARM-IDM-MORA; this process may be done externally to the application, if desired.
- V. Calculating the amount of the financial security using the screen enabled in the MORA module for this purpose.

The following figure shows the main functionalities of SIRMA in relation to the obligations established in article 33 of the Regulation that develops Law 26/2007.

Heading of article 33 of the Regulation partially implementing Law 26/2007, of 23 October, on Environmental Responsibility.	SIRMA data source or assistance module
Identify the accident scenarios for the installation and establish the probability of occurrence of each of them.	ARM module
Estimate an environmental damage index (IDM) associated with each accidental scenario following the steps set out in Annex III of the Regulation.	IDM module
Calculate the risk associated with each accidental scenario as the product of the scenario's probability of occurrence and the environmental damage index.	
Select scenarios with the lowest rate of associated environmental damage that pool 95 per cent of the total risk.	
Set the amount of the financial guarantee as the value of the environmental damage of the scenario with the highest IDM among the selected accidental scenarios:	IDM, Environmental risk analysis and MORA
First, the environmental damage generated in the selected scenario will be quantified in terms of extent, intensity and time scale.	Environmental risk analysis
Second, the environmental damage generated in such a baseline scenario will be monetised, the value of which will be equal to the cost of the primary repair project.	MORA module
Once the amount of the compulsory financial guarantee has been calculated, the costs of damage prevention and avoidance must be added to the amount of the compulsory financial guarantee.	

**Figure 3-1.** Modules included in SIRMA and basic functionalities. Source: Prepared by the authors.

SIRMA provides other additional functionalities to operators it is worth mentioning:

- I. The documents included in the tool allow obtaining information regarding the environmental liability legislation. It also offers guidance on the implementation and current developments on the legislation in Spain.
- II. Risk management. Operators can use the results of the ARM module to identify elements with a high risk due to a high probability of occurrence or the magnitude of the agent involved in an incident. With this information, for example, the operator can decide to change certain equipment for other with lower failure probability, substitute certain substances for other less pollutant, etc to reduce the probability of occurrence and/or the risk.  
On the other hand, the IDM module can be used as an estimator of the magnitude of the environmental damages linked to each risk scenario. Using it with the probability of occurrence of each scenario (ARM module) the operator can make risk management decisions.
- III. Using the MORA module to evaluate incidents that already happened, to help in the design of the remediation project, with the adaptations needed for each case.

SIRMA provides a specific module for calculating the probability of accident scenarios related to road freight transport and a geographic viewer in addition to the utilities described above, mainly associated with the ARM, IDM and MORA modules. The transport module is based on the methodology developed by MITERD in the sector MIRAT: Road freight transport activities and helps users to calculate accident probabilities. The geographic viewer includes the cartography related to the different natural resources protected by the LRM. It also includes topic-specific information related to the application of environmental liability legislation in Spain.

SIRMA is available in Spanish and English.

## PART I

### 4. ACCESS TO SIRMA

The Access to SIRMA is through this link:

<https://servicio.mapa.gob.es/mora/login.action>

Figure 4.1 shows the welcome screen of the tool, in which the users:

- Can select the language (Spanish or English).
- The users that already have an account can access the tool introducing their email address and password and clicking on “Enter”.
- The users that already have an account and have forgotten their password can receive a new one clicking on “Did you forgot your password?”.
- The new users can create a new account by clicking on “Create a new account” and filling the form of Figure 4.2.



Figure 4-1. SIRMA access screen. Source: SIRMA.

The screenshot shows the 'New operator account' registration page on the SIRMA website. The page header includes the Spanish government logo and the text 'COMISIÓN TÉCNICA DE PREVENCIÓN Y REPARACIÓN DE DAÑOS MEDIOAMBIENTALES'. The SIRMA logo is also present. The main content area is titled 'Sistema de Información de Responsabilidad Medioambiental (SIRMA)' and 'New operator account'. Below this, there is a form section labeled 'Operator data' with the following fields: 'Mail address', 'Name', 'Surnames', 'Company/Agency', 'Password', and 'Confirm Password'. Each field has a corresponding input box. Below the password fields, there is a security verification step: 'For security, enter the code that appears in the image below.' The image shows the code 'T 7 5 V H' in a stylized font. At the bottom right of the form, there are 'Save' and 'Cancel' buttons.

Figure 4-2. Create new account screen. Source: SIRMA.

## 5. SIRMA BROWSER

Once the application is accessed, the main screen is common to all system functionalities:

- Information Law 26/2007
- ARM-IDM-MORA computer applications:
  - ARM-IDM-MORA Global Project
  - ARM module.
  - IDM calculation module.
  - Economic damage assessment module (MORA)
- Geographic viewer
- Transport Module
- Tools for managing user profiles.

Colour coding has been used throughout the application to clearly identify each of these components. According to this code, the navy-blue colour identifies the documentation part of the application, as well as the geographic viewer and the transport module; the mustard colour represents the global projects; the aquamarine colour corresponds to the ARM module; the light blue colour corresponds to the IDM calculation module; the green colour corresponds to the MORA module; and the grey colour corresponds to the user profile management utilities. In this way, the colour of the header of each screen tells the user which module they are in. The logos representing each application are also displayed.

In the left side of the main screen, there is an interactive navigator that allows accessing each of the SIRMA functionalities.

As indicated above, the various calculation modules contained in SIRMA (ARM, IDM and MORA) can be accessed independently, so the user can choose to use the module or modules needed in each case. Besides this, the user can use the “Global Project” functionality to create projects that include the functionalities of the three modules sequentially, finally producing a complete report including all the steps required to conduct the Environmental Risk Analysis according to the regulations.



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**Comisión Técnica de Prevención y Reparación de Daños Medioambientales**

 Log out  


**Environmental Liability Information System (SIRMA)**

**Law 26/2007 Information**

- Legal Basis
- Risk Analysis >
- Financial Security
- Implementation reports and environmental liability enforcement >
- Publications
- FAQs

**ARM, IDM and MORA computer applications**

- Introduction and aim
- Global ARM-IDM-MORA Project >
- ARM Application >
- IDM Application >
- MORA Application >

**Geographic viewer**

- Description and access

**Transport Module**

- Description
- Event tree

My Profile >

## Welcome to the Environmental Liability Information System (SIRMA)

The Environmental Liability Information System (SIRMA) gathers all the information related to the Environmental Liability Law 26/2007, of 23 October, as well as access to all the documents, guides and tools developed to facilitate its implementation in Spain.

All these documents, guides and computer applications have been developed by the Directorate-General for Environmental Quality and Assessment of the Ministry for the Ecological Transition and the Demographic Challenge in its role as chair and secretariat of the Technical Commission for the Prevention and Remediation of Environmental Damages.

It also provides access to the Environmental Risk Analysis (ARM), Environmental Damage Index (IDM) and Environmental Liability Supply Model (MORA) computer applications, developed with the aim of helping all operators to carry out their environmental risk analysis and determine the amount of the mandatory financial security foreseen in Law 26/2007.

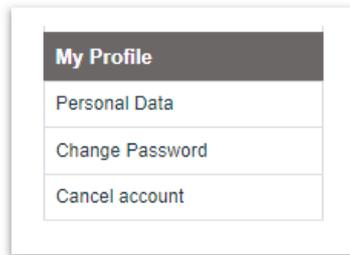

  


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 W3C  | Version 2.2.1

**Figure 5-1.** SIRMA Home screen. Source: SIRMA.

## 6. MY PROFILE FUNCIONALITIES

My profile functionalities are common to all the system and can be accessed under the section “My Profile” on the navigator.

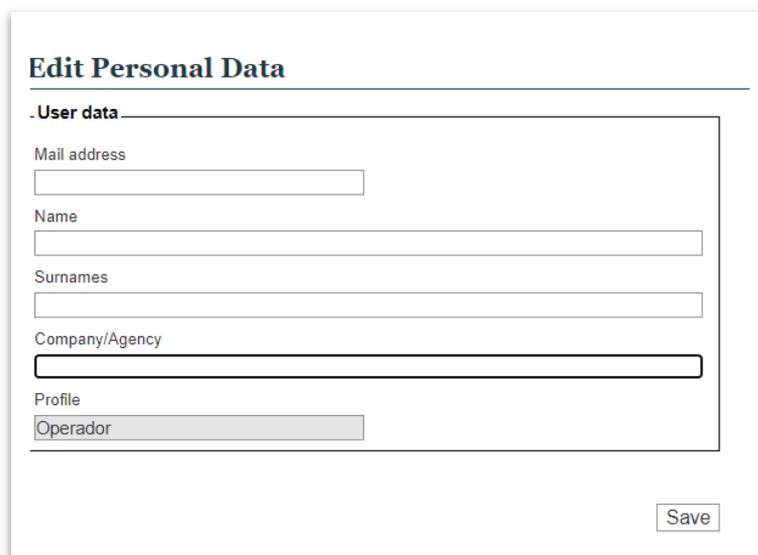


**Figure 6-1.** My Profile. Source: SIRMA.

The use of its different options is described below.

### 6.1. EDIT PERSONAL DATA

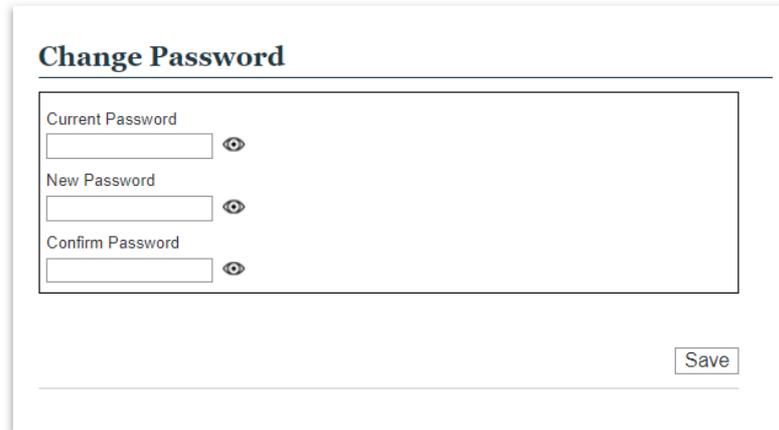
In the Personal Data screen it is possible to change the email account associated to SIRMA, change the name, surname and company/agency of the user.

A screenshot of the 'Edit Personal Data' form. The form is titled 'Edit Personal Data' and contains several input fields: 'Mail address', 'Name', 'Surnames', 'Company/Agency', and 'Profile'. The 'Profile' field is currently set to 'Operator'. A 'Save' button is located at the bottom right of the form.

**Figure 6.1-1.** Edit personal data screen. Source: SIRMA.

### 6.2. CHANGE PASSWORD

This screen allows changing the password used to access SIRMA.



**Change Password**

Current Password  

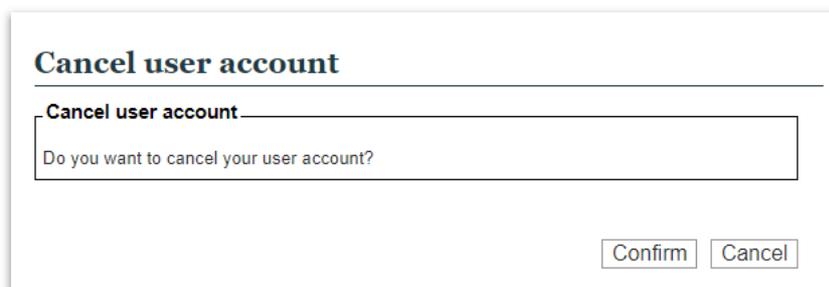
New Password  

Confirm Password  

**Figure 6.2-1.** Change Password screen. Source: SIRMA.

### 6.3. CANCEL ACCOUNT

It allows cancelling the SIRMA account. Once the account is cancelled, it will not be possible to reactivate it unless for the tool administrators.



**Cancel user account**

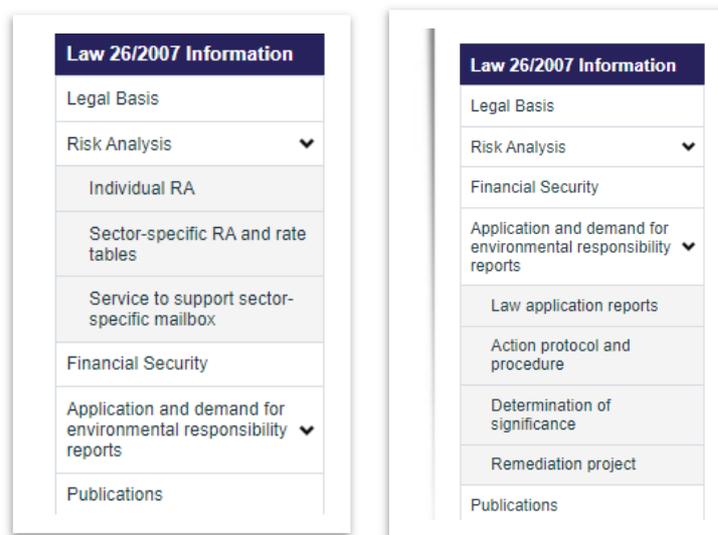
**Cancel user account**

Do you want to cancel your user account?

**Figure 6.3-1.** Cancel user account screen. Source: SIRMA.

## 7. INFORMATION AND DOCUMENTS AVAILABLE IN SIRMA

In the left-hand side of the screen navigator, it is available the information and documents available in SIRMA. It includes links to the different documents developed by the Ministry for the Ecological Transition and the Demographic Challenge related to the implementation of the environmental liability legislation.



**Figure 7-1.** Navigator: Law 26/2007 information. Source: SIRMA.

It includes five main sections:

- Legal Basis
- Risk Analysis
  1. *Individual risk analysis*
  2. *Sector-specific risk analysis and rate tables*
  3. *Service to support sector-specific mailbox*
- Financial Security.
- Application and demand for environmental responsibility reports. (Implementation reports and environmental liability requests)
- Publications.



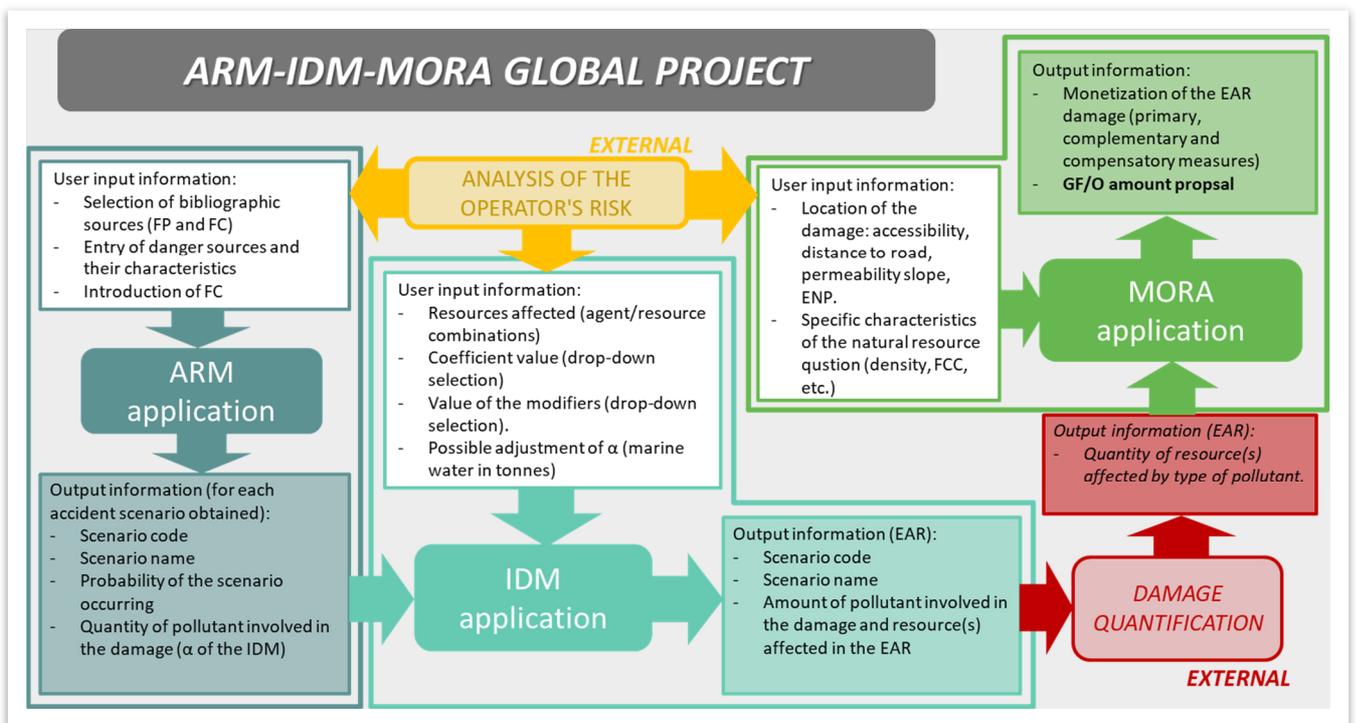
**Figure 7-2.** Environmental liability publications. Source: SIRMA.

## PART II

### 8. CREATION OF ARM-IDM-MORA GLOBAL PROJECTS

Since April 2022, the Environmental Liability Information System (SIRMA) offers the possibility of creating projects that incorporate the functionalities of the three modules in a chained and integrated manner. This functionality is called "Global Projects".

SIRMA users can use the "ARM-IDM-MORA Global Project" browser section to undertake complete projects that sequentially incorporate all the phases of the Environmental Risk Analysis that can be done in an assisted manner by the various modules that make up the software application. It is necessary at this point to recall that the quantification of the damage of the reference scenario (estimate of the extent, intensity and timescale) must be done externally to SIRMA.



**Figure 8-1.** Interconnection between ARM, IDM and MORA in the Global Projects. Source: SIRMA.

#### 8.1. ACCESS TO ARM-IDM-MORA GLOBAL PROJECTS

The Global Projects functionality must be accessed through the SIRMA browser. Specifically, through the buttons "Description," "Perform New Project," "Project history" of the heading "ARM-IDM-MORA Global Project" located under the documentary utilities of the tool.



Comisión Técnica de Prevención y Reparación de Daños Medioambientales



**Environmental Liability Information System (SIRMA)**  
Global ARM-IDM-MORA project - Description

**Law 26/2007 Information**

Legal Basis

Risk Analysis

Financial Security

Implementation reports and environmental liability enforcement

Publications

FAQs

**ARM, IDM and MORA computer applications**

Introduction and aim

**Global ARM-IDM-MORA Project**

ARM Application

IDM Application

MORA Application

**Geographic viewer**

Description and access

**Transport Module**

Description

Event tree

Query log

Administration

My Profile

### Description

The "Environmental Liability Information System" (SIRMA) allows the creation of a complete project that connects the functionalities of the "Environmental Risk Analysis" (ARM), the "Environmental Damage Index" (IDM) and the "Environmental Liability Supply Model" (MORA) software tools that assist operators and users in the application of Environmental Liability regulations.

This functionality has as a product the so-called "Global Projects" and contributes to integrate the most relevant results of the respective software applications in a single document. Through the "ARM-IDM-MORA Global Project" menu, SIRMA users have the option of developing projects that sequentially incorporate all the phases of the environmental risk analysis that can be carried out in an assisted manner through the ARM, IDM and MORA applications, with the quantification of the damage having to be estimated externally to SIRMA.

By creating a "Global Project", the tool will facilitate the incorporation of the information resulting from each of the applications that can serve as input data for the following phases of the analysis.

Example projects

In the table below, the project that accompanies the SIRMA user guide as an example is available. To consult the text of the project, just click on the "Example" icon. In addition, by clicking on the "Modify / See" icon, it is possible to consult all the necessary screens to carry it out and navigate through them.

Name	Completed	Example	Modify / See
Ejemplo - Instalación (X)	Yes		

Documentation

[User's guide](#)

[Annexes](#)

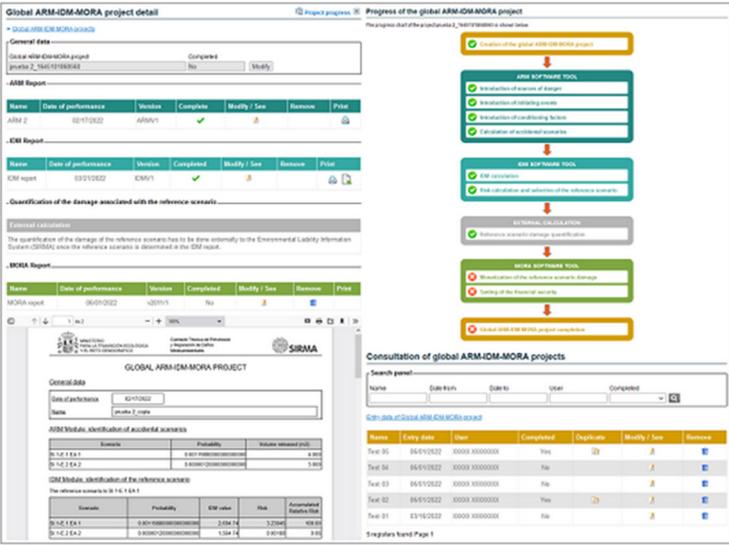


Figure 8.1-1. Access to ARM-IDM-MORA Global Projects - Description. Source: SIRMA.

## 8.2. GENERAL FUNCTIONALITIES OF ARM-IDM-MORA GLOBAL PROJECTS

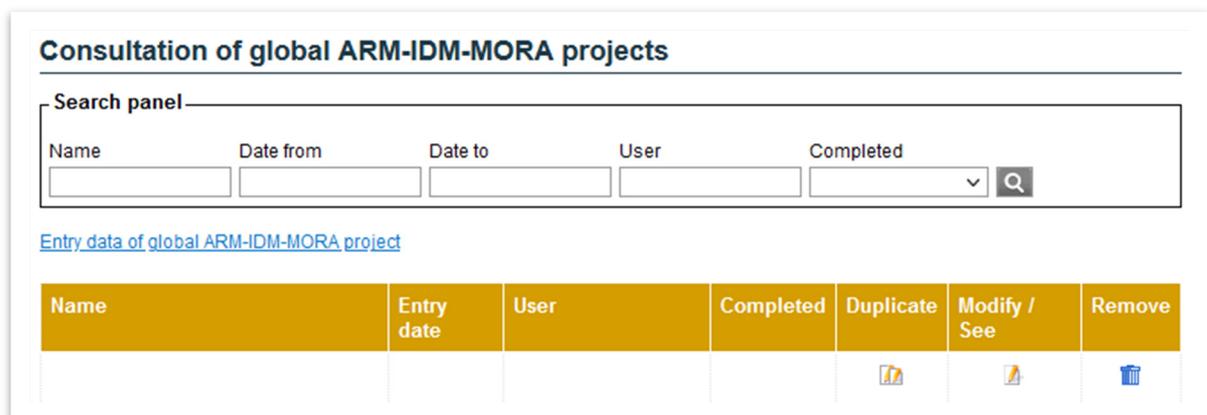
### 8.2.1. NAVIGATION PANEL –PROJECT MANAGEMENT AND CONSULTATION

The following actions are included in the ARM-IDM-MORA global projects navigation panel on the left of the screen:



**Figure 8.2.1-1.** ARM-IDM-MORA Global Project navigation panel. Source: SIRMA.

- **Description.** It includes a brief overview of the global project functionality. Besides this, it provides, through hyperlinks, the tool’s user manual in PDF format.
- **Create a New Project.** This link makes it possible to open a blank project.
- **Projects Repository.** Upon clicking on this function, the application opens the “**Consultation of global ARM-IDM-MORA projects**” screen, which collects all the reports a user has registered, and indicates through columns for each a series of merely informative data - in the first 4 columns -: the name assigned to the project, the execution date on which reporting began, the name of the user and whether or not it is finished. The remaining 4 columns include a number of functionalities that allow the following actions:

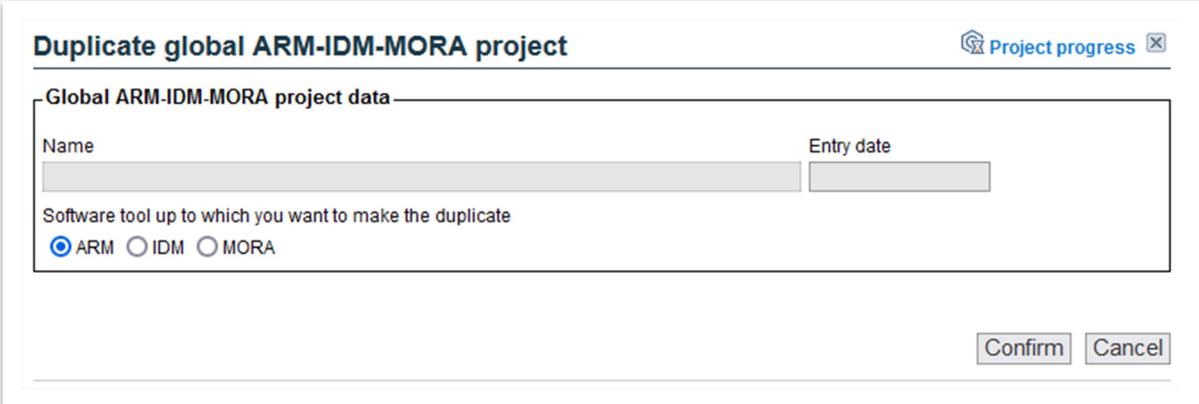


**Figure 8.2.1-2.** Report history – Consultation of global ARM-IDM-MORA projects. Functionalities. Source: SIRMA.

- **“Duplicate (📄).”** Once a global project is finished, the application allows you to create a copy of the project. Upon clicking on the double report icon, a screen will open a screen that indicates to what point in the report development the duplicate is to be made. Thus, if the “ARM” option is selected, a duplicate of the unfinished ARM portion of the project will be generated such that the data contained in this part of the project can be amended - neither the IDM nor the MORA reports will be duplicated. If you select “IDM” with the cursor, a duplicate of the project will be created with the completed ARM report and the incomplete IDM report such that

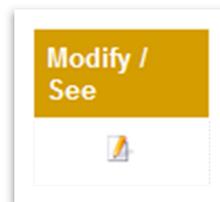
the data entered in the IDM report can be amended - the MORA report would not be duplicated in this case. Finally, if you choose the “MORA” option, the application will generate a duplicate of the global project with the completed ARM and IDM reports and the unfinished MORA report such that the data contained in the latter can be amended.

The application will assign the duplicated project the name of the original global project as well as a numerical code. The user can easily update this name using the “Modify” button.



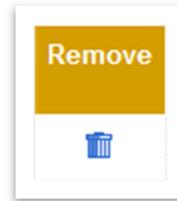
**Figure 8.2.1-3.** Screen to duplicate the project. Source: SIRMA.

- “**Modify/see** (📄).” This option allows you to access the project to configure or finish it if it has not been finished or view it if it has.



**Figure 8.2.1-4.** Icon for configuring or viewing the project. Source: SIRMA.

- “**Remove** (🗑️).” This column makes it possible to delete the projects you want to discard from the user’s profile using the “trash” icon. If you press this icon, the application will open a screen to confirm you want to delete this project. This screen includes the name of the project and the date the report was created.



**Figure 8.2.1-5.** Icon to remove the global project. Source: SIRMA.

The “Consult global projects ARM-IDM-MORA” screen also includes a search panel at the top that makes it easier for the user to browse this screen; it allows him/her to locate projects by their name, date of completion —“Date from” and “Date to”— and whether or not it is completed. Upon entering the desired parameters and pressing the “magnifying glass” icon, the application will return said user’s reports that meet the criteria entered (see Figure 8.2.1-2).

### 8.3. CONDUCT A NEW ARM-IDM-MORA GLOBAL PROJECT

Upon clicking “Create a New Project” in the section corresponding to the browser’s “ARM-IDM-MORA Global Project” section, a screen will open called “Global ARM-IDM-MORA project general data” where the user must enter the name he/she wants for the global project generated. Subsequently, each of the ARM, IDM and MORA reports of which it consists will request their own descriptive name.

This screen also includes, for information, the project’s creation date and the name of the user who generated it.

**Global ARM-IDM-MORA project general data**

Global ARM-IDM-MORA project data

Name

Entry date      User

Save    Cancel

**Figure 8.3-1.** General data of the ARM-IDM-MORA global project. Source: SIRMA.

Upon pressing the “Save” button, the application will generate the new project, showing the “Global ARM-IDM-MORA project detail” screen.

### Global ARM-IDM-MORA project detail Project progress ✕

[Global ARM-IDM-MORA projects](#)

**General data**

Global ARM-IDM-MORA project Completed

Users guide

**- ERA Report**

[Entry data of ERA Report](#)

Name	Date of performance	Version	Complete	Modify / See	Remove	Print
There are no records to show.						

**- IDM Report**

Name	Date of performance	Version	Completed	Modify / See	Remove	Print
There are no records to show.						

**- Quantification of the damage associated with the reference scenario**

External calculation

The quantification of the damage of the reference scenario has to be done externally to the Environmental Liability Information System (SIRMA) once the reference scenario is determined in the IDM report.

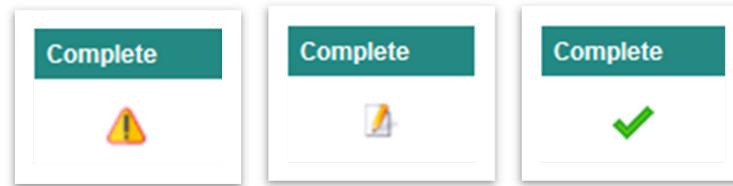
**- MORA Report**

Name	Date of performance	Version	Completed	Modify / See	Remove	Print
There are no records to show.						

**Figure 8.3-2.** Detail of the ARM-IDM-MORA global project. Source: SIRMA

This screen contains the “Project general data” - a name that has been assigned to said project, whether or not it is finished and a “Modify” button that will allow you to change the project’s name whenever it is not completed; besides this, the tables corresponding to each of the ARM, IDM and MORA modules appear. Once a report has been registered in each module, the functions that can be performed from the corresponding table are:

- **“Completed”**: Applicable to ARM reports only. From this panel option, the application allows you to finish the ARM report that has been developed. This step is essential to continue the project since, until the ARM report is finished, it is not possible to register the ARM report. Pressing the “report” icon in this column makes it possible to finish it, and a tick is shown. If the report is unfinished and it is not possible to finish it, the “Warning” icon (!) will be displayed - when the mouse is placed over this icon, the application indicates, through a pop-up message, what fields the ARM report are awaiting information.

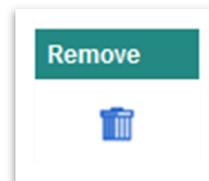


**Figure 8.3-3.** Functionality to complete the ARM report of a global project.

Source: SIRMA

In the case of IDM and MORA, this column called “Finished” simply provides information about whether or not the report has been finished —”No” or tick, as appropriate.

- **“Configure/see (📄)”**: Upon clicking the report icon, the tool will allow you to modify the report generated or, if it has already been finished, to open it for consultation.
- **“Remove (🗑️)”**. This column makes it possible to delete the report desired, be it ARM, IDM or MORA, using the “trash” icon. If you press this icon, the application will open a screen to confirm you want to delete this report. This screen includes the name of the report and the date on which it was created.



**Figure 8.3-4** Icon to remove the ARM, IDM, or MORA reports. Source: SIRMA.

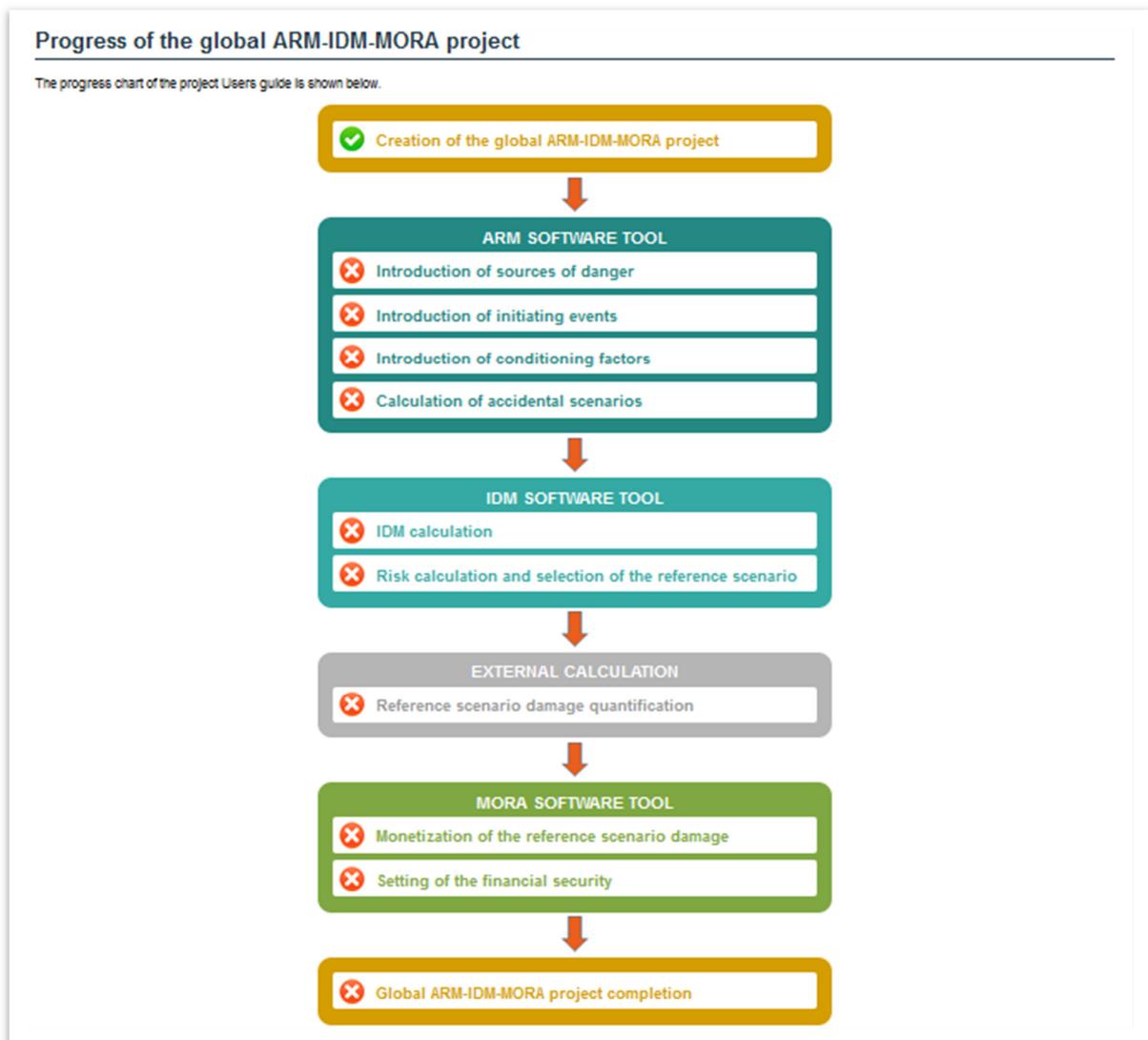
- **“Print (🖨️)”**. This column allows you to print or save the PDF report generated with each module. For more information about the specifications for printing each report, it is recommended that you consult the sections of the user’s guide covering this matter in each module.

Besides the tables with the functions listed above for the ARM, IDM and MORA modules, the “Detail of the ARM-IDM-MORA global project” screen includes a merely informative table covering the damage quantification phase of the reference scenario, which states that this phase of the process must be undertaken by the operators outside SIRMA and prior to calculating the repair cost through MORA.

When a new global project is generated, the application enables the **“Entry data of ARM report”** hyperlink on the ARM report table to begin the analysis.

Lastly, on the upper right corner of the “Detail of the ARM-IDM-MORA global project” screen is the **“Project progress”** outline.

Upon clicking “Project progress,” SIRMA opens a new window that visually indicates the sections of the process of calculating the financial security that have already finished and which are still pending complete - a cross in a red circle is used to warn that the step in the process is not complete, while a tick on a green background indicates that this step is complete.



**Figure 8.3-5.** Progress of the global ARM-IDM-MORA project. Source: SIRMA

### 8.3.1. REGISTRATION OF ARM, IDM AND MORA REPORTS.

When a global project is created, as indicated in the previous section, the first report that may be registered in the project is the ARM Report. This action can be made by clicking on the “**ARM Report Registration**” hyperlink that appears as available on the ARM Report table.

**- ARM Report**

[Entry data of ARM Report](#)

Name	Date of performance	Version	Complete	Modify / See	Remove	Print
There are no records to show.						

**Figure 8.3.1-1.** Registration of ARM Report. Source: SIRMA

Once the creation of the ARM report has been accessed, the application works analogously to the ARM module. To see how it works, you are advised to consult section 9. MODULE FOR DEVELOPING THE ENVIRONMENTAL RISK ANALYSIS (ARM) of this guide.

When the user has finished the ARM Report - using the “Complete” function of the ARM Report table - the application will enable the “**Entry data of IDM Report**” hyperlink that will appear as available in the IDM Report table.

**- IDM Report**

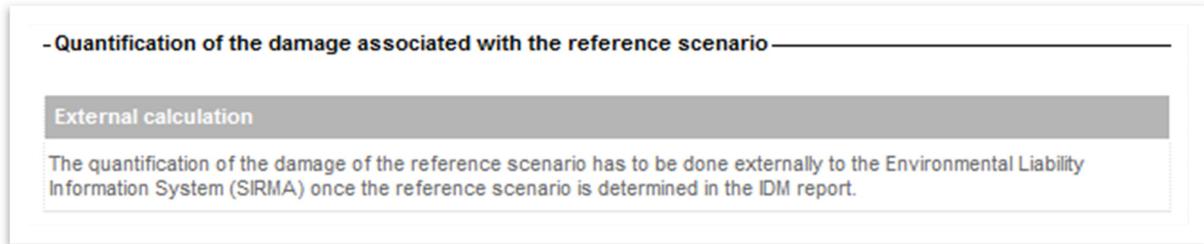
[Entry data of IDM Report](#)

Name	Date of performance	Version	Completed	Modify / See	Remove	Print
There are no records to show.						

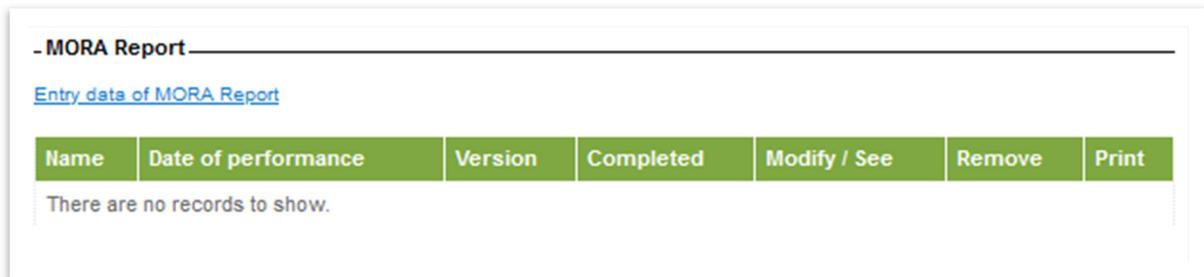
**Figure 8.3.1-2.** Registration of IDM Report. Source: SIRMA

Again, when creating the IDM report, the application works as it would with the IDM module independently. To see how the IDM module works, it is recommended that you consult section 10. MODULE FOR CALCULATING THE INDEX OF ENVIRONMENTAL DAMAGE (IDM) of this user guide. In the case of the IDM Report, the application will show, pre-uploaded, the information derived from the ARM Report; you can see what information it concerns in section 8.3.2. IMPORTING DATA BETWEEN THE ARM, IDM AND MORA MODULES IN GLOBAL PROJECTS.

When the IDM report has been finished, the application will enable the “**Entry data of MORA Report**” hyperlink, which will appear as available in the MORA Report table, although, before beginning to monetize the damage in the accident reference scenario, the user must quantify said damage (in terms of extension, intensity and timescale) by applying the provisions of article 33.2e)1 of the Regulations for the partial implementation of Law 26/2007 externally to the SIRMA computer application. As with the ARM Report and the IDM Report, the MORA Report is constructed within the overall project analogously to how it would do so through the stand-alone MORA module. It is therefore necessary to refer to section 11 to see how MORA works. FINANCIAL APPRAISAL OF DAMAGES MODULE (MORA) in the guide.



**Figure 8.3.1-3.** Note on the quantification of the damage. Source: SIRMA



**Figure 8.3.1-4.** Registration of MORA Report. Source: SIRMA

### 8.3.2. IMPORTING DATA BETWEEN THE ARM, IDM AND MORA MODULES IN GLOBAL PROJECTS

One of the main functions of global projects is to exploit the information obtained due to a given module and that serves as input to the next module as indicated in Figure 8-1. Interconnection between ARM, IDM and MORA in the Global Projects.

More specifically, the information SIRMA imports from the ARM Report to the IDM Report is as follows:

- Code of the accident scenarios obtained from the ARM Report.
- Name of the accident scenarios obtained from the ARM Report.
- Probability of the accident scenarios obtained from the ARM Report occurring.
- Amount of agent released in each accident scenario obtained from the ARM Report. This data will appear as an  $\alpha$  value in the IDM module, and it must be the user who verifies that said value is appropriate as an estimator of the amount of agent involved in the damage and paying special attention to the units in which said quantity is expressed.

On the other hand, SIRMA imports from the IDM Report to the MORA Report only the code and name of the reference scenario that will be proposed by the application as the name of the MORA Report. This is because, as previously explained, before the use of MORA, the user must quantify said damage externally to SIRMA.

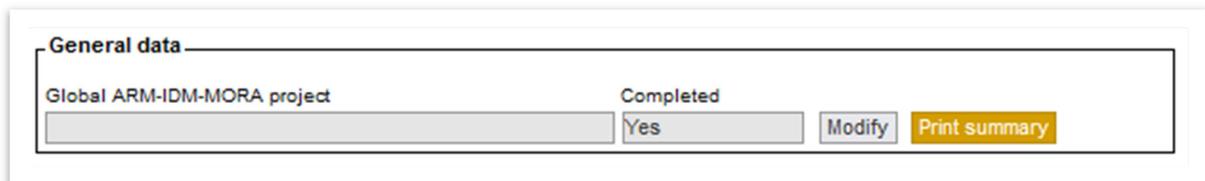
### 8.3.3. COMPLETION OF THE ARM-IDM-MORA GLOBAL PROJECT

When the user has completed the three reports - including the external damage quantification step - the application enables a button under the MORA Report table which allows you to finish the ARM-IDM-MORA global project. By pressing this button, and after a confirmation screen, the application will take the global project to be completed.



**Figure 8.3.3-1.** Button for complete the ARM-IDM-MORA global project. Source: SIRMA

From the moment the global project ends, the application generates a new **“Print summary”** button together with the project’s general data, which will allow you to save or print a summary document in PDF format containing the basic information obtained from each application - accidental scenarios (probability of occurrence and volume released), the result of the IDM of each scenario and selection of the reference scenario, repair estimate in MORA and an estimate of the financial security according to MORA.



**Figure 8.3.3-2.** Button to print or save the ARM-IDM-MORA global project summary Report.

Source: SIRMA

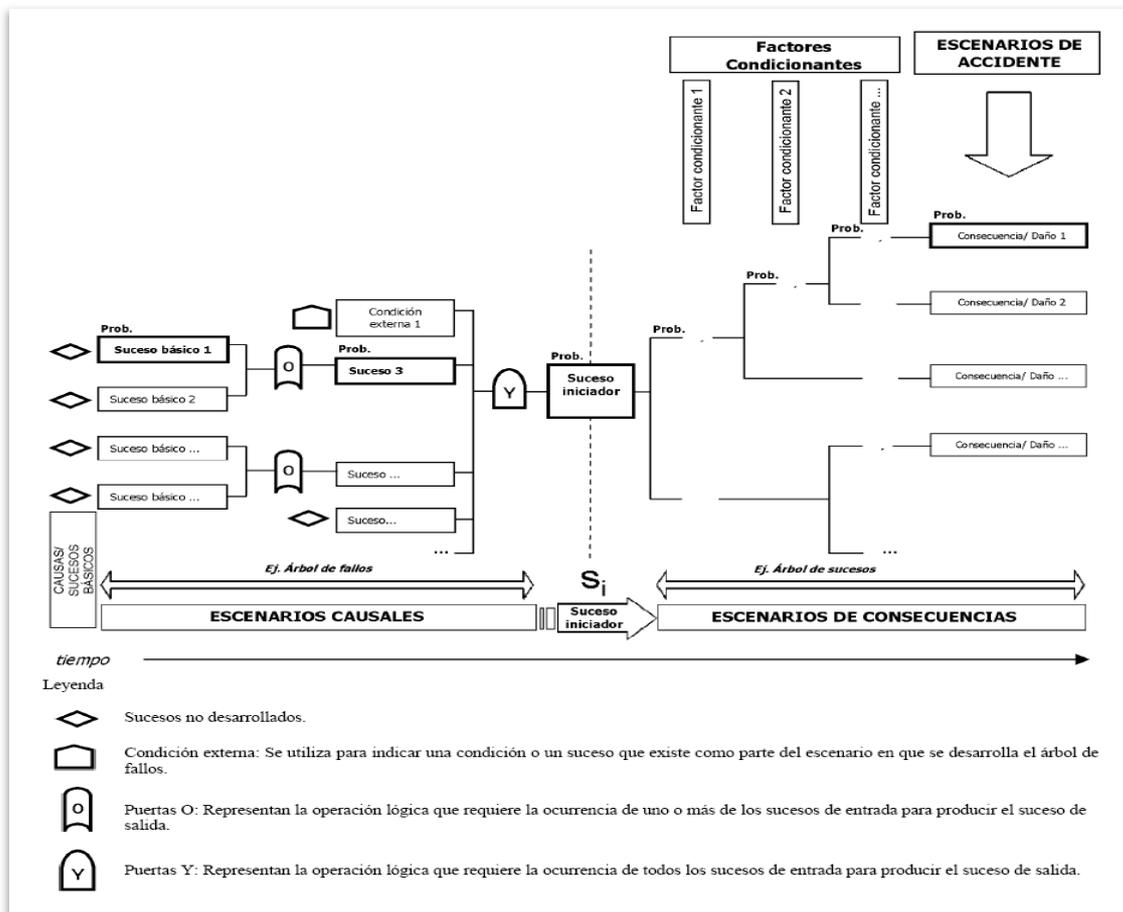
Moreover, once finished, the report may be duplicated if the user so wishes according to what is set out in section 8.2.1. NAVIGATION PANEL – PROJECT MANAGEMENT AND CONSULTATION.

## 9. ENVIRONMENTAL RISK ANALYSIS (ARM) MODULE

### 9.1. THEORETICAL PRINCIPLES

The ARM module helps in the drafting of the environmental risk analysis according to the methodology established in Law 26/2007 of Environmental Liability and the Regulation that further develops it, and more specifically in the creation of the events trees following the scheme established in UNE 150008:2008 Standard (see Figure 9.1-1).

Before using the ARM module, the user must know this methodology and to have an scheme of the environmental risk analysis of the facility, having identified the different elements from which the events trees will be built.



**Figure 9.1-1.** General scheme of the methodology for the elaboration of environmental risk analysis. Source: UNE 150008 Standard (page 11)

The module covers all the key aspects needed when from creating the events trees until the identification of the different risk scenarios and their probability:

- **Identification of sources of danger (and their causes)**

- **Consideration of the typology of the substances that may be involved in the environmental damage.**
- **Identification and inventory of initiating events.**
- **Identification and classification of conditioning factors.**
- **Search, register and establishment of the probabilities of the initiating events and the conditioning factors.**
- **Construction of the events trees and accidental scenarios.**

## 9.2. ACCESS TO THE ARM MODULE

The ARM module is accessible through the SIRMA navigator, using the “Description”, “Create a New Report”, “Reports Repository” and “Bibliography” buttons under the “ARM Application” menu.



The screenshot displays the SIRMA web application interface. At the top, there is a header with the Spanish government logo and the text 'GOBIERNO DE ESPAÑA' and 'MINISTERIO PARA LA TRANSICIÓN ECOLÓGICA Y EL RETO DEMOGRÁFICO'. To the right, it says 'Comisión Técnica de Prevención y Reparación de Daños Medioambientales' and features the 'ARM' and 'SIRMA' logos. A 'Log out' button is also visible.

The main content area is titled 'Environmental Liability Information System (SIRMA) - ARM Application - Description'. On the left, there is a navigation menu with the following items: 'Law 26/2007 Information', 'Legal Basis', 'Risk Analysis', 'Financial Security', 'Implementation reports and environmental liability enforcement', 'Publications', 'FAQs', 'ARM, IDM and MORA computer applications', 'Introduction and aim', 'Global ARM-IDM-MORA Project', 'ARM Application', 'IDM Application', 'MORA Application', 'Geographic viewer', 'Description and access', 'Transport Module', 'Description', 'Event tree', 'Query log', 'Administration', and 'My Profile'.

The main content area is divided into two columns. The left column is titled 'Description' and contains the following text:
 

Within the mandatory financial security calculation process, the Environmental Risk Analysis software application (ARM for its acronym in Spanish) enables the elaboration of environmental risk analysis report.

According to UNE 150.008:2008 standard for environmental risk analysis and assessment, it helps in the construction of the event tree analysis:

- Selection of the sources of danger
- Determination of the initiating events
- Introduction of the conditioning factors
- Obtaining the accident scenarios with their respective associated probability and, where appropriate, the amount of pollutant released

Below this text, there are links for 'Documentation', 'User's guide', and 'Annexes'.

The right column is titled 'Consultation of ARM reports' and contains a table with the following data:

Report	Date of performance	Method	Clear	Complete	Duplicate	Modify / Set	Remove
Report 01	05/29/2022	ARMV1	XXXX XXXXXXXX				
March 2022	03/29/2022	ARMV1	Monica Ramos	✓	OK		
Year 03	03/29/2022	ARMV1	Monica Ramos				
03/24/2022	03/24/2022	ARMV1	Monica Ramos				
P1	03/23/2022	ARMV1	XXXX XXXXXXXX				
Year 02	10/02/2021	ARMV1	XXXX XXXXXXXX				
Year 01	10/02/2021	ARMV1	XXXX XXXXXXXX				
10/02/2021	10/02/2021	ARMV1	XXXX XXXXXXXX				

Below the table, there is a section for 'Event tree of the initiating event' and 'Initiating event data'.

The right column also contains a section for 'Environmental Risk Analysis (ARM)' with a 'Report ARM data' form and a 'Source of danger' section. The 'Source of danger' section includes a 'Name of source of danger' field with the value 'bomba de gas' and a 'Biogeographic source' field with the value 'PURPLEBOOK.VH062095'. The 'Outline of the ARM report' section shows a tree structure of the report content.

Figure 9.2-1. ARM Module access. Source: SIRMA.

### 9.3. ARM MODULE GENERAL FUNCIONALITIES

#### 9.3.1. NAVIGATION PANEL – REPORTS MANAGEMENT

The navigation panel of the ARM module include the following actions:



**Figure 9.3.1-1.** ARM Navigation panel. Source: SIRMA.

- **Description.** Includes a brief summary of the ARM module purpose. It also includes links to the user’s guide.
- **Create a New Report.** It enables the creation of a new report.
- **Reports Repository.** Clicking on this tab opens the 'Consultation of ARM Reports' screen. This screen lists all reports registered by the user and displays informative data in the first three columns: the report name, creation date, and application version. The five columns below provide various functions for performing the following actions:

#### Consultation of ARM reports

---

Search panel

Name	Date from	Date to	Completed
<input type="text"/>	<input type="text"/>	<input type="text"/>	Yes <span style="font-size: 0.8em;">v</span> <span style="font-size: 0.8em;">Q</span>

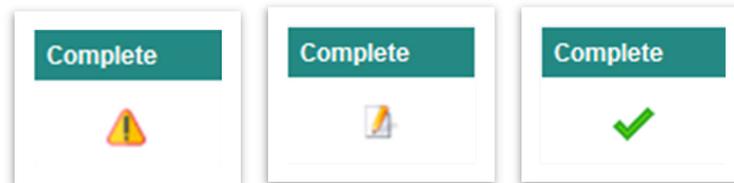
[Entry data of Report](#)

Name	Date	Version	Complete	Duplicate	P. A. measures	Modify / See	Remove
		ARMV1	✓				
		ARMV1	✓				
		ARMV1	✓				

3 registers found. Page 1

**Figure 9.3.1-2.** Reports repository - Consultation of ARM Reports. Features Source: SIRMA.

- “**Complete**”. The application uses an icon code to indicate whether prevention and avoidance measures have been loaded in the ARM report. It is set out as follows:



**Figure 9.3.1-3.** Symbols indicating the status of the reports. Source: SIRMA.

- Exclamation point (!): indicates that prevention and avoidance measures cannot be included in the report as it has unreported fields (not finalised). The ARM report must be completed for the icon described below to be displayed in this column, enabling the inclusion of measures for prevention and avoidance.
- The 'Report' icon (📄) indicates that prevention and avoidance measures can be included in the report by clicking on it.
- 'Report with green light bulb' icon (💡) When an ARM report includes at least one prevention and avoidance measure, a green light bulb will appear in the 'Consultation of Reports' screen. This indicates that the operator has included such measures in the report.

**Complete report** [Outline of the report](#)  

---

Report ARM data

Name	Date of performance

[Summary of initiating events](#)  
 [Summary of accident scenarios](#)  
 [Print ARM report](#)

**Figure 9.3.1-4.** Complete report screen. Source: SIRMA.

- **Summary of initiating events**, that opens a new window with a summary table of the initiating events included in the report and their information.

- **Summary of accident scenarios**, that opens a new window with a summary table of the accident scenarios included in the report and their information.
  - **Print ARM report**, that opens a new window for printing the ARM report.
- “**Duplicate** (📄)””. Once the report is completed, the tool allows the creation of a duplicate in which it is possible to modify its information.
  - “**Modify/see** (📄)””. This option allows access to a report in order to modify or complete it, if not completed yet, and view it if it has been completed.
  - “**Remove** (🗑️)””. It allows deleting a report.
- **Application bibliographic sources**. In this section the user can consult the bibliographic references from which the probability data of the different elements that make up the ARM application have been extracted.

Additionally, when using the ARM module, the application provides the number of the specific page of the bibliographic reference in which the information provided is located in order for the user to verify that the characteristics of the element present in their installation correspond to those that have been assigned in the application.

This verification that the characteristics of an element (source of danger, initiating event, etc.) correspond to those described in the bibliography, is essential because the calculation will only be correct if the characteristics chosen are adequate. to each specific case.

<b>FLEMISHGOV2009</b>	<a href="#">Failure frequencies - FG 2009.</a> <a href="#">Failure frequencies - FG 2009. - Appendix</a>
<b>HSE2003</b>	<a href="#">Failure frequencies (fire) - HSE 2003.</a>
<b>HSE2019</b>	<a href="#">Failure Rates - HSE 2019.</a>
<b>PROTECCIONCIVIL1994</b>	<a href="#">Failure frecuencies - Dirección General de Protección Civil. 1994</a>
<b>PURPLEBOOK.VROM2005</b>	<a href="#">Failure frequencies - Purplebook, VROM 2005.</a>

**Figure 9.3.1-5.** “Bibliography” window. Source: SIRMA.

- **Registration of bibliographic sources.** In this section, the user can register new bibliographic sources, different from those used by default by the ARM application, to be used later in the development of their report. This allows the user to register new sources of danger, basic events, conditioning factors and assign probabilities to them, always in a justified way.

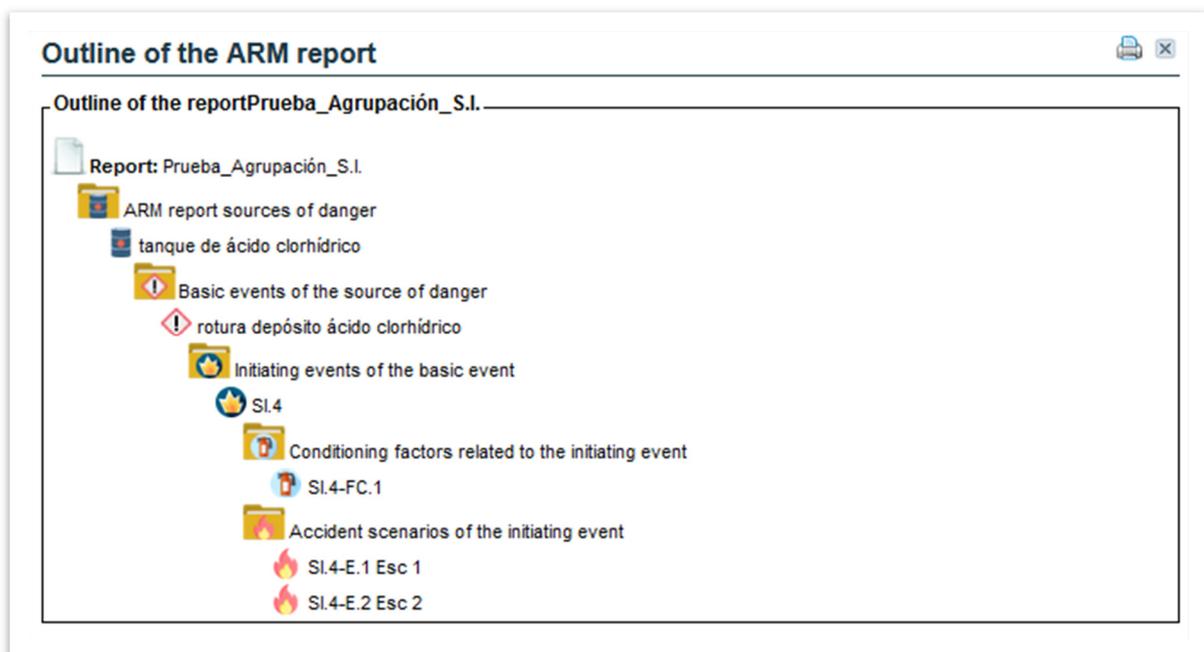
### 9.3.2. REPORT TOOLS

On the upper right-hand side of each report window, there are three symbols:



**Figure 9.3.2-1.** Report Tools. Source: SIRMA.

The first one, “Outline of the report” opens an interactive diagram representing the report that is being created and allows to navigate withing that report.



**Figure 9.3.2-2.** Outline of the ARM report. Source: SIRMA.

The “print” button (🖨️) allows viewing the report generated so that it can be saved or printed.



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## Environmental Risk Analysis (ARM)

**Report ARM data**

Name	Date of performance
Prueba 16/11/20_1641994098195	01/12/2022

**Source of danger**

**Source of danger data**

Name of source of danger

Bibliographic source	Page	Source of danger
HSE2019	7	Large vessels >12000 m3

**Basic event**

**Basic event data**

Name of basic event

Basic event	Probability
Major release (hole diameter 1000 mm)	0.0002

Type of pollutant	Type of reactivity	Type of discharge
Group 1		Continuous source term < 10 kg/s

**Figure 9.3.2-3.** Example of a report. Source: SIRMA.

And the symbol (x) allows closing the report being used.

In addition, there is a **flow diagram** that allows the user to identify the steps of the ARA project, highlighting in a darker shade the phase the user is currently in. Under that flow diagram there is also **hyperlinks** that allows navigating through the project.



**Figure 9.3.2-4.** Flow diagram and links to the phases of a project. Source: SIRMA.

## 9.4. CREATE A NEW REPORT

In the initial window of each report the “General Data ARM Report” is shown, where the “**Name**” of the report can be edited. The “**Entry Date**” and “**User**” are automatically filled in by SIRMA.

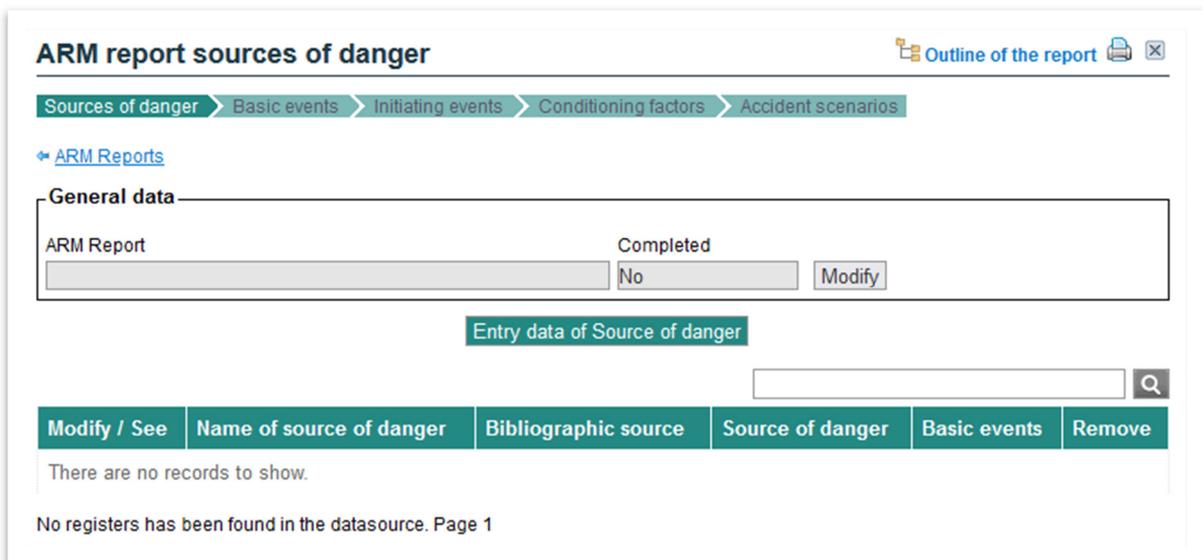
To start the report, the user has to click on the “**Save**” button, and to dismiss it, on the “**Cancel**” button.

### 9.4.1. SOURCES OF DANGER

The ARM report sources of danger window shows:

- The name of the report
- If it is finished or not
- A button (Modify) that allows modify the general information of the report in the previous screen.

Under this information, there is a button called “**Entry data of Source of danger**”.



**Figure 9.4.1-1.** “Entry data of Source of danger” button. Source: SIRMA.

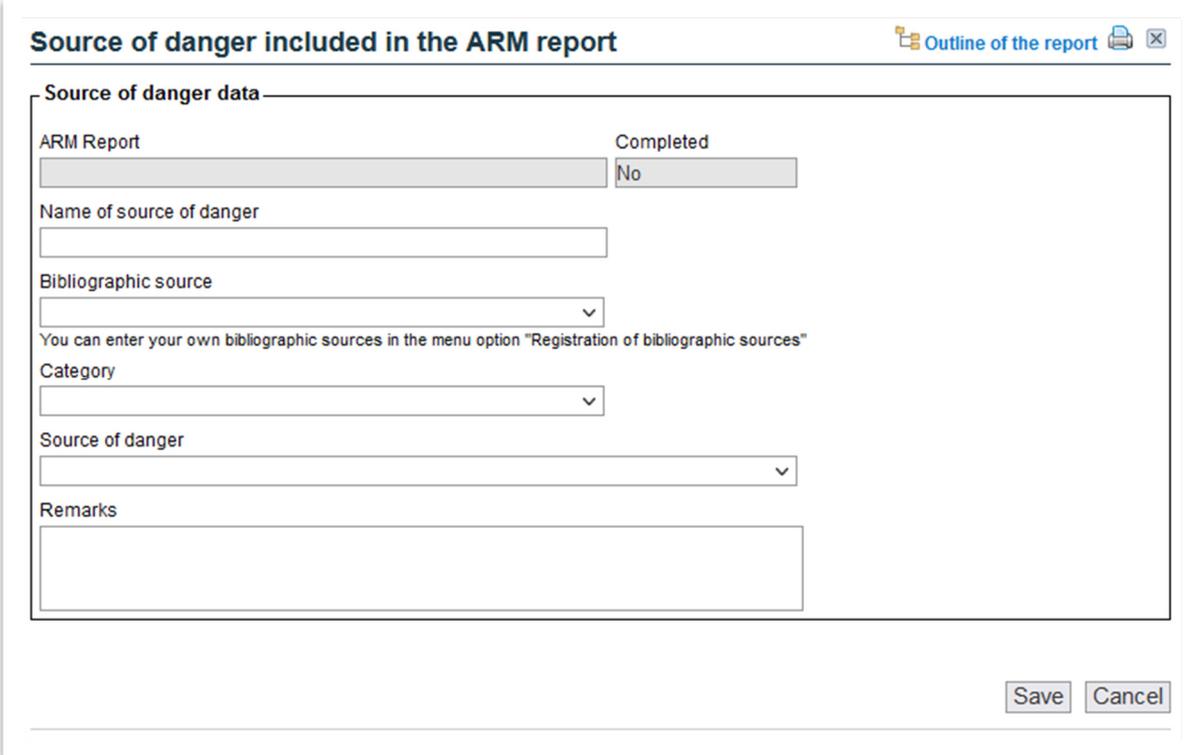
By clicking on this button, the user accesses a new screen in which the information regarding a source of danger can be introduced.

In this “**Source of danger included in the ARM report**” screen, the following information needs to be completed.

- “**Name of source of danger**”.
- “**Bibliographic source**”. The user has to choose among the sources available in the tool, from the list box.
- “**Category**”. The user has to choose among the sources available in the tool, from the list box.

- **“Source of danger”**. This list box allows the final selection of the source of danger, as it is in the bibliography. It indicates the page of the bibliography in which the source of danger is included.
- **“Remarks”**: It allows including comments or remarks.

Once this information is completed, the **“Save”** button has to be clicked to continue, or **“Cancel”** to dismiss this source of danger.



**Source of danger included in the ARM report** Outline of the report  

**Source of danger data**

ARM Report Completed

Name of source of danger

Bibliographic source

You can enter your own bibliographic sources in the menu option "Registration of bibliographic sources"

Category

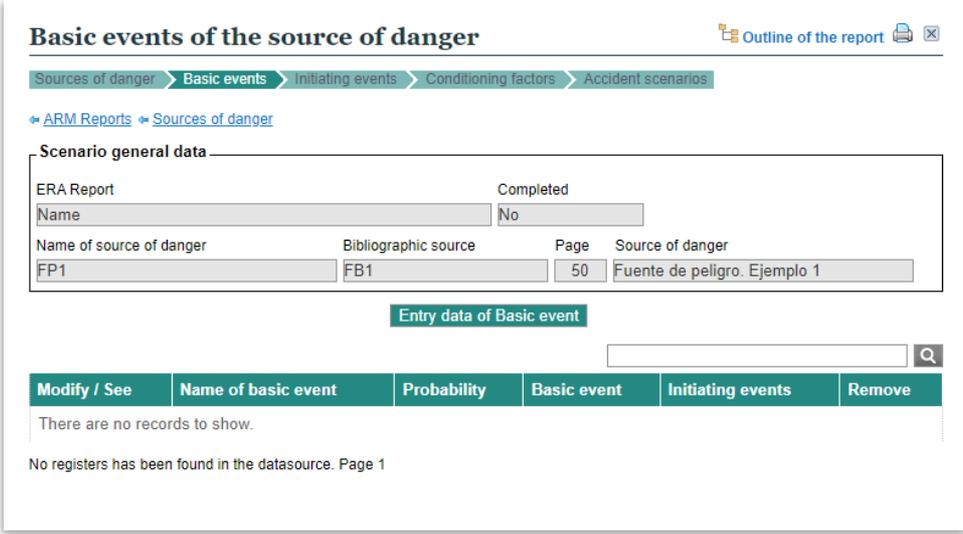
Source of danger

Remarks

**Figure 9.4.1-2.** Source of danger included in the ARM report screen. Source: SIRMA.

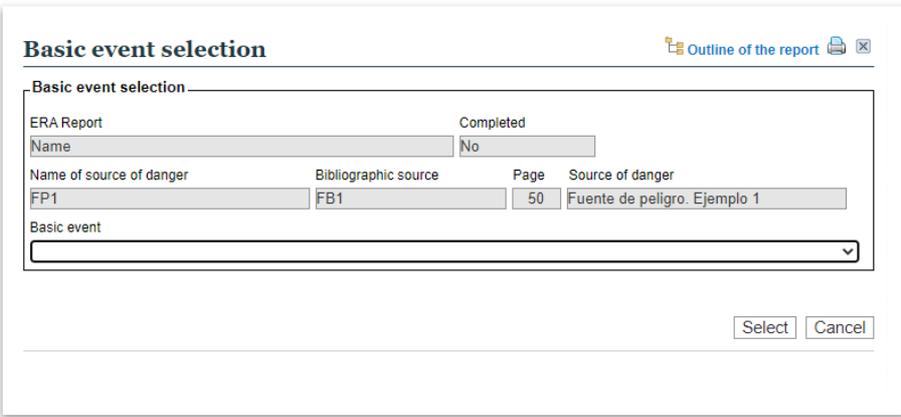
## 9.4.2. BASIC EVENTS

Once the information on the information for a source of danger has been introduced, clicking on the “report” symbol, under the Basic events column, the **“Basic events of the source of danger”** screen will open.



**Figure 9.4.2-1.** Basic events of the source of danger screen. Source: SIRMA.

This screen shows, firstly, the general information of the report with the main data on the sources of danger associated to the basic event. Behind it you can find the “**Entry data of Basic Event**” button. Clicking on it a new screen “**Basic event selection**” that allows selecting the type of basic event opens. Each basic event has a probability associated, that will be shown in following screens.



**Figure 9.4.2-2.** Basic event selection screen. Source: SIRMA.

In the “**Basic event related to the source of danger**” screen, the general information of the report and of the source of danger associated to the basic event are shown. It also includes the probability of occurrence associated to the basic event selected, as well as other fields that the user will have to fill in for calculating the probability of the initiating event. This fields will depend on the type of basic event but generally speaking are:

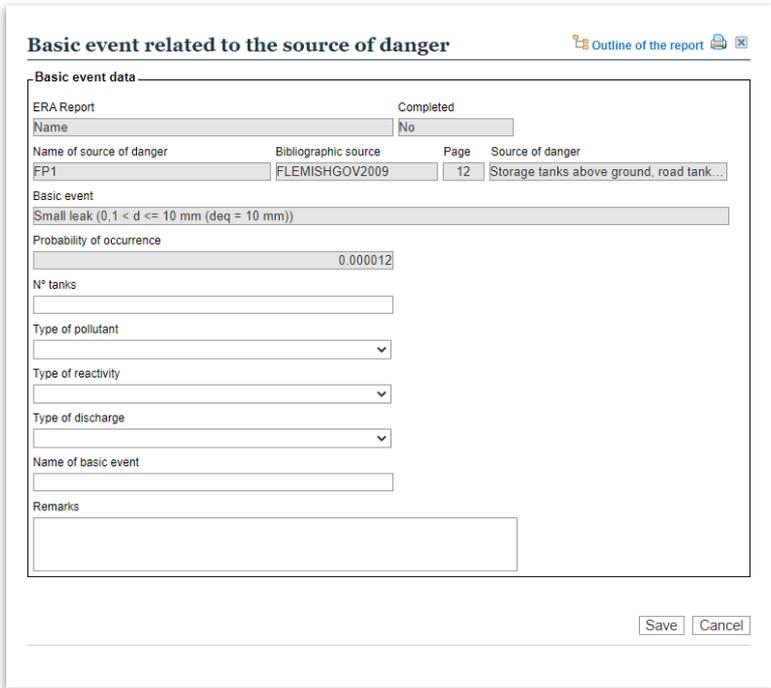
- **Number of elements** present in the facility (tanks, valves, etc.)
- **Type of pollutant**, allows indicating if the substance is combustible or non-combustible, or if it belongs to any of these groups:

Group	Description
Group 0	Products in gaseous state. The product is below the boiling point or the normal boiling point is lower or equal to -25°C
Group 1	Products that normally are in or higher than the ignition point, but lower than the normal boiling point. Example: Liquids P1: Extremely and highly flammable liquids, more specifically liquids with an ignition point lower than 21° C
Group 2	Products that are at below 35° C and below the ignition point. Example: Liquids P2: Flammable liquids, more specifically liquids with an ignition point higher than 21° C and lower than 55° C
Group 3	Products that are at below 35° C or higher and below the ignition point. Example: Liquids P2: Flammable liquids, more specifically liquids with an ignition point higher than 55° C and lower than 250° C

**Table 9.4.2-1.** Groups of substances. Source: *Flemish Government*, 2009.

- **Type of Reactivity.**
- **Type of discharge**
- **Name of the basic event**
- **Remarks.**

The fields in grey cannot be edited.



**Basic event related to the source of danger** Outline of the report

Basic event data

ERA Report Completed

Name No

Name of source of danger	Bibliographic source	Page	Source of danger
FP1	FLEMISHGOV2009	12	Storage tanks above ground, road tank...

Basic event

Small leak (0,1 < d <= 10 mm (deq = 10 mm))

Probability of occurrence

0.000012

N° tanks

Type of pollutant

Type of reactivity

Type of discharge

Name of basic event

Remarks

Save Cancel

**Figure 9.4.2-3.** Basic event related to the source of danger screen. Source: SIRMA.

Clicking on the “Save” button the “Basic events of the source of danger” screen will be shown, now with a table including the information of the basic event introduced:

- **“Modify/See”**. Clicking of the “pencil” symbol () , the Basic event related to the source of danger is opened again, and it is possible to check or modify the information previously introduced.
- **“Name of the basic event”**.
- **“Probability”**. Probability of the basic event calculated from the bibliography and the information introduced by the user.
- **“Basic event”**. The type of the basic event.
- **“Initiating events”**. Clicking on the “report” symbol () , the user accesses the following screen: “Initiating events of the basic event”.
- **“Remove”**. Clicking on the () symbol, the user can delete the basic event.



**Basic events of the source of danger** Outline of the report  

Sources of danger > Basic events > Initiating events > Conditioning factors > Accident scenarios

ARM Reports Sources of danger

**Scenario general data**

ERA Report Completed  
 Name

Name of source of danger  Bibliographic source  Page  Source of danger

**Entry data of Basic event**



Modify / See	Name of basic event	Probability	Basic event	Initiating events	Remove
	Name	0.000012	Small leak (0,1 < d <= 10 mm (deq = 10 mm))		

One register found. Page 1

**Figure 9.4.2-4.** “Basic events of the source of danger”. Source: SIRMA.

If the user wants to enter new basic events the same procedure has to be followed, clicking again on the **“Entry data of Basic event”** button.

### 9.4.3. INITIATING EVENTS OF THE BASIC EVENT

Clicking on the “report” symbol (📄) of the Basic events of the source of danger screen, the user accesses the “Initiating events of the basic event” following screen.

#### Initiating events of the basic event

 Outline of the report ✕

Sources of danger > Basic events > Initiating events > Conditioning factors > Accident scenarios

[ARM Reports](#) > [Sources of danger](#) > [Basic events](#)

**Scenario general data**

ERA Report	Completed	
Name	No	
Name of source of danger	Bibliographic source	
FP1	FLEMISHGOV2009	
	Page	
	12	
	Source of danger	
	Storage tanks above ground, road tank...	
Name of basic event	Basic event	Probability
Name	Small leak (0,1 < d <= 10 mm (deq = 10 mm))	0.000012
Type of pollutant	Type of reactivity	Type of discharge
Group 0	High	Continuous source term 10 - 100kg/s

Group initiating events

Data of the initiating event must be reported in order to access to the conditioning factors

🔍

Modify / See	Code	Initiating event	Probability	Volume released (m <sup>3</sup> )	Conditioning factors	Event tree of the initiating event
	SI.1	Jet fire. Pool fire	0.000006		⚠️	⚠️
	SI.2	Vapour cloud explosion. Jet fire. Pool fire	0.0000036		⚠️	⚠️
	SI.3	Flash fire. Jet fire. Pool fire	0.0000084		⚠️	⚠️
	SI.4	Leakage/Toxic vapour cloud	0.0000048		⚠️	⚠️

4 registers found. Page 1

**Figure 9.4.3-1.** Initiating events of the basic event screen. Source: SIRMA.

In this screen, the user has to introduce the information on the volume of the pollutant associated to each initiating events, entering on the “Modify/See” screen by clicking on the “pencil” symbol (🖋️).

In this new screen, the following fields are shown:

- **“Name of the initiating event”**
- **“Fuel type”**. The user has to select from the list box from the 5 options given: Type 1 (highly flammable fuel), type 2 (flammable fuel), type 3 (combustible liquid); type 4 (metal compound) and type 5 (strong oxidising agent). To classify types 1, 2 and 3 the following criteria established in NFPA30 (NFPA, 1996) can be followed:
  - Highly flammable fuel. Ignition point lower than 22,8°C.

- Flammable fuel. Ignition point lower between 22,8 and 37,8 °C.
- Combustible liquid. Ignition point higher than 37,8 °C
- “Pollutant description”.
- “Volume released (m<sup>3</sup>)”.
- “Remarks”.

If the bibliography being used identifies several fire-type initiating events derived from the same basic event (pool fire, flash fire, jet fire, etc.) each with their associated probability of occurrence, the user will be offered the option to group all or part of them into the same initiating event using the “Group initiating events” button that appears on the table.



**Figure 9.4.3-2.** Button to group initiating events. Source: SIRMA.

It will be the analyst who will have to explain the grouping of the fire-type initiating events by giving the reasons for the aggregation - for example, that the same environmental consequences are expected regardless of the original type of fire. This tool aggregates the probabilities of the initiating events that are selected using their validation box, generating an initiating event called “Grouping fire.”

**Sucesos iniciadores de tipo Incendio**

Código	Suceso iniciador	Agrupación Incendio
SI.1	Fire ball (bajo presión). Incendio de charco (sin presión)	<input type="checkbox"/>
SI.5	Vapour cloud explosion. Incendio de charco	<input type="checkbox"/>
SI.6	Incendio flash. Incendio de charco	<input type="checkbox"/>

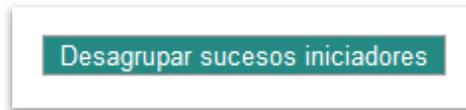
**Justificación de las agrupaciones de sucesos iniciadores**

Justificación

**Figure 9.4.3-3.** Screen to group fire-type initiating events. Source: SIRMA.

Using the “Save” and “Cancel” buttons located in the lower-right corner of the screen, the user may record the amendments to the initiating events entered on this screen or discard them.

If, once the action has been performed, the user wishes to ungroup the grouping, this can be done by pressing the “Ungroup initiating events” button, which, through a confirmation screen, allows the user to return to the initial list of initiating events provided by the bibliography.



**Figure 9.4.3-4.** Button to ungroup initiating events. Source: SIRMA.

**Initiating event related to the basic event** Outline of the report  

**Initiating event data**

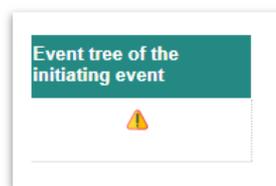
ERA Report		Completed	
Name		No	
Name of source of danger	Bibliographic source	Page	Source of danger
FP1	FLEMISHGOV2009	12	Storage tanks above ground, road tank...
Name of basic event		Basic event	Probability
Name		Small leak (0,1 < d <= 10 mm (deq = 10 mm))	0.000012
Type of pollutant	Type of reactivity	Type of discharge	
Group 0	High	Continuous source term 10 - 100kg/s	
Initiating event		Modifier	Probability
Jet fire. Pool fire		0.50	0.000006
Code	Name of the initiating event		
SI.1			
Fuel type			
<input type="text" value=""/>			
Pollutant description		Volume released (m <sup>3</sup> )	
<input type="text" value=""/>		<input type="text" value=""/>	
Remarks			
<input type="text" value=""/>			

**Figure 9.4.3-5.** Initiating event data screen. “Initiating event related to the basic event.” Source: SIRMA.

If the requested information is entered and the “Save” button is pressed, the application will add the amount released in column “**Spilled volume (m<sup>3</sup>)**” of the “Basic event initiating events” screen and the warning sign (!) that appeared in the “**Conditioning factors**” column will be amended by a Report icon() , which will allow the environmental risk assessment to continue.

Besides the information described above —“Configure/view,” “Volume spilt (m<sup>3</sup>)” and “Conditioning factors”— the table includes the following items in the rest of the columns:

- **“Code.”** It is an alphanumeric code that the application assigns to each initiating event to make it easier to follow throughout the report.
- **“Initiating Event.”** It is the name of the initiating event in the bibliography whence it has been extracted.
- **“Probability.”** This is the probability of occurrence assigned to each initiating event according to the data entered.
- **“Event tree of the initiating event.”** This column appears at this point filled with warning symbols (!), which will be amended by “tree” icons as you advance in the report and the accident scenarios are generated. Using the aforementioned tree icon, you can view the event tree associated with each initiating event.



**Figure 9.4.3-6.** Symbol of the event tree of the initiating event. Source: SIRMA.

#### **9.4.4. CONDITIONING FACTORS DATA**

From the “Initiating events of the basic event screen”, it is possible to access the screen that allows the introduction of the conditioning factors applicable to each initiating event of the environmental risk analysis. This can be done clicking on the “report” symbol (📄).

In the **“Conditioning factors related to the initiating event”**, we can find the general information already introduced, and below, the **“Entry data of Conditioning factor”** button, as well as a table.

At the bottom of the screen, we can find the **“Generate accident scenarios”** button, that has to be clicked at this point only if we do not have conditioning factors applicable to this initiating event.

## Conditioning factors related to the initiating event

Outline of the report

Sources of danger > Basic events > Initiating events > **Conditioning factors** > Accident scenarios

ARM Reports Sources of danger Basic events Initiating events

Scenario general data

ERA Report	Completed		
Name	No		
Name of source of danger	Bibliographic source	Page	Source of danger
FP1	FB1	50	Fuente de peligro. Ejemplo 1
Name of basic event	Basic event	Probability	
Name	Fuente de peligro 1	0.0004	
Type of pollutant	Type of reactivity	Type of discharge	
Group 0			
Name of the initiating event	Code	Initiating event	
Name	SI.5	Flash fire. Jet fire. Pool fire	
Fuel type	Volume released (m <sup>3</sup> )	Probability	
Highly flammable liquid	3.00	0.0004	

Entry data of Conditioning factor

Search

Modify / See	Code	Conditioning factor	Performance parameters	Volume variation in case success of conditioning factor (m <sup>3</sup> )	Volume variation in case failure of conditioning factor (m <sup>3</sup> )	Remove
There are no records to show.						

No registers has been found in the datasource. Page 1

Generate accident scenarios

**Figure 9.4.4-1.** Conditioning factors related to the initiating event screen. Source: SIRMA.

By clicking on the “**Entry data of Conditioning factor**” button, it is possible to include conditioning factors, using the screen “**Conditioning factor included in the ARM Report**”, that includes, in addition to the previously introduced data, the following fields:

- “**Code**”. This conditioning factor will be assigned a code by the tool. This code will be a combination of the initiating event and the conditioning factor.
- “**Conditioning factor name**”. This will be introduced by the user.
- “**Bibliographic source**”. The user has to select the bibliographic source included in the tool, using the list box.
- “**Category**”. It has to be selected using the list box.
- “**Conditioning factor**”. It has to be selected using the list box. It includes the page of the bibliography in which it is described.

- **“Volume variation in case success of conditioning factor (m3)”**. It allows the user to include in the analysis the volume variation of the substance involved in the accident in case the conditioning factor is successful. It is important to clarify that the volume that is modified is the one being evaluated, not the original one liberated by the initiating event. This volume can not be negative either, and the minimum value is 0.
- **“Volume variation in case failure of conditioning factor (m3)”**. It allows the user to include in the analysis the volume variation of the substance involved in the accident in case the conditioning factor is not successful.
- **“Remarks”**. This field allows the user to include comments on the conditioning factor.

### Conditioning factor included in the ARM Report Outline of the report

Conditioning factor data

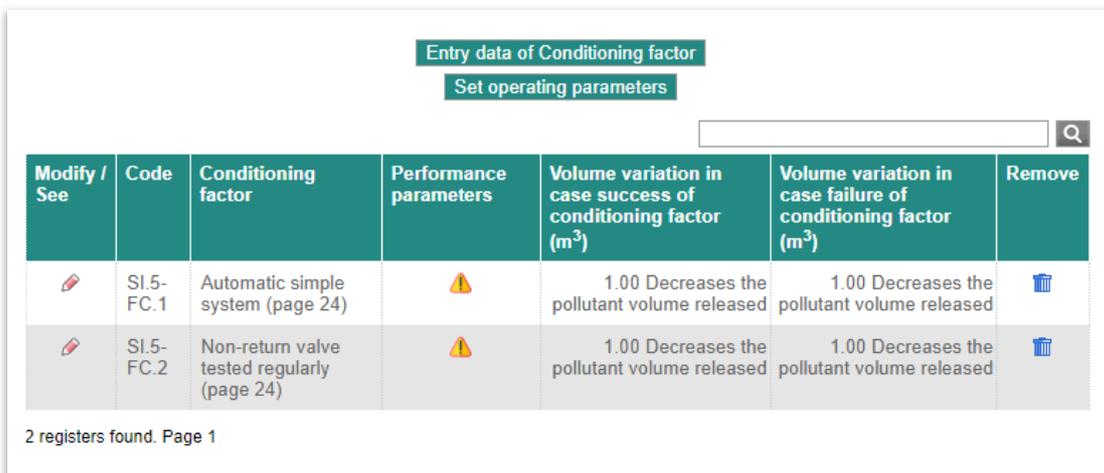
ERA Report		Completed	
<input type="text" value="Name"/>		<input type="text" value="No"/>	
Name of source of danger	Bibliographic source	Page	Source of danger
<input type="text" value="FP1"/>	<input type="text" value="FB1"/>	<input type="text" value="50"/>	<input type="text" value="Fuente de peligro. Ejemplo 1"/>
Name of basic event		Basic event	Probability
<input type="text" value="Name"/>		<input type="text" value="Fuente de peligro 1"/>	<input type="text" value="0.0004"/>
Type of pollutant	Type of reactivity	Type of discharge	
<input type="text" value="Group 0"/>	<input type="text"/>	<input type="text"/>	
Name of the initiating event		Code	Initiating event
<input type="text" value="Name"/>		<input type="text" value="SI.5"/>	<input type="text" value="Flash fire. Jet fire. Pool fire"/>
Fuel type	Volume released (m <sup>3</sup> )	Probability	
<input type="text" value="Highly flammable liquid"/>	<input type="text" value="3.00"/>	<input type="text" value="0.0004"/>	
Code	Conditioning factor name		
<input type="text"/>	<input type="text" value="CF1"/>		
Bibliographic source			
<input type="text" value="FLEMISHGOV2009"/>			
<small>You can enter your own bibliographic sources in the menu option "Registration of bibliographic sources"</small>			
Category			
<input type="text" value="Blocking system"/>			
Conditioning factor			
<input type="text"/>			
Volume variation in case success of conditioning factor (m <sup>3</sup> )			
<input type="text"/>	<input checked="" type="radio"/> Decreases the pollutant volume released <input type="radio"/> Increases the volume released		
Volume variation in case failure of conditioning factor (m <sup>3</sup> )			
<input type="text"/>	<input checked="" type="radio"/> Decreases the pollutant volume released <input type="radio"/> Increases the volume released		
Remarks			
<input type="text"/>			

**Figure 9.4.4-2.** Conditioning factor included in the ARM Report screen. Source: SIRMA.

Using the “Save” and “Cancel” buttons the user can save or dismiss the information introduced.

Clicking of the “Save” button, the “Conditioning factors related to the initiating event” screen will be showed, with a summary on the conditioning factors introduced. They can be modified clicking on the “pencil” symbol (✎) on the “Modify/see” column.

On the “Performance parameters” column, if only one conditioning factor has been introduced, that column will have the text “Acts first”. But if there is more than one conditioning factor on a particular initiating event, there will be a warning symbol on that column indicating that it is necessary to establish an order in which the conditioning factors operate. In this sense, a new button, “Set operating parameters” will be automatically created.

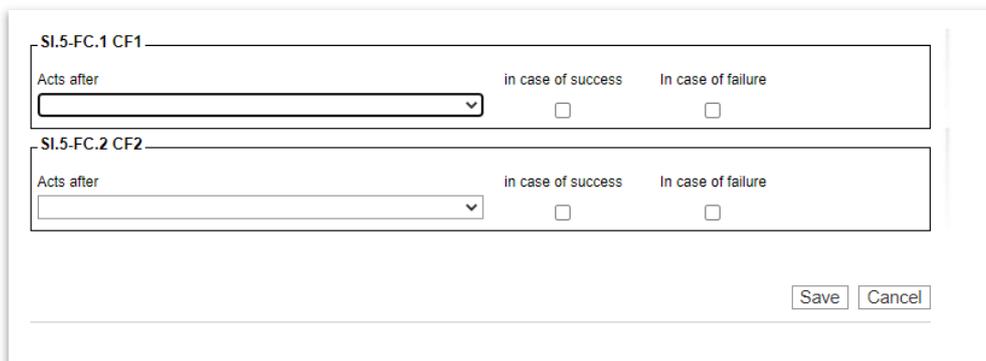


Modify / See	Code	Conditioning factor	Performance parameters	Volume variation in case success of conditioning factor (m³)	Volume variation in case failure of conditioning factor (m³)	Remove
	SI.5-FC.1	Automatic simple system (page 24)		1.00 Decreases the pollutant volume released	1.00 Decreases the pollutant volume released	
	SI.5-FC.2	Non-return valve tested regularly (page 24)		1.00 Decreases the pollutant volume released	1.00 Decreases the pollutant volume released	

2 registers found. Page 1

**Figure 9.4.4-3.** Set operating parameters button. Source: SIRMA.

Clicking on this button a new screen opens in which it is possible to indicate the order in which each conditioning factor acts, and if it does in case of success or in case of failure of the previous one.



SI.5-FC.1 CF1

Acts after  in case of success  In case of failure

SI.5-FC.2 CF2

Acts after  in case of success  In case of failure

**Figure 9.3.4-4.** The performance parameters of the conditioning factors must be reported screen Source: SIRMA.

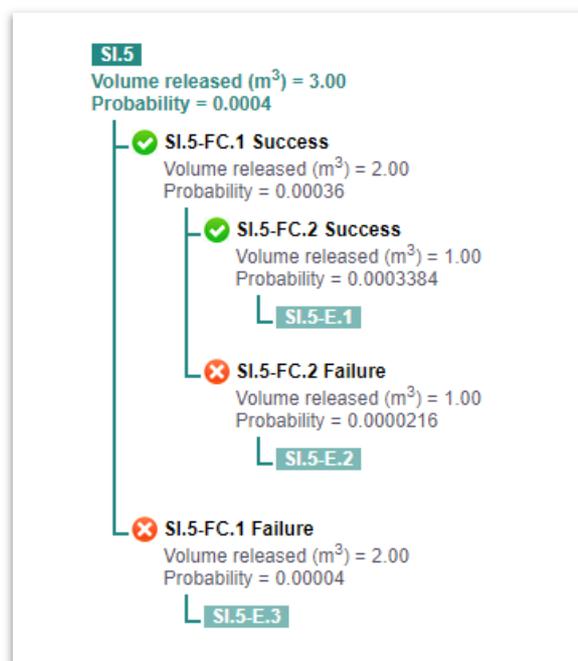
### 9.4.5. ACCIDENT SCENARIOS GENERATION

Once all the conditioning factors have been introduced and their order in which they operate, it is possible to generate their accident scenarios by clicking on the “**Generate accident scenarios**” button.

In addition, an event tree of the initiating event is created and can be viewed clicking on the “**Event tree of the initiating event**” button.



**Figure 9.4.5-1.** Event tree of the initiating event button. Source: SIRMA.



**Figure 9.4.5-2.** Event tree example. Source: SIRMA.

The scenarios generated are shown in the screen on a summary table with the following information:

- “**Modify/See**”. Clicking on the “pencil” symbol (✎) it is possible to see some parameters of the accident scenario created.
- “**Code**”. It is automatically generated with a combination of the initiating event and the accident scenario. For example: SI.1-E.1
- “**Name**”. The name given by the user to the accident scenario.

- **“Volume released (m3)”**. The volume of the polluting agent released associated to the accident scenario. It is calculated by the tool from the information given by the user.
- **“Probability”**. The probability of occurrence of the accident scenario. It is also calculated by the tool from the information given by the user.
- **“Detail”**. Clicking on the “Report” symbol (📄), a new window opens with all the information of the accident scenario.

Modify / See	Code	Name	Volume released (m <sup>3</sup> )	Probability	Detail
	SI.5-E.1		1.00	0.0003384	
	SI.5-E.2		1.00	0.0000216	
	SI.5-E.3		2.00	0.00004	

3 registers found. Page 1

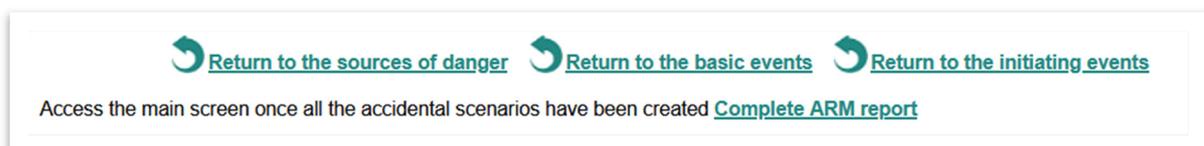
**Figure 9.4.5-3.** Summary table with the accident scenarios of an initiating event. Source: SIRMA.

There is also at the bottom of this screen, three links that allow to come back to the previous screens, in case the user has not finished the analysis and wants to introduce new elements:

- **“Return to the sources of danger”**.
- **“Return to the basic events”**.
- **“Return to the initiating events”**.

Below the links, there following information is shown:

“Access the main screen once all the accidental scenarios have been created [Complete ARM report](#)”



**Figure 9.4.5-4.** Navigation links and completion of the report. Source: SIRMA.

#### 9.4.6. REPORT COMPLETION

Once all the information the user wants to include in the analysis is filled in, it is possible to complete the report on the Consultation of ARM reports screen. If all the information needed by the tool has been introduced, a “report” symbol (📄) will be shown. Clicking on this symbol, the report will be completed.

On the contrary, If there are still information to be introduced, and a warning symbol will appear in this “Complete” column.

Once the report has been completed, this column will show a green verification symbol, and the report can not be edited. If the user wants to change information on this report, it is possible to make a duplicate of the report by clicking on the “Duplicate” button (📄) assigning it a different name.

#### 9.5. USER’S BIBLIOGRAPHICAL SOURCES

Clicking on the '**Registration of bibliographic sources**' section of the navigation panel opens the '**Bibliographic sources entered by the user**' screen. This screen allows users to enter new probability data and prevention and avoidance measures in addition to those already included in the application's own bibliography.

New sources of information, such as data for other hazard sources, including the probability of basic events and initiating events derived from them, or new conditioning factors with associated failure probabilities, can be added. However, it is possible to include additional prevention and avoidance measures for specific initiating events such as spills or fires.

This data, which must be justified, can be used in the ARM reports.

Two tables appear on the "**Bibliographic sources entered by the user**" screen:

- 1) This table collects all the bibliographic sources used to determine the user's own probabilities. Each source is represented by a column containing relevant data.
- 2) This table collects all bibliographic sources of prevention and avoidance measures created by a user. It includes a series of data for each source in columns.

If you haven't registered any of your own bibliographic sources yet, the table will be empty, as shown below.

### Bibliographic sources entered by the user

In this section, the user can register new bibliographic sources, different from those used by default by the ARM application, to be used later in the development of their report.

#### Bibliographic sources of probability

This section allows the user to register new sources of danger, basic events, conditioning factors and assign probabilities to them, always in a justified way.

[Entry data of Bibliographic source](#)



Modify / See	Code	Contents	Version	Sources of Danger categories	Conditioning Factors categories	Remove
There are no records to show.						

No registers has been found in the datasource. Page 1

#### Bibliographic sources of prevention and avoidance measures

This section allows the user to register new prevention and avoidance measures.

[Entry data of Bibliographic source](#)



Modify / See	Code	Version	Contains P. A. measures	P. A. measures	Remove
There are no records to show.					

No registers has been found in the datasource. Page 1

**Figure 9.5-1.**Bibliographic sources introduced by the user. Source: SIRMA.

The table will be populated as described below once a new bibliographic source of probability is added. This table collects various types of information, including informative data such as the code assigned to the bibliographic source and the data version of the ARM module in which the bibliographic source is being created. The remaining columns offer several functions for the following actions:

- **Configure/View.** Clicking on the 'pencil' icon opens the 'General data of the bibliographic source' screen. This screen allows you to view or modify the code, name, and observations associated with the bibliographic source being consulted.

**Bibliographic source general data**

**Bibliographic source data**

Code

Full name

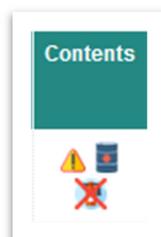
User

Remarks

**Figure 9.5-2.** General data of the bibliographic source. Source: SIRMA.

The Save/Cancel buttons can be used to record the changes made or discard them.

- **Content.** It is a column that allows the user to visually verify the data the bibliographic source contains. Thus, through various icons, it indicates the following aspects to the user:



**Figure 9.5-3.** Content of the bibliographic source. Source: SIRMA.

- **Warning symbol:** It indicates that the bibliographic source cannot yet be selected as a reference in ARM reports because it has no complete sources of danger or conditioning factors. If you place the mouse over this warning, you can view a message that clarifies which elements remain to be completed, for example, *“There are basic events without initiating events.”*
- **Tank icon (Source of danger).** In this case, the icon will be crossed out with a red cross if the source of danger entered is not completed or not crossed out if, on the other hand, all the required information has also been entered in the source of danger such that it can be used in the ARM reports prepared by the

user. Once again, by placing the mouse over the icon of the crossed-out drum, you can consult a message that clarifies which elements are still to be completed.

- **Extinguisher icon (Conditioning factor).** As with the tank icon, the extinguisher will be crossed out with a red cross if the conditioning factor entered is not filled in or not crossed if, on the other hand, all the required information has also been entered in the source of danger such that it can be used in the ARM reports prepared by the user. As with the previous icons, by placing the mouse over the crossed-out extinguisher, you can consult a message that clarifies which elements are still to be completed.
- **Categories Sources of danger.** The “Report” icon gives access to the information contained in the categories of source of danger, either to create them or for consultation/editing.
- **Categories of Conditioning Factors** As in the previous case, through the “Report” icon you can access the information contained in the categories of conditioning factors, either for their creation or consultation/editing.
- **Delete.** Using the trash can icon, the application allows you to delete the selected bibliographic source. Before drafting it, a deletion confirmation screen is displayed.

In the same “**Bibliographic sources introduced by the user**” initial screen - see Figure 9.5-1 - there is also a hyperlink called “Registration of bibliographic source” which is used to begin the process of registering a certain bibliographical source by the users.

### 9.5.1. REGISTRATION OF BIBLIOGRAPHIC SOURCES

The next screen the application displays if you click on the hyperlink to generate a new bibliographic reference is “**Bibliographic source general data**” In this window, the user must fill in the various fields requested for the source generated to be registered properly.

**Bibliographic source general data**

**Bibliographic source data**

Code

Full name

User

Remarks

**Figure 9.5.1-1.** General data of the bibliographic source. Source: SIRMA.

Specifically, the sections to be filled in are as follows:

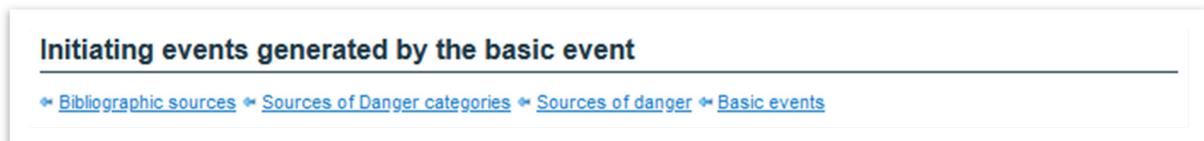
- **Code.** An abbreviated code must be entered into the box to refer to the bibliographic source being added. This code will later be available in the drop-down list of bibliographic sources of the ARM reports. Example: HM2012.
- **Full name.** Here the user must include the full name and date of the bibliographic reference source being added. Example: Hens & Manilla 2012.
- **User.** User's name in the SIRMA application. This is a non-editable field.
- **Remarks.** This is an field filling in which is optional, in which the user may include observations and comments about the bibliographical source he/she deems appropriate.

Once the corresponding fields have been filled in and upon clicking the "Save" button, a new line will be generated in the "**Consult user's bibliographic sources**" table; information may be added to it. This reference will contain the elements "Categories of danger" and "Categories of conditioning factor" marked by the "report" icon. If you click on this icon, you will be able to begin the process of adding information to the bibliographical source.

At this point, the user may enter information about the probability of failure of the sources of danger or probability of activation/failure of the conditioning factors; this data must be filled in for only one of them.

## 9.5.2. DIAGRAM FOR BROWSING BIBLIOGRAPHIC SOURCES ENTERED BY THE USER

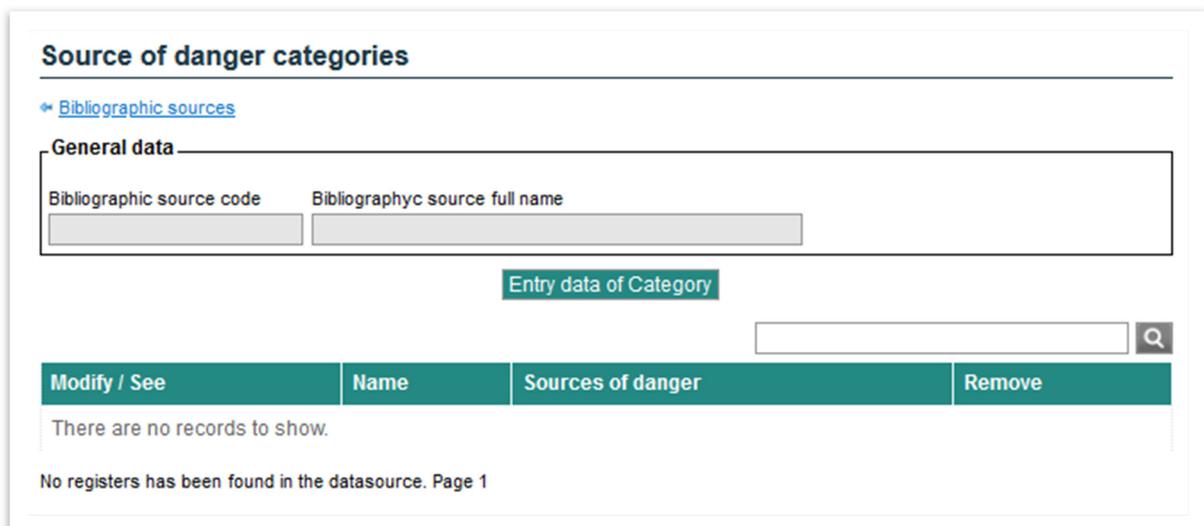
As the user fills in the information in the bibliographical sources he/she generates - whether for the sources of danger or for the conditioning factors - the application generates, at the top of the screen, a diagram for interactive browsing that makes it possible to move from some screens to others by clicking the hyperlinks created.



**Figure 9.5.2-1.** Example of the browsing diagram. Source: SIRMA.

## 9.5.3. INTRODUCTION OF SOURCES OF DANGER

If you click on the report icon in the “Source of danger categories” column, the window opens that allows you to add new source of danger categories.

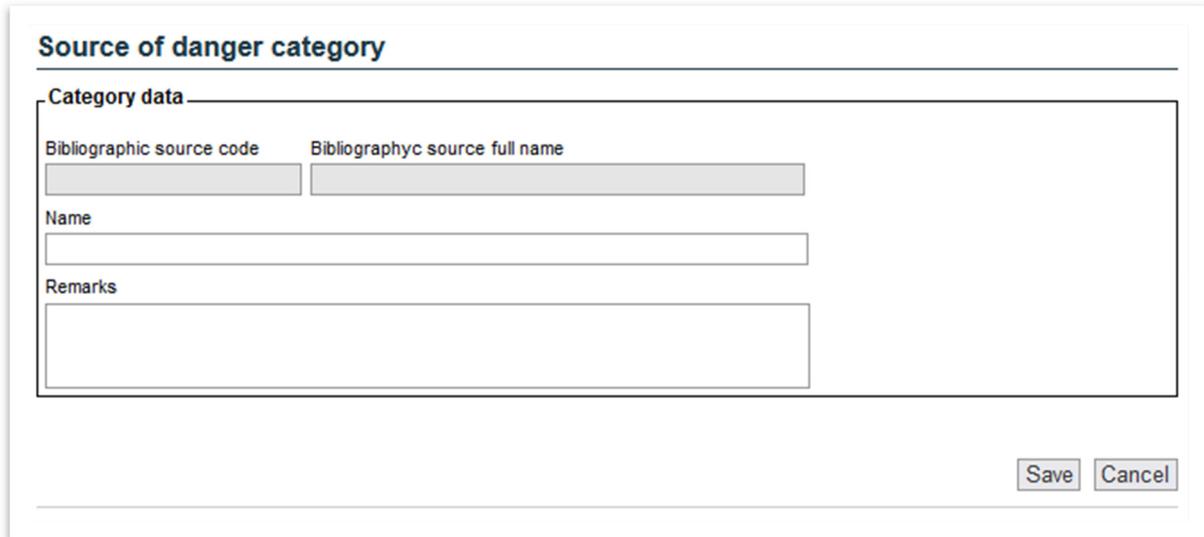


**Figure 9.5.3.-1.** Source of danger categories. Source: SIRMA.

This screen displays the “**Entry data of Category**” button, which begins the process of generating categories of sources of danger.

### 9.5.3.1. CATEGORY OF SOURCE OF DANGER

As indicated previously, the “**Entry data of Category**” button can be used to begin the process of generating categories of sources of danger.



**Source of danger category**

**Category data**

Bibliographic source code	Bibliographic source full name
<input type="text"/>	<input type="text"/>
Name	
<input type="text"/>	
Remarks	
<input type="text"/>	

**Figure 9.5.3.1-1.** Category of source of danger. Source: SIRMA.

More specifically, the data to be filled in in this window is as follows:

- **Name.** It will be necessary to enter the name given to the general category to which the sources of danger would later be added. Example: Tanks; Pipelines; Containers.
- **Remarks:** As on other occasions, this is a field filling in which is optional, in which the user may include observations and comments about the category of source of danger he/she deems appropriate.

If you press the “Save” button, it will record the new source of danger category.

Once a certain category has been created, the user may add one or several sources of danger thereto, for example, several types of tanks - single wall, double wall, etc. - by pressing the “report” icon that appears in the table created in “**Sources of danger categories**” The “pencil” icon can be used to edit the information assigned to the Category of source of danger and the “trash can” icon can be used to delete it.

### Source of danger categories

[Bibliographic sources](#)

**General data**

Bibliographic source code

Bibliographic source full name

**Entry data of Category**

Modify / See	Name	Sources of danger	Remove

One register found. Page 1

**Figure 9.5.3.1-2.** Categories of source of danger. Source: SIRMA.

As mentioned previously, at this point, the user may continue with the process of adding information by clicking on the “report” icon under the “Sources of danger” section in the table, thus opening the “**Sources of danger**” screen.

### 9.5.3.2. SOURCES OF DANGER

As stated in the previous section, to continue with the process of adding information, it is necessary to click on the “report” icon under the “Sources of danger” section of the table. The application thus opens the “**Sources of danger**” screen.

### Sources of danger

[Bibliographic sources](#) [Sources of Danger categories](#)

**General data**

Bibliographic source code

Bibliographic source full name

Source of danger category

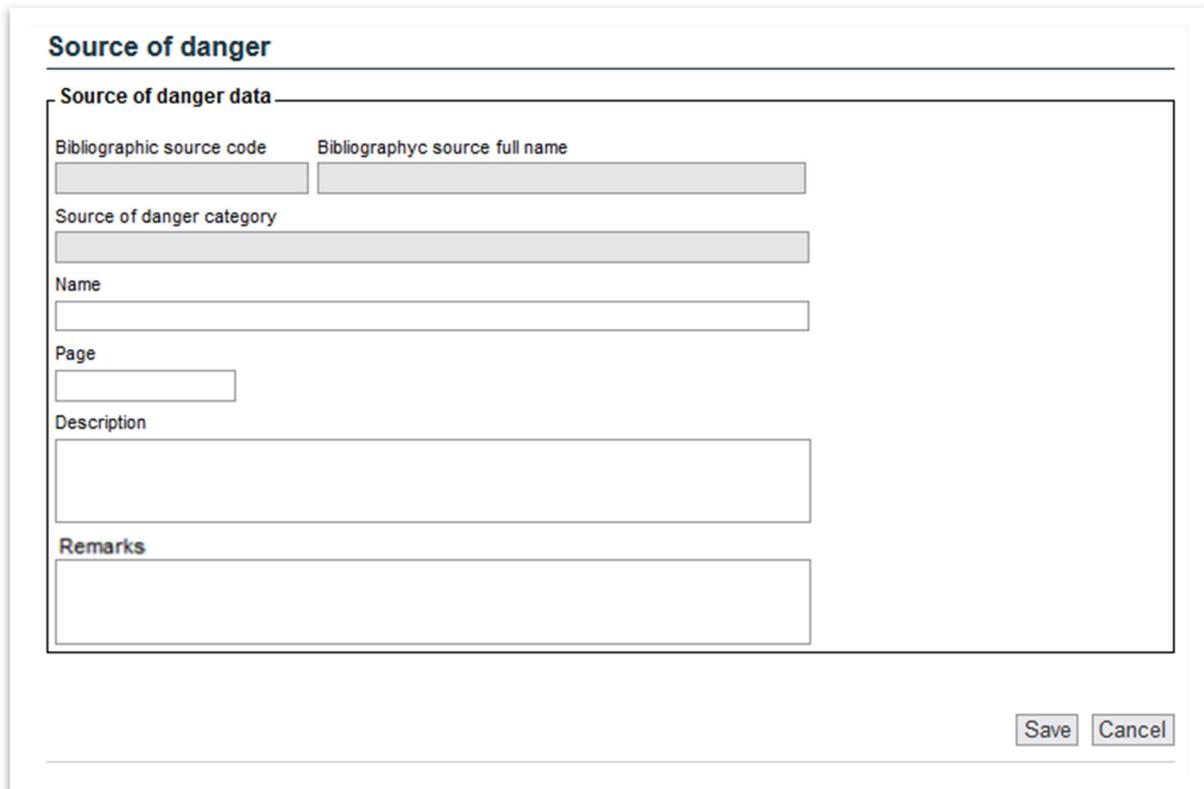
**Entry data of Source of danger**

Modify / See	Name	Available in ERA reports	Basic events	Remove
There are no records to show.				

No registers has been found in the datasource. Page 1

**Figure 9.5.3.2-1.** Sources of danger. Source: SIRMA.

The “**Sources of danger**” window contains the “**Entry data of Source of danger**” button, which makes it possible to add one or more sources of danger to the category being reported on.



**Source of danger**

**Source of danger data**

Bibliographic source code      Bibliographic source full name

Source of danger category

Name

Page

Description

Remarks

Save    Cancel

**Figure 9.5.3.2-2.** Data of the Source of danger. Source: SIRMA.

The information the computer application requests about each source of danger that is to be added to the category is as detailed below.

- **Name.** The specific name of the source of danger being described must be entered. An example would be: Single-layer above-ground tanks.
- **Page.** Include the page reference in the bibliography from which information is being extracted. This field is not mandatory since the probability can be extracted from own statistics if properly justified.
- **Description.** Add the detailed description contained in the bibliography - or as determined by the user in the case of own records - for the source of danger entered - specific characteristics or specific conditions for the probability. An example of this description would be to include the source of danger material, its operating conditions, etc.

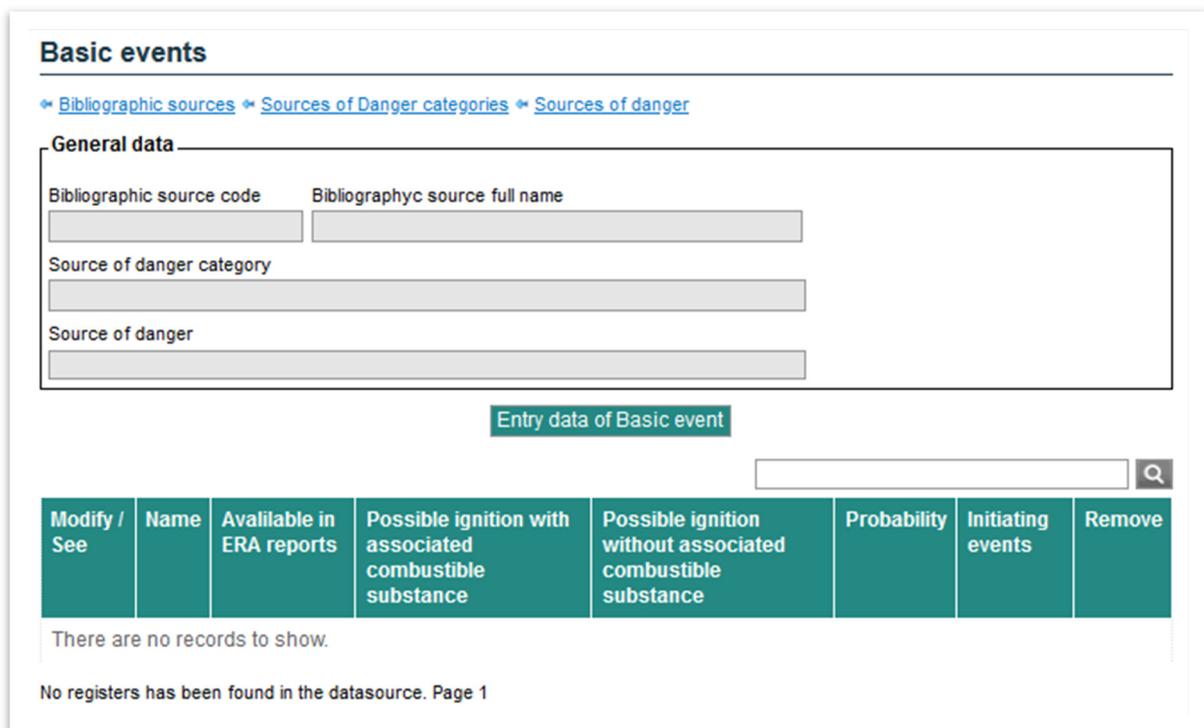
- **Remarks:** Again, this is an field filling in which is optional, in which the user may include observations and comments about the source of danger he/she deems relevant.

Use the Save/Cancel buttons to save the data entered or to discard it.

Once the source of danger is generated, it appears in the “**Sources of danger**” table (see Figure 9.5.3.2-1) in which, besides being able to edit the aforementioned fields (“pencil” icon) or to delete the source of danger (“trash” icon), the column “Available in ARM reports” states whether the source of danger has had all the information filled in so that it is possible to use it in ARM reports. Moreover, the table includes the “Basic events” field (“report” icon) which can be used to access a new screen on which you may register the basic events associated with the source of danger.

### 9.5.3.3. BASIC EVENTS

As introduced in the previous section, to begin the process of adding information to the basic events of a source of danger, click on the “report” icon in the “Basic events” column of the “**Sources of danger**” table (see Figure 9.5.3.2-1).



**Basic events**

[Bibliographic sources](#)
[Sources of Danger categories](#)
[Sources of danger](#)

**General data**

Bibliographic source code:   
 Bibliographic source full name:   
 Source of danger category:   
 Source of danger:

**Entry data of Basic event**

Modify / See	Name	Available in ERA reports	Possible ignition with associated combustible substance	Possible ignition without associated combustible substance	Probability	Initiating events	Remove
There are no records to show.							

No registers has been found in the datasource. Page 1

**Figure 9.5.3.3-1.** Basic events. Source: SIRMA.

In the new window and using the “**Entry data of Basic event**” button, it will be possible to assign one or more basic events to the source of danger.

### Basic event

**Basic event data**

Bibliographic source code      Bibliographic source full name

Source of danger category

Source of danger

Name

Possible ignition with associated combustible substance

Possible ignition without associated combustible substance

Description

Remarks

**Figure 9.5.3.3-2.** Data of the Basic event. Source: SIRMA.

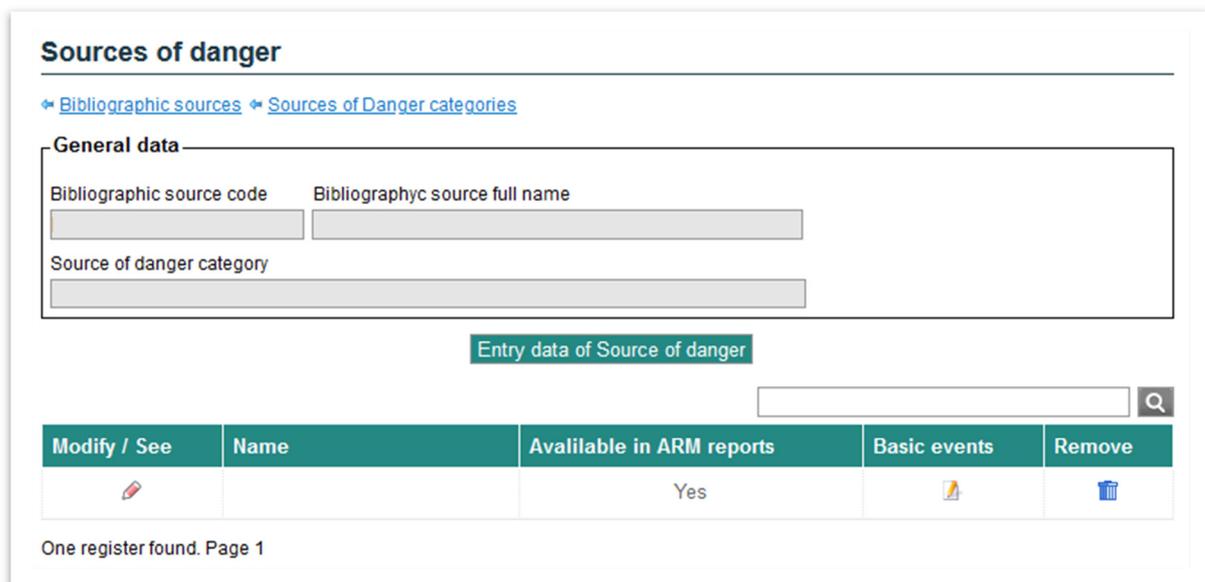
Specifically, the information requested to record a basic event associated with a source of danger is that which is listed below.

- **Name.** This box must be filled in with the specific name of the basic event. An example of a basic event could be a breakage in the tank.
- **Possible ignition with an associated combustible substance.** This is a validation box that allows you to indicate whether the basic event may cause fire-type initiating events with spillage of an associated substance.
- **Possible ignition without an associated combustible substance.** This is a validation box that allows you to indicate whether the basic event may cause fire-type initiating events without spillage of an associated substance. These would be fires generated by a spark or similar and they would not have an associated combustible substance. This type of initiating event need not involve an associated volume of substance, making it possible to indicate in the corresponding box that the quantity spilt is zero.

- **Description.** Detailed description of the basic event set out in the literature (specific characteristics or conditions for the probability). For example, Total breakage for volumes of more than 1000 kg.
- **Remarks:** Again, this is an field filling in which is optional, in which the user may include, if he/she so wishes, observations and comments about the basic event.

As on other screens, use the Save/Cancel buttons to save the data entered or to discard it.

Once a basic event has been recorded in a source of danger, it shall be set out in the table of the source of danger basic events being reported.



**Sources of danger**

← [Bibliographic sources](#) ← [Sources of Danger categories](#)

**General data**

Bibliographic source code      Bibliographic source full name

Source of danger category

Entry data of Source of danger

Modify / See	Name	Available in ARM reports	Basic events	Remove
		Yes		

One register found. Page 1

**Figure 9.5.3.3-3.** Basic events. Source: SIRMA.

This table sets out, for information purposes, the data entered in the previous screen - name, possible ignition with associated fuel substance and possible ignition without associated fuel substance -, the availability of the basic event in the ARM reports and the following icons are enabled:

- **Configure/See.** The pencil icon allows you to modify the data associated with the basic event.
- **Probability.** Clicking on the report icon enables the functionality that allows you to enter the probability associated with the basic event. This screen is described below.
- **Initiating events.** Once the probability of the basic event is entered, this icon allows you to associate the initiating events to the basic event that is being reported. Until the probability of the basic event is available, it is not possible to

report the initiating events; a warning icon appears in this column with the message “*The probability of the basic event must be reported.*”

- **Delete.** Using the trash can icon and, after a confirmation, it is possible to eliminate the basic event record.

**Basic event probability**

[← Bibliographic sources](#)
[← Sources of Danger categories](#)
[← Sources of danger](#)
[← Basic events](#)

**General data**

Bibliographic source code 
 Bibliographic source full name

Source of danger category

Source of danger

Basic event

**Entry data of Probability**



Modify / See	Units of the basic event	Probability	Fields	Remove
There are no records to show.				

No registers has been found in the datasource. Page 1

**Figure 9.5.3.3-4.** Probability of the basic event. Source: SIRMA.

As previously discussed, clicking on the report icon in the “Probability” column opens the window which allows you to enter the probability of the basic event using the “**Entry data of Probability**” button.

### Probability related to the basic event

**Probability of the basic event data**

Bibliographic source code  Bibliographic source full name

Source of danger category

Source of danger

Basic event

Units of the basic event  Probability

Description

Remarks

**Figure 9.5.3.3-5.** Probability related to the basic event. Source: SIRMA.

The information requested to register the probability of a basic event's occurring is as listed below.

- **Units of the basic event.** The probability assigned to the basic event in the bibliography must be entered. The final unit of probability must be expressed in "Failures per year." This is why the fields containing this unit of probability, for example: Failures per year per tank must then be entered by the user, using the "field" functionality, which will multiply the probability of the basic event entered in this section - in the case of the example, the "Number of tanks" field must be added later.
- **Probability.** Numerical probability associated in the bibliography to the basic event. As noted above, the final probability of the basic event shall be conditioned by the fields affecting its units, such that it ends up being expressed in "Failures per year."
- **Description.** The specific conditions included in the bibliography for the aforementioned probability must be added in this box.
- **Remarks:** This is an field filling in which is optional, in which the user may include, if he/she so wishes, observations and comments about the basic event.

### Basic event probability

[Bibliographic sources](#)
[Sources of Danger categories](#)
[Sources of danger](#)
[Basic events](#)

**General data**

Bibliographic source code

Bibliographic source full name

Source of danger category

Source of danger

Basic event



Modify / See	Units of the basic event	Probability	Fields	Remove
				

One register found. Page 1

**Figure 9.5.3.3-6.** Probability of the basic event. Source: SIRMA.

Once the probability of occurrence has been assigned to the basic event, it is possible to add the fields that would modify said probability, by multiplying both items. For example, if the probability of the basic event is expressed in failures per number of tanks per year, this “field” would make it possible to enter a “number of elements” item that would later make it easier in the ARM report to introduce this item into the analysis.

Upon clicking the “Report” icon in the “Fields” column and upon pressing the “**Entry data of Field**” button, the application opens a new window that allows this information to be entered.

### Field that affects the probability of the basic event

Field that affects the probability of the basic event data

Bibliographic source code	Bibliographic source full name
<input type="text"/>	<input type="text"/>
Source of danger category	
<input type="text"/>	
Source of danger	
<input type="text"/>	
Basic event	
<input type="text"/>	
Units of the basic event	Probability
<input type="text"/>	<input type="text"/>
Field	
<input type="text"/>	

**Figure 9.5.3.3-7.** Field that affects the probability of the basic event. Source: SIRMA.

The drop-down menu the application offers may be used to enter the field that affects the probability of the basic event's occurring. As many fields may be registered as elements affecting the probability.

- **Field.** The drop-down menu includes a series of generic fields: number of elements, length, diameter, number of uses, etc. A field would be created in the ARM report whose value would be multiplied by that of the probability of the basic event.

Entry data of Field

Name	Remove
Number of equipments	

One register found. Page 1

 [Return to the basic events](#)

**Figure 9.5.3.3-8.** Fields that affect the probability of the basic event. Source: SIRMA.

The fields entered shall be set out in the table on the “Fields affecting the probability of the basic event” screen, which also allows them to be deleted using the “trash” icon.

When the fields affecting the probability of the basic event - if any - are completed, the initiating event(s) associated with the basic event being reported continues being registered. This is not a mandatory field, that is, if the probability were expressed directly in failures/year, it would not be necessary to enter information in this section.

This screen also features a hyperlink that allows you to return to the “**Basic events**” screen once the fields required to calculate the probability of the basic event has been fully added.

**Basic events**

[← Bibliographic sources](#)
[← Sources of Danger categories](#)
[← Sources of danger](#)

**General data**

Bibliographic source code 
 Bibliographic source full name

Source of danger category

Source of danger

Entry data of Basic event



Modify / See	Name	Available in ARM reports	Possible ignition with associated combustible substance	Possible ignition without associated combustible substance	Probability	Initiating events	Remove
		Yes	Yes	No			
		No	No	No			

2 registers found. Page 1

**Figure 9.5.3.3-9.** Basic events. Source: SIRMA.

Once the probability of the basic event has been finished, the application enables the “Report” icon in the “Initiating events” column, which makes it possible to add one or several initiating event to the basic event entered.

#### 9.5.3.4. INITIATING EVENTS

As described previously, the “Report” icon in the “Initiating events” column of the “**Basic events**” table, may be used to add one or more initiating events to the basic event entered on the “**Initiating events related to the basic event**” screen.

### Initiating events generated by the basic event

[Bibliographic sources](#)
[Sources of Danger categories](#)
[Sources of danger](#)
[Basic events](#)

**General data**

Bibliographic source code  Bibliographic source full name

Source of danger category

Source of danger

Basic event

**Entry data of Initiating event**

The sum of the modifiers is 0.00

Modify / See	Initiating event	Modifier	Remove
There are no records to show.			

No registers has been found in the datasource. Page 1

**Figure 9.5.3.4-1.** Initiating event generated by the basic event. Source: SIRMA.

By means of the “**Entry data of Initiating event**” button, the tool makes it possible to add initiating events to a certain basic event.

### Initiating event related to the basic event

**Basic event data**

Bibliographic source code  Bibliographic source full name

Source of danger category

Source of danger

Basic event

Initiating event

Modifier

Enter the value 1 if there is only one initiating event for the basic event

Remarks

**Figure 9.5.3.4-2.** Initiating event related to the basic event. Source: SIRMA.

The fields you are asked to fill in on the initiating event date entry screen are as follows:

- **Initiating event.** The field is structured as a drop-down list that lists the types of initiating events that can be generated from a basic event. Specifically, it is possible to enter initiating events such as spillage, fire or emission of solid particles.
- **Modifier.** It is a numerical number that would be multiplied by the probability of the basic event. It is used if a basic event generates several types of initiating events, and it is therefore necessary to distribute its probability of occurring. If, for example, a given basic event may evolve into various types of fire and a spillage, each must have associated with it its corresponding percentage probability of the basic event. The sum of the probability of all the initiating events deriving from the same basic event must be the probability associated therewith or, in other words, the sum of all the modifiers affecting the same basic event must be 1.

If a certain basic event can only generate an initiating event, the entire probability thereof will pass to the initiating event such that the Modifier will be the unit. The following measure is therefore attached to the cell:

*“Enter the value 1 if there is only one initiating event for the basic event.”*

- **Remarks:** As in previous screens, this is an open field filling in which is optional. It would include the specific characteristics of the initiating event entered if they existed.

As discussed previously, once all the information for a given basic event is completed - with its initiating event(s) correctly reported - the application indicates, on the main screen of “**Sources of danger**”, that it is available for use in ARM reports using an information column in the source of danger whence it derives: Available in ARM reports: Yes/No. Besides this, on the “**Bibliographic sources entered by the user**” screen, in the “Content” column, the “Deposit” icon, representing the sources of danger, will be unlocked.

## 9.5.4. INTRODUCTION OF CONDITIONING FACTORS

### 9.5.4.1. CATEGORY OF CONDITIONING FACTORS

Should the user wish to include in the bibliographic source that may have generated a conditioning factor so that it subsequently appears available in his/her ARM reports, he/she must access, from the “Conditioning factors categories” column of the main screen, “**Bibliographic sources entered by the user**” by pressing the “report” icon.

### Conditioning factor categories

[Bibliographic sources](#)

**General data**

Bibliographic source code  Bibliographic source full name

**Entry data of Category**

Modify / See	Nombre	Conditioning factors	Remove
There are no records to show.			

No registers has been found in the datasource. Page 1

**Figure 9.5.4.1-1.** Categories of conditioning factor. Source: SIRMA.

This screen contains the button “**Entry data of Category,**” with which you can register a category of conditioning factors, to which it will subsequently be possible to add the relevant conditioning factors and their probabilities.

### Conditioning factor category

**Category data**

Bibliographic source code  Bibliographic source full name

Nombre

Description

Remarks

**Figure 9.5.4.1-2.** Category of conditioning factor. Source: SIRMA.

The information the application requests to register a new category of conditioning factors is as follows:

- **Name.** It would be necessary to include the name of the general category to which the conditioning factor(s) will later be added. Examples of these categories would include: Automatic containments, fire extinguishing means, etc.
- **Description.** Specific description set out in the bibliography for the category of conditioning factors added.
- **Remarks.** Again, this is an open field filling in which is optional. It would include the specific characteristics of the category of sources of danger that have been included in the description.

**Conditioning factor categories**

[← Bibliographic sources](#)

**General data**

Bibliographic source code

Bibliographic source full name

[Entry data of Category](#)

Modify / See	Nombre	Conditioning factors	Remove
			

One register found. Page 1

**Figure 9.5.4.1-3.** Categories of conditioning factor. Source: SIRMA.

Once the category of sources of danger has been created, it is possible to add to this category one or more conditioning factors; continuing with the example, several types of automatic containment could be introduced: rafts, valves, etc. To do so, it will be necessary to click on the “report” icon in the “Conditioning factors” column.

#### 9.5.4.2. CONDITIONING FACTORS

As previously specified, by using the “report” icon on the “**Conditioning factor categories**” screen, the “**Conditioning factors**” window is displayed; the user can use this to add one or more conditioning factors to the category created.

### Conditioning factors

[Bibliographic sources](#)
[Conditioning Factors categories](#)

**General data**

Bibliographic source code  Bibliographic source full name

Conditioning factor category

**Entry data of Conditioning factor**

Modify / See	Name	Fail rate	Remove
There are no records to show.			

No registers has been found in the datasource. Page 1

**Figure 9.5.4.2-1.** Conditioning factors. Source: SIRMA.

Once in the “**Conditioning factors**” screen of the Category being filled in, it is possible to add factors by clicking on the “**Entry data of Conditioning factor**” button.

### Conditioning factor

**Conditioning factor data**

Bibliographic source code  Bibliographic source full name

Conditioning factor category

Name

Fail rate  Page

Description

Remarks

**Figure 9.5.4.2-2.** Conditioning factor. Source: SIRMA.

On the conditioning factor registration screen, the application requests the following information:

- **Name.** The user must enter the specific name of the conditioning factor within the category to which it belongs. An example would be: Automatic raft-type containment.
- **Failure rate.** The probability of failure on the part of the conditioning factor set out in the bibliography that is being used as a reference.
- **Page.** The user may include in this cell the page that sets out the probability in the bibliography used. This is an optional field since the probability may come from own records.
- **Description.** Description set out in the bibliography for the conditioning factor introduced (specific characteristics or conditions for the probability). For example, conditioning factor material, etc.
- **Remarks:** Open field filling in which is optional. It would include the specific characteristics of the category of sources of danger that have been included in the description.

When the user enters complete information for a specific conditioning factor, the application displays the following message: *“The conditioning factors listed below may be used in ARM reports.”*

At the same time, on the main **“Bibliographic sources entered by the user”** screen in the “Content” column, the “Extinguisher” icon will be unlocked; this represents the conditioning factors, which indicates there are conditioning factors in this bibliographic source that may be used in ARM reports.

## 9.6. PREVENTION AND AVOIDANCE MEASURES

### 9.6.1. RATIONALE AND METHODOLOGY OF P&A MEASUREMENT FUNCTIONALITY

The SIRMA IT platform includes functionality for preventing and avoiding environmental risks. This functionality assists operators in incorporating these measures into the risk estimation process for installations subject to environmental risk analysis. To achieve this goal, the module incorporates a catalogue of prevention and avoidance measures along with their corresponding unit costs. The user can modify these costs if necessary.

Prevention and avoidance measures are incorporated in the ARM reports, either through an individual report or an overall project. These measures are added to the sources of hazards that have already been identified and finalised. The new measures are now displayed as a separate column in the user's ARM report repository table.

New measures to prevent and avoid damage are implemented at the source of the hazard. The tool enables the addition of prevention and avoidance measures for each hazard source identified in the ARM report being analysed.

The user can select the most suitable measures from the proposals and apply them in the desired quantity to their installation and the element being assessed. In other words, the catalogue presents measures in monetary units per unit of pollutant collected (euros per cubic metre) or per unit of measure applied (euros per metre of barrier). The user can indicate the number of units of each prevention and avoidance measure they wish to include in their budget.

The cost of prevention and avoidance measures displayed on the screen corresponds to the amount recorded in the prevention and avoidance measures catalogue (SIRMA, 2023). If the user has more specific and well-supported information for their case, they can adjust this amount in a justified manner. If default information is changed, the application will display a notification.

The prevention and avoidance measures catalogue, from which the SIRMA costs are derived, has been compiled after a thorough review of the market costs for each measure. After conducting the literature review, we have only considered the costs that pertain to the retention capacity of the measure in question. On this basis, after carrying out the necessary calculations - in most cases the price of the prevention/avoidance measure in relation to the absorption/retention capacity of the material, the unit cost of each measure was determined (€/litre of dispersant; €/metre of barrier; €/extinguisher, etc.)

If multiple unit costs were available for the same prevention or avoidance measure, the average of the unit costs was calculated or the highest value was selected, following a conservative approach. The market costs are displayed in the application under the reference SIRMA (2023) to avoid advertising commercial information related to the websites and secondary sources consulted to determine the costs provided by the software application.

In addition to the measures available in the SIRMA catalogue, the software tool allows users to add new bibliographic sources of prevention and avoidance measures to the report. This feature enables users to include measures that are not listed in the catalogue. To achieve this goal, new measures for prevention and avoidance will be incorporated in the user bibliography functionality (refer to section 9.7. Bibliographic sources of prevention and avoidance measures).

Upon completion of this module, the user will receive a final budget that is categorised by hazard source. The budget will include all analysed measures for each hazard source, along with their associated implementation costs.

The purpose of requesting a quote in SIRMA for prevention and avoidance measures is to enable the operator to estimate the cost (in euros) of implementing these measures in their installation for risk management in compliance with environmental liability regulations. The operator can use these measures as conditioning factors in the Environmental Risk Analysis to reduce the risk and, therefore, the required financial security for its installations.

## 9.6.2. ACCESS TO P&A MEASUREMENT FEATURE

On the initial **ARM 'Report Repository'** screen, as shown in the figure below, there is a column labelled 'P.A. Measures'. This column contains an edit icon (  ) labelled 'Prevention and avoidance measures', which only appears for finalised ARM reports.

This icon leads to the screen for prevention and avoidance measures, where users can register the necessary measures.

### Consultation of ARM reports

---

Search panel

Name	Date from	Date to	Completed	Q
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	

[Entry data of Report](#)

Name	Date	Version	Complete	Duplicate	P. A. measures	Modify / See	Remove
		ARMV1	✓				

One register found. Page 1

**Figure 9.6.2-1.** Access to the Prevention and Avoidance Measures "P.A. Measures" from the ARM report history. Source: SIRMA.

This feature stores the generated information and enables the printing of a report containing the budget data for the implemented hazard prevention and avoidance measures.

## 9.6.3. PREVENTION AND AVOIDANCE MEASURE

Once you click on the edit icon for the 'P.A. Measures' column, the screen shown below will open.

### Prevention and avoidance measures

[ARM Reports](#)

**General data**

ARM Report  Completed

[View budget](#)

Name of source of danger	Bibliographic source	Source of danger	Applied P. A. measures total (€)	Measures
			0.00	
<b>Report total (€)</b>			<b>0.00</b>	

**Figure 9.6.3-1.** Initial screen displaying prevention and avoidance measures. Source: SIRMA.

The prevention and avoidance measures table displays the names of the hazard sources, along with their bibliographic sources and the selected hazard source from the ARM module. These hazard sources have been preloaded in the ARM report, allowing the user to attach appropriate measures to each one.

Clicking on the edit icon () will take you to the screen for Prevention and Avoidance Measures applied to the hazard source. This is where you can enter the measures. To do this, click on the "Entry data of measure" button on the screen below.

### Prevention and avoidance measures applied to the source of danger

[Prevention and avoidance measures](#)

**General data**

ARM Report  Completed

Name of source of danger  Bibliographic source  Page  Source of danger

[Entry data of Measure](#)

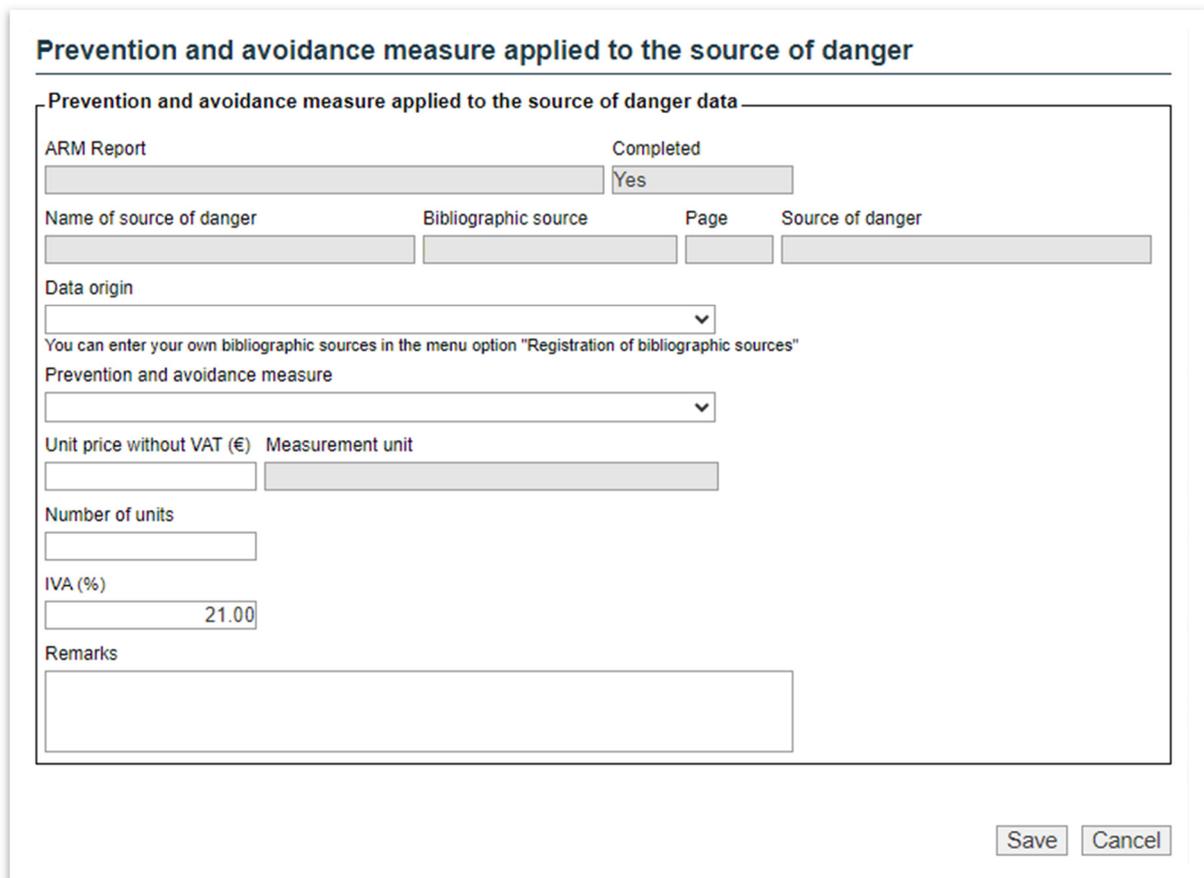
Modify / See	Name	Unit price without VAT (€)	Measurement unit	No. units	VAT (%)	Total (€)	Remove
There are no records to show.							
<b>Source of danger total (€)</b>						<b>0.00</b>	

**Figure 9.6.3-2.** Discharge screen for prevention and avoidance measures. Source: SIRMA.

After clicking on the 'Entry Data of Measure' button, a screen will appear displaying a breakdown of the prevention and avoidance measures applied to the hazard source (refer to the screen below). On this screen, the user is prompted to specify the data source - either SIRMA or another bibliographic source suggested by the operator - as well as the prevention and avoidance measures and the number of units.

The tool loads the unit price, excluding VAT (€), and its units of measurement. You can manually modify the default price and VAT %. Additionally, there is a comments section available for users to include any relevant notes.

Clicking 'Save' will save the measure data and allow for registration of the next one.



**Prevention and avoidance measure applied to the source of danger**

Prevention and avoidance measure applied to the source of danger data

ARM Report Completed

Name of source of danger Bibliographic source Page Source of danger

Data origin

You can enter your own bibliographic sources in the menu option "Registration of bibliographic sources"

Prevention and avoidance measure

Unit price without VAT (€) Measurement unit

Number of units

IVA (%)

Remarks

**Figure 9.6.3-3.** Prevention and avoidance measure data screen. Source: SIRMA.

The user should repeat this process for each source of danger in their installation, registering prevention and avoidance measures and filling in the corresponding data for each measure.

After including the desired measures in each hazard source, click on the hyperlink in the top left-hand corner of the screen labelled '←Prevention and avoidance measures' (as shown below) to return to the budget screen.

### Prevention and avoidance measures applied to the source of danger

[← Prevention and avoidance measures](#)

**General data**

ARM Report  Completed

Name of source of danger  Bibliographic source  Page  Source of danger

**Entry data of Measure**

Modify / See	Name	Unit price without VAT (€)	Measurement unit	No. units	VAT (%)	Total (€)	Remove
	Absorbent rolls	1.21	Retained liter	10.00	21.00	14.64	
	Absorbent or adsorbent particulate material.	3.95	Retained liter	50.00	21.00	238.98	
<b>Source of danger total (€)</b>						<b>253.62</b>	

**Figure 9.6.3-4.** '←Prevention and avoidance measures' link. Source: SIRMA.

To return to the main ARM report repository screen, click on the hyperlink labelled 'ARM Reports' located at the top left of the screen (refer to the screen below).

### Prevention and avoidance measures

[← ARM Reports](#)

**General data**

ARM Report  Completed

**View budget**

Name of source of danger	Bibliographic source	Source of danger	Applied P. A. measures total (€)	Measures
			253.62	
<b>Report total (€)</b>			<b>253.62</b>	

**Figure 9.6.3-5.** '←ARM Reports' link. Source: SIRMA.

After completing the prevention and avoidance measures, the 'P.A. measures' column is marked in green () , distinguishing it from the previous report icon. Once the prevention and avoidance measures have been completed, the table in the ARM report repository screen will appear as follows:

Name	Date	Version	Complete	Duplicate	P. A. measures	Modify / See	Remove
		ARMV1	✓				

**Figure 9.6.3-6.** The ARM report indicates that prevention and avoidance measures have been completed. Source: SIRMA.

### 9.6.4. P&A MEASURES BUDGET

On the following screen, you can click the 'View budget' button to access the budget breakdown.

**Prevention and avoidance measures**

[ARM Reports](#)

**General data**

ARM Report	Completed
<input type="text"/>	<input type="text" value="Yes"/>

[View budget](#)

Name of source of danger	Bibliographic source	Source of danger	Applied P. A. measures total (€)	Measures
			253.62	
<b>Report total (€)</b>			<b>253.62</b>	

**Figure 9.6.4-1.** 'View budget' button. Source: SIRMA.

Once you click on 'view budget', you will receive a breakdown of the costs for all added measures. This includes the unit price without VAT (€), the measurement unit, the number of units, the VAT (%), and the total (€), as shown in the screen below. Additionally, the screen displays a button labelled 'Print Budget'.

### Prevention and avoidance measures budget

[← Prevention and avoidance measures](#)

**General data**

ARM Report  Completed

Yes

**Print budget**

Prevention and avoidance measure	Unit price without VAT (€)	Measurement unit	No. units	VAT (%)	Total (€)
<b>Source of danger:</b>					
Absorbent rolls	1.21	Retained liter	10	21.00	14.64
Absorbent or adsorbent particulate material.	3.95	Retained liter	50	21.00	238.98
<b>total (€)</b>					<b>253.62</b>
<b>Report total (€)</b>					<b>253.62</b>

**Figure 9.6.4-2.** Budget breakdown of prevention and avoidance measures with a 'print budget' button. Source: SIRMA.

### 9.6.5. PRINTABLE REPORT

At this point, you have the option to download a printable document that summarises the budget breakdown of prevention and avoidance measures in a PDF format. After clicking on the 'Print budget' button, the user is presented with the option to open or save the printable report. The report will appear as shown below:



**PREVENTION AND AVOIDANCE MEASURES BUDGET**

ARM

Prevention and avoidance measure	Unit price w/o VAT (€)	Original unit price w/o VAT (€)	Measurement unit	No. units	VAT (%)	Original VAT (%)	Total (€)	
Source of danger:								
Absorbent rolls	1.21		Retained liter	10	21.00		14.64	
Absorbent or adsorbent particulate material.	3.95		Retained liter	50	21.00		238.98	
total (€)							253.62	
							Report total(€)	253.62

**Figure 9.6.5-1.** Printable budget in PDF format. Source: SIRMA.

## 9.7. PREVENTION AND AVOIDANCE MEASURES BIBLIOGRAPHIC SOURCES

### 9.7.1. PREVENTION AND AVOIDANCE MEASURES BIBLIOGRAPHIC SOURCE REGISTRATION

To add a new bibliographic source with prevention and avoidance measures, click on the 'Entry data of Bibliographic source' hyperlink located at the bottom left of the 'Bibliographic sources entered by the user' screen, as shown below:

#### Bibliographic sources entered by the user

In this section, the user can register new bibliographic sources, different from those used by default by the ARM application, to be used later in the development of their report.

**Bibliographic sources of probability**

This section allows the user to register new sources of danger, basic events, conditioning factors and assign probabilities to them, always in a justified way.

[Entry data of Bibliographic source](#)

Modify / See	Code	Contents	Version	Sources of Danger categories	Conditioning Factors categories	Remove
			ARMV1			
			ARMV1			
			ARMV1			
			ARMV1			
			ARMV1			

7 registers found. Showing from 1 to 5 [1](#) [2](#) [Next](#) [Last](#)

**Bibliographic sources of prevention and avoidance measures**

This section allows the user to register new prevention and avoidance measures.

[Entry data of Bibliographic source](#)

Modify / See	Code	Version	Contains P. A. measures	P. A. measures	Remove
There are no records to show.					

No registers has been found in the datasource. Page 1

**Figure 9.7.1-1.** Bibliographic sources for prevention and avoidance measures should be cited. Source: SIRMA.

Clicking on the hyperlink to generate a new bibliographic reference will display the 'Bibliographic source of prevention and avoidance measures general data' screen. The user must complete the required fields in this window to ensure proper registration of the generated source.

**Bibliographic source of prevention and avoidance measures general data**

**Bibliographic source data**

Code

Full name

User

Remarks

Save Cancel

**Figure 9.7.1-2.** Details of the bibliographic source. Source: SIRMA.

The following sections are required to be completed:

- **Code.** Enter an abbreviated code in the box to refer to the bibliographic source being incorporated. This code will be available in the source drop-down menu of the prevention and avoidance measures data in the ARM reports. Example: LP2014.
- **Full Name.** The full name and date of the bibliographic reference source being entered must be included by the user. Example: López Prix 2014.
- **User.** User's name in the SIRMA application. This field is not editable.
- **Remarks.** This field is optional and allows the user to include any relevant observations or comments on the bibliographic source.

After filling in the corresponding fields and clicking the 'Save' button, a new entry will be created in the '**Bibliographic Sources of Prevention and Avoidance Measures**' table, allowing for additional information to be added. The column labelled 'P.A. measures' and marked with the 'report' icon will be displayed in this reference. Clicking on this icon will start the process of adding information to the bibliographic source.

## 9.7.2. INTRODUCTION OF PREVENTION AND AVOIDANCE MEASURES

By clicking on the report icon in the 'P.A. Measures' column mentioned above, the user can access a window to add new prevention and avoidance measures.

### Prevention and avoidance measures

[Bibliographic sources](#)

**General data**

Bibliographic source code  Bibliographic source full name

**Entry data of Measure**

Modify / See	Code	Name	Type of initiating event	Unit price without VAT (€)	Measurement unit	Remove
There are no records to show.						

No registers has been found in the datasource. Page 1

**Figure 9.7.2-1.** Display of prevention and avoidance measures. Source: SIRMA.

This screen features an **'Entry data of Measure'** button that initiates the process of creating prevention and avoidance measures. One or more prevention and avoidance measures can be included in the literature source being reported.

### Prevention and avoidance measure

**Prevention and avoidance measure data**

Bibliographic source code  Bibliographic source full name

Code  Name

Type of initiating event  Unit price without VAT (€)  Measurement unit

Description

Remarks

**Figure 9.7.2-2.** Prevention and avoidance measure data. Source: SIRMA.

Below are the details of the information required by the software application for each prevention and avoidance measure to be included in the bibliographic source.

- **Code.** Enter a short code in the box to refer to the prevention and avoidance measures being introduced. Example: LP2014.
- **Name.** Please enter the specific name of the prevention and avoidance measure being described. Example: Absorbent barriers.
- **Type of initiating event.** To select the initiating event typology, which is derived from the hazard source, you must choose between two options: spill or fire.
- **Unit price without VAT (€).** This section outlines the cost of prevention and avoidance measures, excluding VAT.
- **Measurement unit.** The unit price is expressed in this measurement unit. Example: retained litres.
- **Description.** Incorporate the detailed description provided in the bibliography. An example of a description could include the measure's material, conditions of use, and other relevant details.
- **Remarks.** This field is optional and allows the user to include any relevant observations or comments about the source of the hazard.

The buttons 'Save' and 'Cancel' can be used to respectively save or discard the data that has been entered.

After generating the measure, it will appear in the 'Prevention and Avoidance Measures' table (refer to the figure below). You can edit the fields described above using the 'pencil' icon and delete the measure using the 'bin' icon.

### Prevention and avoidance measures

[↔ Bibliographic sources](#)

**General data**

Bibliographic source code      Bibliographic source full name

Entry data of Measure

Q

Modify / See	Code	Name	Type of initiating event	Unit price without VAT (€)	Measurement unit	Remove
	ABS	Absorbent mats	Spill	78.00	retained liter	

One register found. Page 1

**Figure 9.7.2-3.** Prevention and Avoidance Measures table. Source: SIRMA.

Clicking on the hyperlink at the top left will take you back to the home screen. There, you will find a list of the operator's own bibliographic sources.

## 10. IDM MODULE

### 10.1. PRINCIPLES AND BASIC INFORMATION

#### 10.1.1. THEORETICAL PRINCIPLES

As set out in section 24.3 of Law 26/2007, of 23 October, the calculation of the obligatory amount of financial security must come from an analysis of the environmental risks, the range and content of which are developed in the regulation which partially develops the Law.

The Royal Decree which modifies the regulation which partially develops Law 26/2007, of 23 October on Environmental Liability, approved by Royal Decree 2090/2008, of 22 December, modified the process of determining the obligatory financial security established in its section 33.

It introduced a new method which notably simplified the calculation of the financial security, whilst at the same time had coherence with the method that was initially introduced in the original regulation established by Royal Decree 2090/2008.

This new method firstly involves identifying the accident scenarios and the probability of them occurring. This step was already stipulated in the previous draft.

Second, the operator must estimate the environmental damage index associated with each accident scenario. This represents a change in this new regulation, following the steps that are established in the new Annex III of the regulation which partially develops Law 26/2007. The Environmental Damage Index (IDM) aims to estimate the damage associated to each accident scenario, and it is based on several estimators of the amount of damaged resources and the remediation costs of the natural resources covered by law. This offers a semi-quantitative result, but it also allows to sort of the accident scenarios in terms of the potential environmental damages that they may cause.

The third step involves calculating the risk associated to each accident scenario as the product of the probability of the scenario occurring and the environmental damage index (IDM).

In the fourth step, the scenarios that have the lowest associated environmental damage index and make up for 95 per cent of the total risk should be selected.

Finally, the amount of financial security will be established as the value of the environmental damage of the scenario with the highest environmental damage index among the selected accident scenarios. In order to do this, first of all the environmental damage generated in the selected scenario will be quantified. Secondly, the environmental damage generated in that scenario of reference will be monetized; this value will be equal to the cost of the primary remediation project.

Should the primary remediation corresponding to the scenario of reference for the calculation of the financial security consists entirely in natural recovery, the amount of same will be equal to the

value of the damage associated to the accident scenario with the highest environmental damage index out of the selected scenarios whose primary remediation is not natural recovery.

In order to establish the amount of financial security with this new procedure it is only necessary to quantify and monetize the environmental damage generated for a selected scenario of reference. This only allows operators to save resources, as it is not necessary to quantify or economically value all the scenarios identified in the analysis of environmental risks.

Therefore, the IDM allows for each accident scenario to be assigned a numeric value which enables the selection of the scenario of reference which will act as a base from which the financial security can be calculated, as well as the calculation of the risk associated to each scenario (product of the probability of the scenario occurring and the IDM).

With the process of evaluating the environmental damage being simplified in this way, the general outline to select the scenario of reference is maintained, and the stages that lead to further complexity are removed, with it now only being necessary to quantify and monetize the environmental damage associated to the selected scenario of reference.

The user has to take into account that:

- Each report created in the ARM module will have information regarding all the accident scenarios of the facility being analysed, including the probability of occurrence and the volume of pollutant discharged for each of them.
- Each report created in the IDM module can have information regarding one or several accident scenarios. It shall include information on the scenarios identified as relevant within the environmental risk analysis.
- Each report created in the MORA module will have information only of one scenario. This can be the reference scenario to calculate the amount of financial security, or any other scenario the user selects for knowing the cost of the remedial measures. But each report will have information only regarding one scenario.

The IDM represents a general model aimed at estimating, in the same unit of measurement, a size order of the potential damage associated with each accident scenario. This allows for different scenarios to be compared with each other and for one to be selected to act as a base from which the financial security can be calculated. The IDM offers a semi-quantitative result that, under no circumstances can be interpreted as the true value of the damage associated to each scenario. Its calculation is supported by a series of estimators of the primary remediation costs that are deduced from the cost equation of the methodology of the Environmental Liability Supply Model (MORA for its acronym in Spanish) for each agent-resource combination. The structure of the equation used for the estimation of this Environmental Damage Index is based on that projected in the Environmental Liability Supply Model. This is a model that is divided into different sections aimed at each agent-resource combination for those that have been proposed using certain variables. Therefore, the IDM should be estimated as the aggregation of the different agent-resource

combinations that correspond to each accident scenario. The different agent-resource groups for which the IDM equation will be used are those shown in Figure 10.1.1-1.

			Resource								
			Water			Continental shelf and seabed	Soil	Sea and estuary banks	Species		
			Marine	Continental					Plants	Fauna	
Surface	Underground										
Agent causing the damage	Chemical	Halogenated VOC	Group 1	Group 2	Group 5	Group 7	Group 9	Group 10	Group 11	Group 16	
		Non-halogenated VOC									
		Halogenated SVOC									
		Non-halogenated SVOC									
		Fuels and NVOC									
		Inorganic substances									
		Explosives									
	Physical	Extraction/Disappearance		Group 3	Group 6			Group 3		Group 12	Group 17
		Inert waste discharge				Group 8					
		Temperature		Group 4			Group 4		Group 13	Group 18	
	Fire									Group 14	Group 19
		Biological	GMO							Group 15	Group 20
	Invasive alien species										
Virus and bacteria											
Fungi and insects								Group 15			

**Figure 10.1.1-1.** IDM agent-resource combinations. Source: Annex III Regulation of partial development Law 26/2007

It is necessary to clarify that within the IDM estimation, the habitat is considered as a combination of abiotic (as the soil) and biotic (flora and fauna) components. Therefore in Figure 10.1.1-1 the “habitat” resource is not present, as it will be remediated by remediating the resources they make it up.

In this way, any environmental damage will be evaluated in line with the agent-resource combinations identified in the previous table and that are established based on the remediation

techniques that are currently available. The user should select the agent-resource combination or combinations that they consider relevant for the scenario that is being evaluated and proceed to calculate the IDM using the equation that is described in the Royal Decree.

The IDM estimation is based on the average primary remediation costs for each agent-resource combination contained within the MORA methodology. This information has been reclassified and transformed into a non-monetary numeric value, thus it is not possible to access the remediation costs that would arise from applying the Environmental Liability Supply Model (MORA) by means of the IDM application. This is logical when considering that the application of the MORA methodology requires the previous determination of the amount of potentially damaged natural resources. Such quantification is not necessary for the IDM estimation and is supplied by means of the calculation of a generic estimation of the amount of damaged resources for each agent-resource combination.

In the equation of the IDM, the modifiers that allow for the estimation of the affected resources based on the amount of agent released (type B modifiers) make up the characteristics of the damage causing agent and the environment that condition their greater or lesser diffusion in the receiving environment. Likewise, modifiers of the unit cost estimator (type A modifiers) and the revision and control cost estimator (type C modifiers) have been identified:

$$IDM = \sum_{i=1}^n \left[ (Ecf + A \times Ecu \times (B \times \alpha \times Ec) + p \times M_{acc}^q + C \times Ecr) \times (1 + Ecc) \right] + (\beta \times Eca)_i$$

Pursuant to that established in the Royal Decree, the variables of the IDM equation have the following meaning:

- **IDM**, is the Spanish acronym of the Environmental Damage Index calculated pursuant to the specifications established in the environmental liability regulation (Annex III of Royal Decree 183/2015 of 13 March which modifies the regulation which partially develops Act 26/2007 of 23 October on Environment Liability, approved by Royal Decree 2090/2008 of 22 December).
- **Ecf**, is the estimator of the fixed cost of the remediation project for the agent causing the damage-resources potentially affected combination *i*.
- **A**, is the multiplier of the estimator of the unit cost of the remediation project, being the result of multiplying the values of the modifiers that affect the unit costs ( $M_{A_j}$ ) for each agent-resource combination *i*. Its formula is:

$$A = \prod_{j=1}^l M_{A_j}$$

- **Ecu**, is the estimation of the unit cost of the remediation project for the agent-resource combination  $i$ .
- **B**, is the multiplier of the estimator of amount, being the result of multiplying the values of the modifiers that affect the amount estimator ( $M_{Bj}$ ) for each agent-resource combination  $i$ . Its formula is:

$$B = \prod_{j=1}^m M_{B_j}$$

- **$\alpha$** , represents the amount of agents involved in the damage.
- **Ec**, represents the relation between the units of affected resources and the units of agents involved in the damage for each agent-resource combination  $i$ .
- **p**, is a constant that only takes a value other than zero for damage to the continental shelf or seabed.
- **Macc**, is the amount of agents associated to the accident. This is measured in tonnes in the case of damage to the continental shelf or seabed. In all other agent-resource combinations this parameter takes the value of zero.
- **q**, is a constant that takes the value of 1 in all agent-resource combinations, with the exception of those that imply damage to the continental shelf or seabed, in which it takes a specific value.
- **C**, is the multiplier of the estimator of the cost of the revision and control of the remediation project, being equal to the value of the modifier that affects the estimator of the cost of the revision and control ( $M_{Cj}$ ) for each agent-resource combination  $i$ . Its formula is:

$$C = M_{C_j}$$

- **Ecr**, is the estimator of the revision and control cost of the remediation project for the agent-resource combination  $i$ .
- **Ecc**, is the estimator of the remediation project consultancy cost, expressed as a percentage of the previous estimators, for the agent-resource combination  $i$ .
- **$i$** , refers to each of the agent-resource combinations  $i$  considered.

- $n$ , is the total number of agent-resource combinations that the agent considers relevant for the scenario that is being evaluated.
- $\beta$ , represents the distance (*Dist*) from the site to be recovered to the nearest accessible thoroughfare expressed in metres.

In the case of scenarios that are predicted to affect various sites, the value of the parameter will be the total of the distance from each site to the nearest thoroughfare.

In the case of scenarios that imply damage exclusively to sea water, the continental shelf or the seabed  $\beta$  will be assigned a value equal to 0.

- **Eca**, is the estimator of the cost of accessing the site that is potentially affected by environment damages, its value is equal to 6.14.

Annex III of this user's guide provides an explanation of the indicators type A, B and C included in the IDM algorithm. In order to select them, a bibliographic review was carried out, specialising on studies of the physical environment and environmental risk evaluation: Guía de elaboración de estudios del medio físico (ESCRIBANO, R. et al. 2006); Guía para la realización del análisis del riesgo medioambiental [en el ámbito del Real Decreto 1254/1999 (Seveso II)] (RUIZ, FJ. et al. 2004); Gestión del riesgo: responsabilidad ambiental y estrategia empresarial (SIMÓN, S. et al. 2010); Memoria del análisis de impacto normativo del Real Decreto por el que se aprueba el Reglamento de desarrollo parcial de la Ley 26/2007, de 23 de octubre, de responsabilidad medioambiental (Ministry of Agriculture, Food and Environment); Manual de contaminación marina y restauración del litoral (SEOÁNEZ, M. 2000); GRIMAZ, S. et al. (2007); GRIMAZ, S. et al. (2008); USDA (BehavePlus Model); ECB (2003); EPA (1998) and standard UNE 150008 for the analysis and evaluation of environmental risk (AENOR, 2008).

The selection of modifiers incorporated in the IDM has been based on two aspects: their likely relevance in explaining the magnitude of the environmental damages and the ease of their use for users of the model.

A scale has been developed for each of the selected modifiers in which, based on the specialised bibliography, different categories have been identified. As way of example, for the type A modifier "vegetation density" three categories have been differentiated (high, medium and low density). Said categories have been established with regard to the number of trees per hectare (in the case of arboreal vegetation) or a qualitative evaluation of the vegetation density (in the case of scrubland or grassland formations) and in order to define the limits that determine the passing from one category to another, the criteria used in the Tarifas Tragsa 2007 has been used.

The reference sources used in order to establish fine the different categories for each of the modifiers used for the IDM estimation are those indicated in the following table.

		Source
<b>Type A Modifiers</b>	Vegetation density	Tarifas Tragsa 2007
	Protected Natural Area (PNA)	Nature Data Bank
	Stoniness	Tarifas Tragsa 2007
	Gradient	Tarifas Tragsa 2007
<b>Type A Modifiers</b>	Biodegradability	European Chemical Substances Information System ( <a href="http://esis.jrc.ec.europa.eu/">http://esis.jrc.ec.europa.eu/</a> )
	Population density	Expert's criteria
	Vegetation density	BEHAVE (USDA) Model
	Temperature difference	Expert's criteria and information on the water quality facilitated by the different River Basin Authorities
	Lake or reservoir	Spanish Inventory of Dams and Reservoirs (MAGRAMA)
	Hazard	Expert's criteria and sectoral regulations regarding Genetically Modified Organisms (GMO).
	Gradient	BEHAVE (USDA) Model
	Permeability	Models of diffusion of chemical substances in the soil and underground waters (GRIMAZ, S., 2007 and 2008)
	Rainfall	Iberian Climatic Atlas (MAGRAMA, 2011)
	River	Environmental Profile of Spain (MAGRAMA, 2010)
	Solubility	FAO (2000)
	Temperature	Iberian Climatic Atlas (MAGRAMA, 2011)
	Type of leakage	Models of diffusion of chemical substances in the soil and underground waters (GRIMAZ, S., 2007 and 2008)
	Toxicity	ECB, 2003
	Wind	Spanish National Atlas (ANE)
	Viscosity	Expert's criteria and models of diffusion of chemical substances in the soil and underground waters (GRIMAZ, S., 2007 and 2008)
Volatility	Environmental Liability Supply Model (MORA)	
<b>Type C Modifiers</b>	Duration 1	Federal Remediation Technologies Roundtable (FRTR)
	Duration 2	Federal Remediation Technologies Roundtable (FRTR)
	Duration 3	Federal Remediation Technologies Roundtable (FRTR)
	Duration 4	Expert's criteria
	Duration 5	Environmental Liability Supply Model (MORA)

**Figure 10.1.1-2.** Modifiers of the IDM algorithm and source of information. Source: Prepared by the authors.

The result of the template is a numeric value that represents the consequences of the damage in a unit of measurement which, even though it does not have a direct mathematical relationship with its monetary value, allows for the maintaining of a relationship of proportionality between the amount released from the agent that caused the damage and the severity of the environmental consequences of each scenario. This thus allows for the ordering of scenarios from greatest to lowest estimated value (the higher the IDM value, the greater the environmental consequences initially predicted).

### **10.1.2. INPUT PARAMETERS**

The IDM estimation requires the following input data:

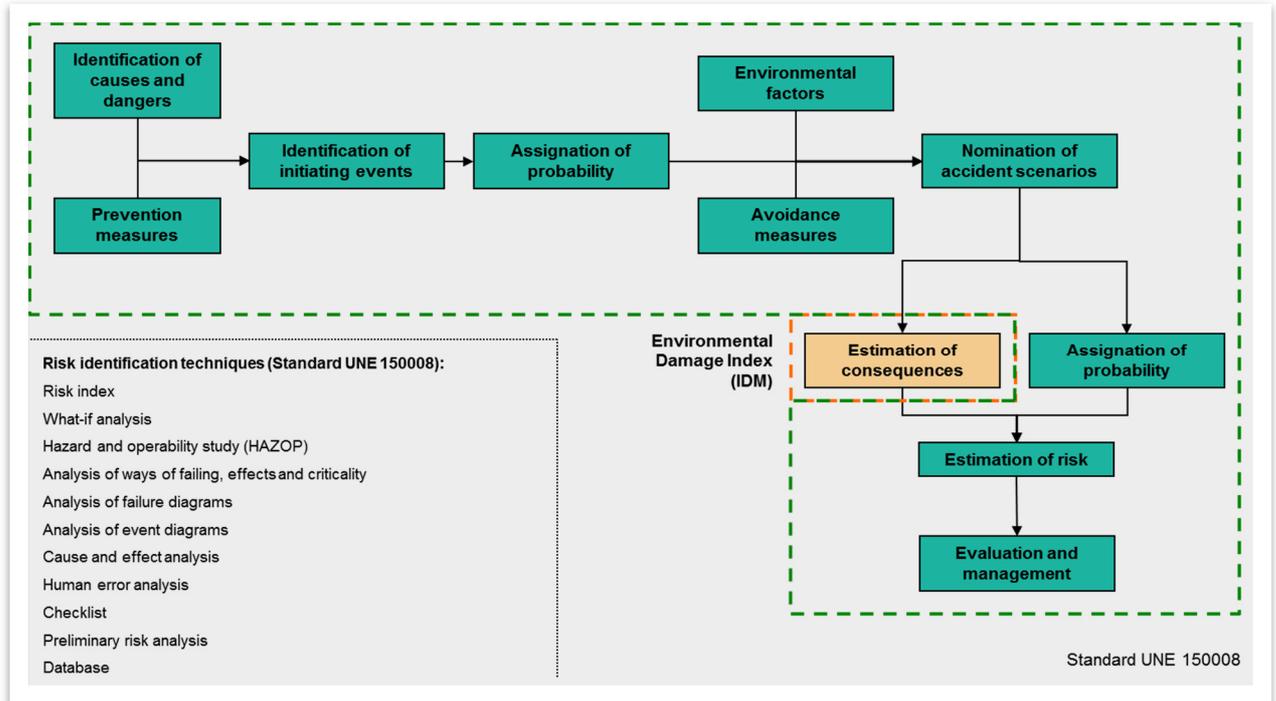
- Prior identification of the relevant accident scenarios.
- Selection of the damage causing types of agent
- Selection of the potentially affected natural resources.
- Determining of the location of the damaged caused in each accident scenario.
- Introduction of the values of the specific qualitative and quantitative variables for each agent-resource combination.

### **10.1.3. IDM IN THE CONTEXT OF THE STANDARD UNE 150008**

Within the new procedure for the determination of the obligatory financial security established in article 33 of the regulation which partially develops Law 26/2007, the operator must estimate the environmental damage index associated to each accident scenario, following the steps established in the new Annex III of the regulation which partially develops Law 26/2007.

With this and following the rest of the procedure outlined in that article 33, the operator will be able to select the scenario of reference which will act as a base from which the financial security can be calculated. This Environmental Damage Index should be applied for as many relevant accident scenarios that the facility under study may have.

The operator should bear in mind by the technical guidelines as set out in Standard UNE 150.008, or equivalent, so as to identify relevant accident scenarios. The following figure shows the framework outlined in Standard UNE 150.008, as well as the stage in which the IDM comes into play. As such, it can be seen how the IDM represents a unit of measurement of the environmental consequences that are deduced from each hypothesis of an accident.



**Figure 10.1.3-1.** The IDM within the framework of Standard UNE 150008. Source: Prepared by the authors.

The following are the phases that the operator should follow in order to determine the amount of financial security that, if it takes place, they should provide:

- 1) Identification of the damage causing agents in each scenario.
- 2) Consideration of the preventive measures applicable.
- 3) Identification of the relevant initiating events.
- 4) Probability of occurrence identification for each initiating event.
- 5) Consideration of the environmental factors and the avoidance measures.
- 6) Postulación de los escenarios accidentales relevantes utilizando la metodología de los árboles de sucesos.
- 7) Estimation of the consequences of each scenario.
- 8) Probability of occurrence identification for each scenario.
- 9) Calculation of the environmental risk.
- 10) Evaluation and risk management.

This module helps the user to estimate the environmental consequences of each scenario using the IDM. It also allows the introduction of the scenario occurrence probability, allowing thus calculating the risk associated to each of the scenarios.

#### **10.1.4. PRECAUTIONS IN THE APPLICATION OF THE ENVIRONMENTAL DAMAGE INDEX**

The simplification of the methodology of the financial security calculation, by means of the use of IDM as a tool for selecting the scenario of reference which will act as a base from which this calculation will be fixed, implicitly implies the assumption of some simplifications. For this reason, outlined below is a summary of the key precautions that must be taken into account when applying the IDM.

Given that the application of the IDM does not require the amount of natural resources potentially affected by the agent causing the damage to be quantified, there will not be certain information available which would be relevant in order to calculate the costs of the primary remediation project. Thus, the IDM constitutes a non-monetary numeric value that lacks a direct mathematical relationship with the primary remediation costs of the damage associated to each scenario. The IDM is only able to assume the proportionality between an amount released from the agent causing the damage and the severity of the environmental consequences that said agent could give rise to. Likewise, the IDM does not allow for the consideration of the efficiency of certain remediation techniques, given that its application does not allow for the identifying of the type of remedial measure that would lead to the expected result at the lowest cost (depending of the agent causing the damage and the particular characteristics of the receiving environment).

The Environmental Damage Index (IDM) has been designed so that it can be applied systematically and generically, and this implicitly implies that it is a model that does not accommodate for the consideration of particular circumstances of the affected natural resource or of the remediation technique that would be most convenient for its remediation.

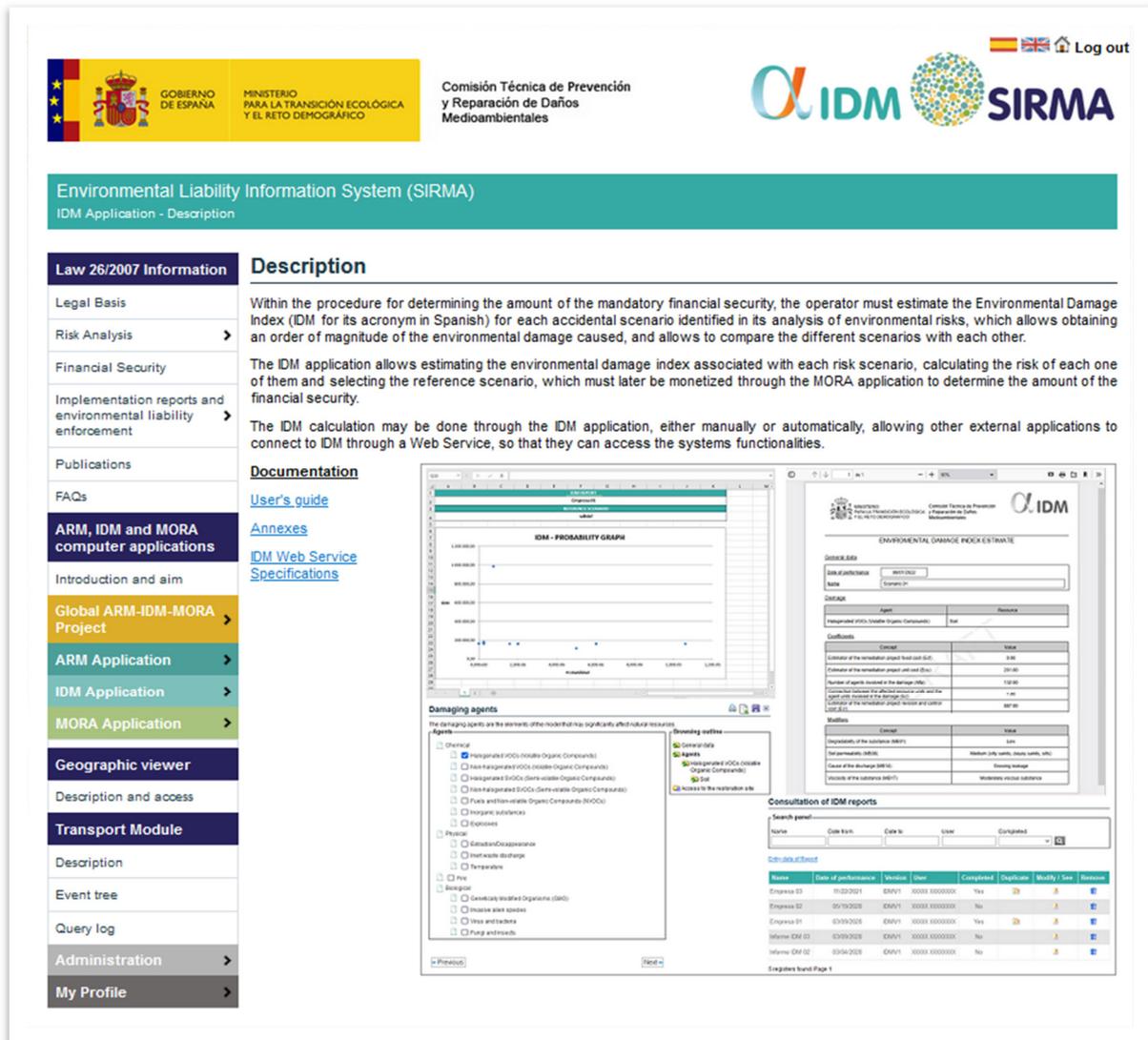
On the other hand, user must bear in mind that the IDM can only be applied for the agent-resource combinations for which it has been designed.

Another aspect to be considered, with regard to the simplifying of the procedure that the IDM provides, is that an estimator of the amount of affected resources ( $E_c$ ) is included. This refers to the units of affected resources (m<sup>3</sup> of water, tonnes of soil, number of individuals of animal species, surface area comprising of plant species, etc.) for each unit of the agent involved in the accident. This is an essential factor so as to be able to estimate the unit cost of the primary remediation, but its determination inevitably implies a simplification.

Finally, it is worth indicating that the IDM estimation model will be adjusted with the information of real cases. These may offer specific data with regard to the amount of substance, the expanse of the damaged resources and the primary remediation costs incurred in each case.

## 10.2. ACCESS TO THE IDM MODULE

The user can access to the IDM module through the menu of the SIRMA tool, using the “Create a New Report” or “Recording Reports” under the “IDM Reports” menu on the left hand side of the tool.



The screenshot displays the SIRMA web application interface. At the top, it features the logos of the Government of Spain and the Ministry for the Ecological Transition and Demographic Challenge, along with the text 'Comisión Técnica de Prevención y Reparación de Daños Medioambientales'. The main header identifies the system as 'Environmental Liability Information System (SIRMA) - IDM Application - Description'. A navigation menu on the left lists various modules, with 'IDM Application' highlighted in green. The main content area is titled 'Description' and provides information about the Environmental Damage Index (IDM) procedure, including its legal basis (Law 26/2007), risk analysis, and financial security. It also includes links to documentation such as the 'User's guide', 'Annexes', and 'IDM Web Service Specifications'. Two screenshots are embedded: one showing an 'IDM - PROBABILITY GRAPH' and another showing the 'ENVIRONMENTAL DAMAGE INDEX ESTIMATE' form with various input fields and a table of results. At the bottom, there is a 'Damaging agents' section with a list of checkboxes for different types of agents, and a 'Consultation of IDM reports' table with columns for Name, Date of performance, Version, User, Completed, Duplicate, Modify, and See.

Figure 10.2-1. Access to the IDM module. Source: SIRMA.

In the navigation panel of the IDM module on the left hand side of the screen, the following options are available:



**Figure 10.2-2.** IDM navigation panel. Source: SIRMA.

### 10.3. CREATE A NEW REPORT

#### 10.3.1. GENERAL OPERATION

Clicking on “Create a New Report” it will be possible to calculate the IDM for one or several accident scenarios, include its probability of occurrence, calculate the environmental risk and select the reference scenario to calculate the amount of financial security.

Each IDM report can have several scenarios and the user will need to finish each of them and the whole report before obtaining the results of the module:

- 1) The risk of each scenario
- 2) The reference scenario
- 3) An IDM-Probability of occurrence graph.

#### 10.3.2. GENERAL DATA REPORT IDM

Clicking on the “Create a New Report” button the following screen opens:



**General Data Report IDM**

**Report IDM data**

Name

Date of performance    User

**Figure 10.3.2-1.** General data report IDM screen. Source: SIRMA.

Once the “Save” button is clicked the IDM tool will show the next screen.

### **10.3.3. CONSULTATION OF SCENARIOS INCLUDED IN THE IDM REPORT**

This screen shows firstly the “Back” button, that allows the user going back to the reports repository of the IDM application.

Below it the “Report IDM data” section includes these elements:

- Name. The name given to the report
- Completed. Indicates if the report is finished or not.
- Modify. It allows modifying the general information of the report.

Below it the “Reference scenario for the calculation of the financial security” section has a twofold functionality:

- a) In the reports not finished, the “Complete” button is shown, allowing finishing the report if all the scenarios introduced are finished.
- b) In the reports finished, the “Export to Excel” and “Export to Pdf” allows to export the results of the report to these formats.

The “Entry data of Scenario” link below, allows the creation of new scenarios to the report. And below that, the “Remove” button allows deleting one or several scenarios selected from the “Delete” column of the table below, that contains these columns:

- Ref. Column used to indicate the reference scenario in the reports finished. In the reports not finished this field is empty.
- Scenario. Name or code of the scenario.
- Probability. Probability of occurrence of the scenario. It is an information introduced by the user.
- IDM value. The IDM value calculated for the scenario.
- Finished. Indicates if the report is finished or not.
- Duplicate. It allows the user to duplicate an scenario finished, and modify its information. This allows making use of common parameters in different scenarios and use it as a template.
- Modify / See. It allows the user modify the scenario if it is not finished or see it without editing it if it is finished.
- Delete. Allows selecting the scenarios the user wants to delete, by clicking on the “Remove” button.

### Consultation of scenarios included in the IDM report

[← Back](#)

**Report IDM data**

Name	Completed
Informe IDM-MORA 2_1594245600000	No <input type="button" value="Modify"/>

**Reference scenario for the calculation of the financial guarantee**

Complete the report to perform the reference scenario selection process

[Entry data of Scenario](#)

Ref.	Scenario	Probability	IDM value	Finished	Duplicate	Modify / See	Delete	
	Informe 2_SC3	0.00004	174,247.02	No			<input type="checkbox"/>	
	Informe 2_SC1	0.001	174,195.78	No			<input type="checkbox"/>	
	Informe 2_SC2	0.0005	106,108.02	No			<input type="checkbox"/>	

3 registers found. Page 1

**Figure 10.3.3-1.** IDM general operation. Source: SIRMA.

## 10.3.4. ENTRY DATA OF SCENARIO

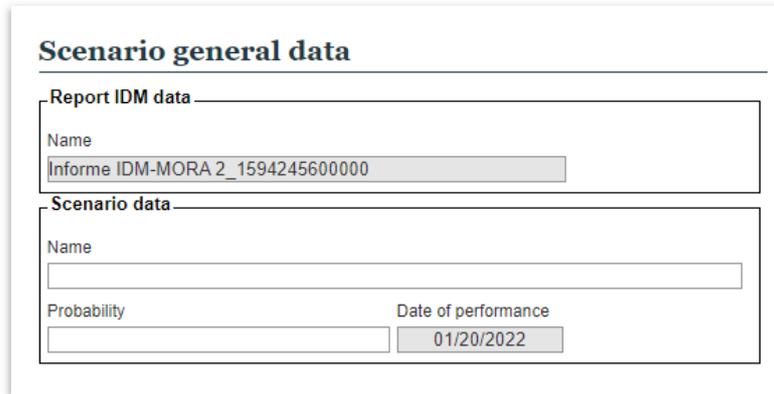
### 10.3.4.1. SCENARIO GENERAL DATA

After clicking on the “Entry data of Scenario” in the “Consultation of scenarios included in the IDM report” screen, a new screen is shown with the following information:

- Report IDM data. It includes the name of the report.
- Scenario data. It includes:
  - Name. Name of the scenario
  - Probability. Probability of occurrence, that has to be introduced by the user to calculate the risk of the scenario and select the reference scenario. The value has to be numeric and between  $10^{-20}$  and  $10^3$ .

In the Spanish version the values with decimals will be separated by a comma (,) and in the English version by a dot (.).

- Date of performance. Date in which the scenario has been created.



**Figure 10.3.4.1-1.** IDM Scenario general data screen. Source: SIRMA.

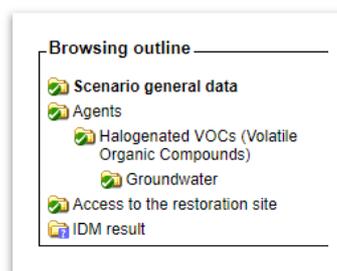
In the upper right side of the screen there are a series of buttons with the following functions:



**Figure 10.3.4.1-2.** Buttons in the Scenario general data screen. Source: SIRMA.

- Print. Allows printing in PDF format the information of the scenario.
- Export to Excel. Allows exporting the information of the scenario to an Excel file.
- Save. Saves the information introduced.
- Close. Closes the form and goes back to the “Consultation of scenarios included in the IDM report” screen.

There is also a navigator called “Browsing outline”



**Figure 10.3.4.1-3.** IDM Browsing outline. Source: SIRMA.

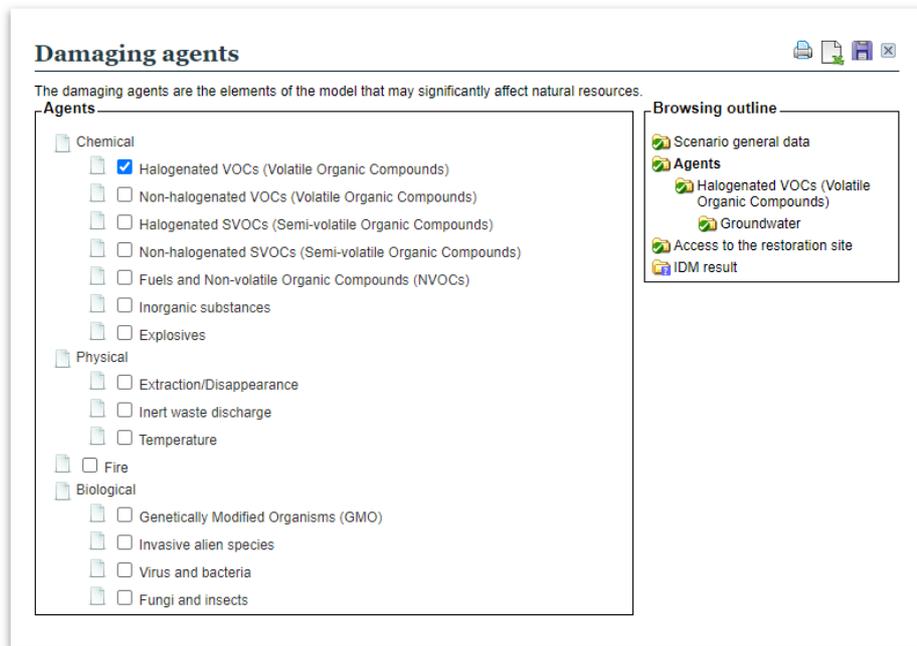
The symbology of the browsing outline is the following:

- The folders represent each of the screen of the IDM application for the corresponding scenario.
- The folders with a question mark indicates the process of that screen in not completed.
- The folders with a green check indicates the process of that screen has been completed.

Once the Scenario general data screen has been completed, clicking on the “Next” button, the process continues.

### 10.3.4.2. DAMAGING AGENTS

In this screen the user will have to select the damaging agents involved in the accident scenario evaluated.



**Figure 10.3.4.2-1.** Damaging agents selection. Source: SIRMA.

In the lower part of this screen, the “Previous” and “Next” buttons allows going to the previous or next screens respectively.

The agents taken into account in the ARM-IDM-MORA tool are:

#### A. Chemical

The damage produced by chemical agents would be associated to the release of a substance in a concentration superior to the toxicity threshold of that substance in a natural resource. In the ARM-IDM-MORA 14 key groups of chemical agents have been identified.

From these 14 groups, 7 are biodegradable and other 7 non-biodegradable, but the IDM module does not distinguish between biodegradable and non-biodegradable.

- Non-halogenated Volatile Organic Compounds.

Volatile Organic Compounds (VOC) are those hydrocarbons that present themselves in a gaseous state at room temperature or those that are very volatile at said temperature. They tend to be a chain with less than twelve carbons and they contain other elements such as oxygen, sulphur and nitrogen. They can have a natural or anthropogenic origin (due to the evaporation of organic solvents, the burning of fuel or due to transport) and they contribute to the creation of photochemical smog and to the greenhouse effect, as they are tropospheric ozone precursors.

- Halogenated Volatile Organic Compounds.

These are hydrocarbons that present themselves in a gaseous state at room temperature or those that are very volatile at said temperature. Unlike halogenated VOCs, these have halogenated elements in their chains (fluorine, chlorine, bromine and iodine). They can have a natural or anthropogenic origin (due to the evaporation of organic solvents, the burning of fuel or due to transport) and they contribute to the creation of photochemical smog and to the greenhouse effect, as they are tropospheric ozone precursors.

- Non-halogenated Semi-volatile Organic Compounds.

The semi-volatile organic compounds (SVOC) are organic compounds that, depending on the temperature, may be a gas, liquid or solid. They are produced in the incomplete combustion of organic matter or fossil fuels. The most representative compounds of this group are polycyclic aromatic hydrocarbons (PAH) and some pesticides.

- Halogenated Semi-volatile Organic Compounds.

These are organic compounds that, depending on the temperature, may be a gas, liquid or solid. Unlike halogenated SVOC, these have halogenated elements in their composition (fluorine, chlorine, bromine and iodine). They are produced in the incomplete combustion of organic matter or fossil fuels. The most representative compounds of this group are polychlorinated biphenyl (PCB) pentachlorophenol (PCP) and some pesticides.

- Fuels and Non-volatile Organic Compounds.

These fuels are dense organic compounds, that are generally non-halogenated, that come from the refining or distillation of petroleum products. They are used as fuels, lubricating oils or in asphalts. In this group the non-volatile organic compounds (NVOC) that are not included in the previous categories are also included.

- Inorganic substances.

These are compounds in which the carbon is not the main component. This group is essentially made up of metals and other compounds such as asbestos, cyanides and fluorine. They tend to be non-volatile compounds. Unlike organic compounds, the inorganic compounds do not easily degrade and are more difficult to eliminate.

- Explosives.

These are substances that if presented in a sufficient amount and if exposed to stimuli such as heat, impact, friction, chemical incompatibility or electrostatic discharge, turn into gases, releasing heat, pressure or radiation in a very brief time. There are many types of explosives and they can be distinguished by their explosive nature (deflagrates or detonators), for their sensibility (primary, secondary or tertiary), for their use (initiator, charge or multiplier) or for the content of the mixture (dynamites, hydrogels, emulsions, trinitrotoluene base or plastic bonding).

The classification of an organic chemical agent within one group or another can be estimated based on the boiling point of the substance by means of the following table.

Class	Boiling point (°C)
Volatile	<100
Semi-volatile	100-325
Non-volatile	>325

**Table 10.3.4.2-1.** Classification of organic chemical substances. Source: University of Granada.

### **B. Physical**

The damage caused by physical agents refers to the excess or defect of substances such as water, earth, temperature or inert waste, that are not associated to a level of toxicity.

### **C. Biological**

Biological agents include genetically modified organisms, exotic invasive species and pathogenic micro-organisms (virus and bacteria for animals or fungi and insects for flora).

To help in the selection of the damage causing agent in each particular case, a matrix has been included which helps to classify the specific agent that causes the damage in one of the previously mentioned specific groups.

<b>Agent causing the damage</b>	<b>The agent has an associated toxicity threshold (chemical agents)</b>	The agent is not an explosive substance	Organic agent	BP <sup>1</sup> <325 °C	BP < 100 °C	The agent contains halogenated elements	Damage by halogenated VOC	
					BP < 100 °C	The agent does not contain halogenated elements	Damage by non-halogenated VOC	
					BP < 100 °C	The agent contains halogenated elements	Damage by halogenated SVOC	
					BP < 100 °C	The agent does not contain halogenated elements	Damage by non-halogenated SVOC	
				BP >325 °C	Fuel	Damage by fuel		
				BP >325 °C	Other substances	Damage by non-volatile organic compounds (NVOCs)		
	Inorganic agent	<i>Damage by inorganic substances</i>						
	The agent is an explosive substance	<i>Damage by explosive substances</i>						
	<b>The agent does not have an associated toxicity threshold</b>	<b>Physical Agents</b>	<i>Damage by extraction or disappearance of a natural resource</i>					
			<i>Damage by inert waste discharge</i>					
			<i>Damage by temperature increase</i>					
		<b>Fire</b>	<i>Damage by fire</i>					
<b>Biological Agents</b>		<i>Damage by genetically modified organisms</i>						
		<i>Damage by exotic invasive species</i>						
		<i>Damage by virus and bacteria</i>						
<i>Damage by fungi and insects</i>								

**Table 10.3.4.2-2.** Matrix for selecting the damage causing agent. Source: Prepared by the authors.

### 10.3.4.3. RESOURCES AFFECTED BY EACH AGENT

Once the agents involved in the scenario have been selected, the resources that could be affected by the damage produced by each of the agents should also be selected. Here, the affected resources screen should be filled out as many times as there are agents in the previous stage. In each case, on the upper part of the screen the agent for which the potentially affected resources are being selected will appear. In this regard, the IDM estimation module preselects those resources that, according to the agents, could have been affected.

<sup>1</sup> BP = Boiling point.

### Resources damaged by Halogenated VOCs (Volatile Organic Compounds)

The natural resources included within the environmental liability regulation scope are the following: water, soil, the shore of the sea and estuary, habitats and species. Depending on the damaging agent, the resources that could be potentially affected are the following:

**Resources**

- Soil
- Coastal fringe and riverbanks
- Water
  - Sea water
  - Continental water
    - Surface water
    - Groundwater
- Habitats and species
  - Plants
    - Non-endangered mature trees (diameter greater than 7.8 in)
    - Non-endangered young trees
    - Non-endangered scrubland
    - Non-endangered grassland
    - Endangered mature trees (diameter greater than 7.8 in)
    - Endangered young trees
    - Endangered scrubland
    - Endangered grassland
  - Animals
    - Non-endangered mammals
    - Non-endangered birds
    - Non-endangered amphibians and reptiles
    - Non-endangered fish
    - Endangered mammals
    - Endangered birds
    - Endangered amphibians and reptiles
    - Endangered fish

**Browsing outline**

- Scenario general data
- Agents
  - Halogenated VOCs (Volatile Organic Compounds)
  - Groundwater
- Access to the restoration site
- IDM result

Go sel. Agents
Next

**Figure 10.3.4.3-1.** Example of resources damaged by an agent. Source: SIRMA.

Each one of the resources will appear separately, as shown below:

**Water.** A resource defined in Act 26/2007 of 23 October on Environmental Liability as all the inland water, both groundwater and surface water, coast water and transition water defined in the recast text of the Act on Water, approved by Royal Legislative Decree 1/2001, of 20 July (RLD 1/2001) as well as all other elements that make up part of the hydraulic public domain. Specifically, the following have been differentiated:

- Continental surface water. All water above the soil surface on the landward side from the coastline.
- Groundwater. All water which is below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil.
- Marine water. Includes coastal and transition water as well as territorial waters.

**Shore of the sea and estuaries.** Resource defined in Act 26/2007 as the assets of the public terrestrial-maritime domain regulated in section 3.1 of Act 22/1988 of 28 July on Coasts. Act 22/1988 indicated that Shore of the sea and estuaries include the following elements:

- The marine-terrestrial area or space understood as being between the lowest low-water line or the lowest neap tide line and the limit to where the waves are known to reach in the greatest storms or, if greater, the peak spring tide high-tide line. This area also extends from the riverbanks to the place where the effect of waves is noticeable. Marshes, lagoons, fens, estuaries and, in general, all low ground that floods as a consequence of the tidal ebb and flow, waves or the filtration of sea water are considered to be included in this area.
- Beaches or areas with loose materials such as sand, gravel and pebbles, including escarpments, berms and dunes, the last of which will be included until the limit that is considered necessary in order to security the stability of the beach and the defence of the coast.

**Superficial water beds (marine and continental).** This natural resource includes land covered by superficial continental water, and land covered by marine water. Therefore, the following elements are specifically considered, as defined in the Royal Legislative Decree 1/2001 of 20 July, on the approval of the recast text of the Act on Water: riverbeds (land covered by water under maximum normal rises), the beds of lakes (land with water during periods that it reaches its higher ordinary level) and reservoir beds (land covered by water when they reach they highest level due to the rivers that supply them being at their maximum normal rises). On the other hand, marine water beds are also considered pursuant to Act 22/1988 of 28 July on Coasts.

**Soil.** Law 26/2007 defines this as the upper layer of the earth's crust, located between the bedrock and the surface. It is made of mineral particles, organic matter, water, air and live organisms and it makes up the interface between the earth, air and water, this gives it the ability to have natural and functional uses. Soil that is permanently covered by a superficial water sheet will not be considered (for the IDM it is considered as a waterbed).

**Habitat.** Law 26/2007 defines habitat has the land or aquatic areas differentiated by their geographic, abiotic and biotic characteristics and that are mentioned in section 2.3 b) of Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on environmental liability with regard to the prevention and remedying of environmental damage or that are protected by other European regulations or by national or autonomous legislation, or by International Treaties that Spain subscribes to.

In terms of that shown in Table 1 of Annex III of the Royal Decree 2090/2008, the habitat will be considered as the group of abiotic (such as the soil) and biotic (such as flora and fauna species) components that it comprises. Therefore, with the aim of avoiding counting these resources twice, the resource "habitat" does not specifically appear on the selection screen of affected resources, but rather together with the resource species, thus integrating habitat to the biotic part of same. The abiotic part is referred to via soil resources and, if it takes place, water; in these cases they are explicitly included.

**Species.** Law 26/2007 defines wild species as the flora and fauna species mentioned in section 2.3 a) of Directive 2004/35/CE of the European Parliament and of the Council of 21 April 2004 on

environmental liability with regard to the prevention and remedying of environmental damage or that are protected by other European regulations or by national or autonomous legislation, as well as by International Treaties that Spain subscribes to, that are found in a wild state in Spain, either permanently or seasonally. In particular, the species included in the Nation Catalogue of Threatened Species or in the catalogues of threatened species created by the autonomous communities in their retrospective territorial areas. Exotic invasive species are not included in the previous definition. These are understood as those introduced, either deliberately or accidentally, outside of their natural distribution areas and that become a threat for the native wild species and habitats.

As has been previously mentioned, in the context of the IDM estimation model, habitat and species will be jointly dealt with, considering the biotic part of the habitat like this and estimating that the abiotic part is completed via the soil and water resources.

This resource includes plant and animal species. Within the plant species, a distinction has been made between tree, scrubland and grassland species. Furthermore, the tree species have been differentiated into two subcategories in terms of their diameter. As such, mature tree species are those that have a diameter greater than 20 cm, and young tree species are those with a smaller one. Likewise, animal species have been distinguished into the main groups of vertebrates (mammals, birds, amphibians and reptiles, and fish). In both cases a difference has been made between threatened and non-threatened species.

The user can use the following classification table in order to introduce the conditions to the plant and/or animal species.

Category	Threat level	Subcategory
Plant species	Endangered	Mature trees
		Young trees
		Scrubs
		Grassland
	Non threatened	Mature trees
		Young trees
		Scrubs
		Grassland
Animal species	Threatened	Mammals
		Birds
		Amphibians and reptiles
		Fish
	Non threatened	Mammals
		Birds
		Amphibians and reptiles
		Fish

**Table 10.3.4.3-1.** Classification of the conditions to the resource species. Source: SIRMA.

#### 10.3.4.4. PARAMETERS FOR THE IDM ESTIMATION

Once the agents causing the damage and the potentially affected resources have been identified for the accidental situation that is being analysed, the IDM estimation module shows a screen for each agent-resource group in which the value of the coefficients indicated in the Royal Decree for this agent-resource combination are gathered and a list of the modifiers that apply to said combination are offered. The user should select a category for each one of the modifiers and they should also fill out the box which corresponds to the mass (in tonnes), volume (in cubic meters) or surface (in hectares) involved in the accident.

Specifically, the coefficients provided on this screen are:

- Estimator of the remediation project fixed cost (Ecf).
- Estimator of the remediation project unit cost (Ecu).
- Accounting relationship between affected resource and agent units involved in damage (Ec).
- Estimator of the remediation project revision and control cost (Ecr).
- Estimator of the remediation project consultancy cost (Ecc).

The following figure shows the coefficients and modifiers screen for a specific agent-resource combination (by means of example, the agent "halogenated volatile organic compounds" and the resource "surface water" have been selected).

### Halogenated VOCs (Volatile Organic Compounds) in Surface water: coefficients and modifiers

The input of the values of the different coefficients and modifiers included in the formula is required to calculate the IDM.

**Coefficients**

Estimator of the remediation project fixed cost

Estimator of the remediation project unit cost

Volume discharged into surface water ( m<sup>3</sup> )

Connection between the affected resource units and the agent units involved in the damage

Estimator of the remediation project revision and control cost

Estimator of the remediation project consultancy cost

**Modifiers**

**B**

Degradability of the substance

Lake or reservoir category

River categories

Solubility of the substance

Volatility of the substance

**C**

Estimated duration of damage

**Browsing outline**

- Agents
- Halogenated VOCs (Volatile Organic Compounds)
- Surface water

**Figure 10.3.4.4-1.** Coefficients and modifiers screen. Source: SIRMA.

#### 10.3.4.5. ACCESS COST ESTIMATION

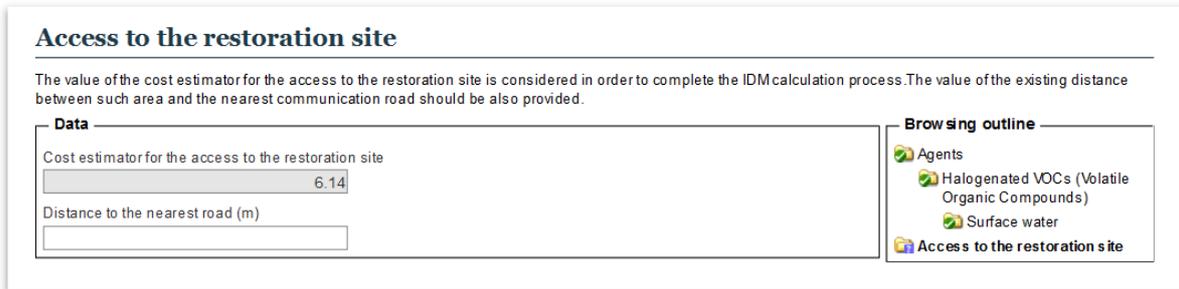
Once the estimations of all the costs that depend on the agent-resource combination for each of the groups that apply to the analysed scenario have been completed, the calculation of the cost for accessing the damaged site can be carried out. This does not depend on the agent-resource combination.

For this, the IDM estimation module offers the value of the estimated access cost per metre of the route that will be needed to be built. The user should provide data regarding the distance (in metres) between the damaged site and the nearest thoroughfare (parameter  $\beta$ ).

Just as was shown in section two of this chapter, the following circumstances must be taken into account when estimating said parameter:

- In the case of scenarios that are predicted to affect various sites, the value of the parameter will be the total of the distance from each site to the nearest thoroughfare.
- In the case of scenarios that imply damage exclusively to sea water, the continental shelf or the seabed will be assigned a value equal to 0.

The following figure shows the access cost estimation screen, with the cost estimator for the access to the remediation site and the distance to the nearest road.



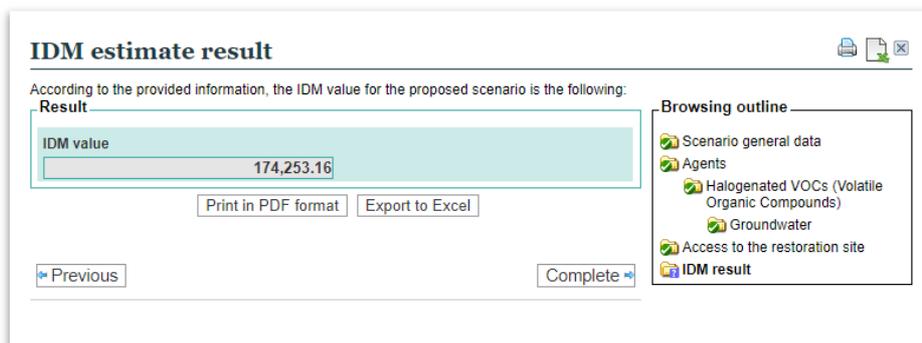
**Figure 10.3.4.5-1.** Access cost estimation screen. Source: SIRMA.

### 10.3.4.6. IDM OF AN SCENARIO

Once all the agent-resource combinations that have been selected for the analysis and estimation of the cost to access the damaged place(s) have been dealt with, the module offers (by means of a result) the IDM value for the accident scenario that is being analysed.

Additionally, this screen shows a series of specific functionalities:

- “Complete” button. It allows finishing the scenario and therefore block it and take it into account in the determination of the reference scenario.
- “Print in PDF format”. It prints the information regarding the scenario in a PDF document.
- “Export to Excel”. It exports the information regarding the scenario in an Excel file.



**Figure 10.3.4.6-1.** Example of a scenario IDM result. Source: SIRMA.

### 10.3.5. CREATING NEW SCENARIOS

The user will need to repeat the previous procedure for each scenario identified, in order to determine the reference scenario for the determination of the financial security.

The scenarios will appear in the “Consultation of scenarios included in the IDM report” screen.

**Consultation of scenarios included in the IDM report**

[← Back](#)

**Report IDM data**

Name: Informe IDM-MORA 2\_1594245600000      Completed: No      [Modify](#)

**Reference scenario for the calculation of the financial guarantee**

Complete the report to perform the reference scenario selection process      [Complete](#)

[Entry data of Scenario](#)

[Remove](#)       [Q](#)

Ref.	Scenario	Probability	IDM value	Finished	Duplicate	Modify / See	Delete	
	Informe 2_SC3	0.00004	174,253.16	No			<input type="checkbox"/>	
	Informe 2_SC1	0.001	174,195.78	No			<input type="checkbox"/>	
	Informe 2_SC2	0.0005	106,108.02	No			<input type="checkbox"/>	

3 registers found. Page 1      [Remove](#)

**Figure 10.3.5-1.** Example of scenarios in the Consultation of scenarios included in the IDM report screen. Source: SIRMA.

### 10.3.6. COMPLETING THE REPORT

Once the user has introduced and completed all the relevant scenarios, it is possible to complete the whole report clicking on the “Complete” button. A new screen is shown asking to confirm it or not, and with the name of the report and the date of performance.

**Complete report**

**Report IDM data**

Name: Informe IDM-MORA 2\_1594245600000

Date of performance: 07/09/2020

[Confirm](#)      [Cancel](#)

**Figure 10.3.6-1.** Confirmation of the report completion. Source: SIRMA.

Once the report has been completed, the following changes applies to the “Consultation of scenarios included in the IDM report” screen:

- The report appears as finished and therefore can not be edited.
- The reference scenario for the determination of the financial security is selected, with a green check in the “Ref.” column of the table.
- The “Export to Excel” and “Export to Pdf” buttons appear, allowing exporting the results of the report into these formats.

**Consultation of scenarios included in the IDM report**

[← Back](#)

**Report IDM data**

Name:  Completed:

**Reference scenario for the calculation of the financial guarantee**

The reference scenario is Informe 2\_SC1

Ref.	Scenario	Probability	IDM value	Finished	Duplicate	Modify / See	Delete
	Informe 2_SC3	0.00004	174,247.02	Yes			
✓	Informe 2_SC1	0.001	174,195.78	Yes			
	Informe 2_SC2	0.0005	106,108.02	Yes			
	SC5	0.008	14,019.77	Yes			

4 registers found. Page 1

**Figure 10.3.6-2.** Example of an IDM report completed. Source: SIRMA.

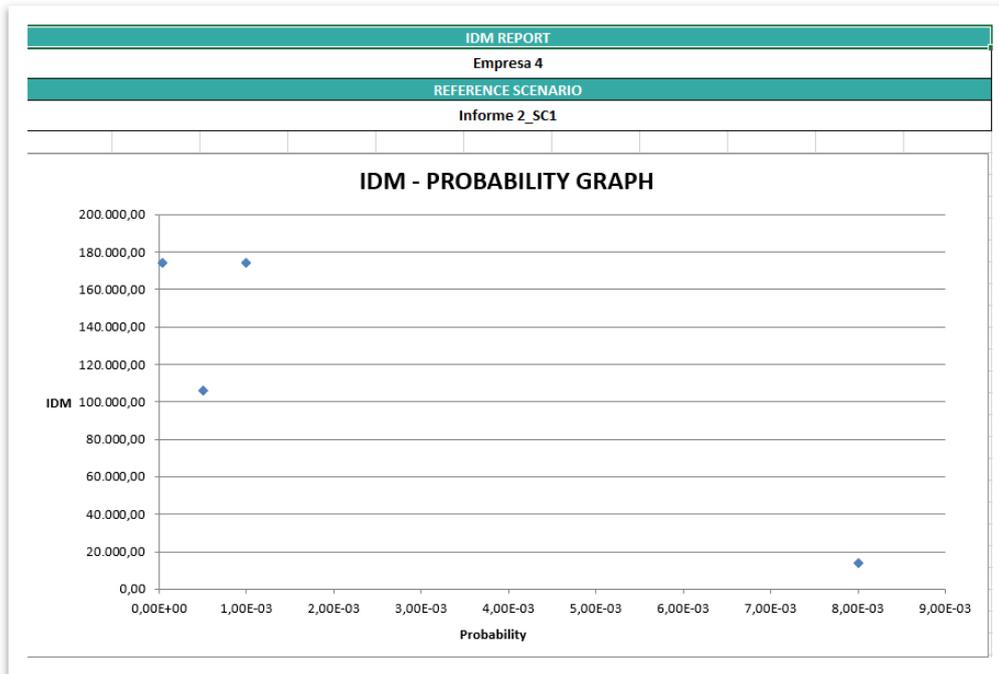
### 10.3.7. EXPORT TO EXCEL

Clicking on the “Export to Excel” button allows exporting the results of the report into an Excel file, with two sheets that allow editing the information.

#### I. Sheet 1 (graph)

This sheet includes the name of the report and of the reference scenario, as well as a graph with all the scenarios included in the report.

The graph provides the user with useful information to design an environmental risk management strategy according to UNE 150008 standard. For example, the scenarios more to the right might deserve more attention as their probability of occurrence and/or their environmental consequences in terms of IDM values are higher.



**Figure 10.3.7-1.** Example of IDM-Probability graph. Source: SIRMA.

## II. Sheet 2 (scenario selection)

This sheet includes the name of the report and of the reference scenario and the table with the calculations to determine the reference scenario according to article 33 of the Regulation of partial implementation of Law 26/2007.

IDM REPORT					
Empresa 4					
REFERENCE SCENARIO					
Informe 2_SC1					
REFERENCE SCENARIO SELECTION PROCESS					
Accidental scenario	Probability	IDM	Risk	Relative risk (%)	Accumulated relative risk (%)
Informe 2_SC3	4,00E-05	174.247,02	6,969888080000000000000000	2,01	100,00
Informe 2_SC1	1,00E-03	174.195,78	174,1957800000000000000000	50,29	97,99
Informe 2_SC2	5,00E-04	106.108,02	53,0540100000000000000000	15,32	47,70
SC5	8,00E-03	14.019,77	112,1581600000000000000000	32,38	32,38

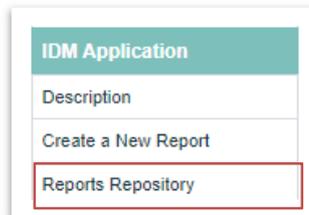
**Figure 10.3.7-2.** Example of sheet 2 of Excel file. Source: SIRMA.

## 10.3.8. EXPORT TO PDF

Clicking on the “Export to PDF” button allows exporting the results of the report into a PDF file, showing the table with the calculations to determine the reference scenario according to article 33 of the Regulation of partial implementation of Law 26/2007.

## 10.4. REPORTS REPOSITORY

The IDM Reports repository gathers all the IDM reports (finished or not) the user has created. To access this repository, the user has to click on the “Reports Repository” of the IDM application navigator, to the left of SIRMA.



**Figure 10.4-1.** IDM application menu. Source: SIRMA.

In the “Consultation of IDM reports” screen that opens, the list of reports appears with these columns:

- Name. Name of the report.
- Date of performance. Date in which the report was created.
- Version. It indicates the version of the application used to create the report.
- Completed. Indicates if the report is completed or not.
- Duplicate. Allows the duplication of finished reports.
- Modify/See. Allows editing reports not finished and seeing finished reports.
- Remove. It allows deleting reports.

**Consultation of IDM reports**

Searching panel

Name  Date from  Date to  Completed

[Entry data of Report](#)

Name	Date of performance	Version	Completed	Duplicate	Modify / See	Remove
prueba 090720	07/09/2020	IDMV1	No			
Name	01/19/2022	IDMV1	No			
Informe IDM-MORA 3	10/23/2019	IDMV1	Yes			
Informe IDM-MORA 2_1594245600000	07/09/2020	IDMV1	No			
Informe IDM-MORA 2	10/23/2019	IDMV1	Yes			
empresa 5	11/05/2019	IDMV1	No			
Empresa 4	10/23/2019	IDMV1	Yes			

7 registers found. Page 1

**Figure 10.4-2.** Consultation of IDM reports screen. Source: SIRMA.

It is possible sorting the results of this table by the values of the different columns by clicking on the title. It is also possible to search for a report using the searching panel tool in the upper side of the screen.

## 10.5. FAQs ON THE IDM MODULE

Below are some of the FAQs that arise when using the IDM estimation module.

1. What scenarios should be analysed with the IDM estimation module?
2. What is the necessary input data for the IDM estimation?
3. How is damage introduced to the habitat in the IDM estimation module?
4. What are the revision and control costs?
5. How should mixes of substances be considered?
6. In the case of instantaneous leakages, what unit of time are we talking about?

---

### 1. What scenarios should be analysed with the IDM estimation module?

It should be taken into account that, prior to using the IDM estimation module, the analyst should have basic information available from their risk analysis as well as the identification of accident scenarios and of the agents and natural resources associated to each of them.

Specifically, the user must know the accident scenarios that are **relevant** in their case. In other words, some of the damage that an economic activity is susceptible of causing can be considered as non-significant with regard to its remediation by means of remediation techniques. In order to determine if damage is relevant or not, the **amount and type** of the agent involved can be taken note of, as can the **duration** of the damage and the **probability** of this occurring.

By way of example, the damage caused by a semi-volatile chemical agent to surface water, due to the dilution and evaporation effect, it becomes a harmless substance in less than a day and this it can be determined as an irrelevant a damage in terms of the evaluation.

In the case of fauna species, the damage can be declared as relevant by paying attention to the number of individuals that have been affected out of the total size of the population of said species. That is to say that, whilst for endangered species the damage to just one individual may be crucial, for general species, a large number of individuals must be affected in order for the population balance of said species to be altered.

### 2. What is the necessary input data for the IDM estimation?

Once the relevant scenarios that will be evaluated with the IDM methodology are selected, it will be necessary to find out the following information for each of them:

1. **Agent** that has caused the environmental damage. The analyst can use the following table to aid the selection of the damage causing agent.

<b>Agent causing the damage</b>	The agent has an associated toxicity threshold ( <b>chemical agents</b> )	The agent is not an explosive substance	Organic agent	BP <sup>2</sup> < 325 °C	BP < 100 °C	The agent contains halogenated elements	Damage by halogenated VOC
						The agent does not contain halogenated elements	Damage by non-halogenated VOC
					BP < 100 °C	The agent contains halogenated elements	Damage by halogenated SVOC
						The agent does not contain halogenated elements	Damage by non-halogenated SVOC
				BP > 325 °C	Fuel	Damage by fuel	
					Other substances	Damage by non-volatile organic compounds (NVOCs)	
		Inorganic agent	<i>Damage by inorganic substances</i>				
		The agent is an explosive substance	<i>Damage by explosive substances</i>				
	The agent does not have an associated toxicity threshold	<b>Physical Agents</b>	<i>Damage by extraction or disappearance of a natural resource</i>				
			<i>Damage by inert waste discharge</i>				
<i>Damage by temperature increase</i>							
<b>Fire</b>		<i>Damage by fire</i>					
<b>Biological Agents</b>		<i>Damage by genetically modified organisms</i>					
		<i>Damage by exotic invasive species</i>					
		<i>Damage by virus and bacteria</i>					
	<i>Damage by fungi and insects</i>						

**Figure 10.5-1.** Matrix for selecting the damage causing agent. Source: Prepared by the authors

2. **Resources affected** by the environmental damage. These may be:

- a. Water:
  - i. Continental surface water.
  - ii. Groundwater.
  - iii. Sea water.
- b. Shore of the sea and estuaries.
- c. Sea bed.
- d. Continental water bed.
- e. Soil.
- f. Habitat. As previously explained, these damages will be introduced as damages to the other resources that that habitat is made up of.
- g. Species. This group includes both plant species and animal species (threatened and otherwise).

<sup>2</sup> BP = Boiling point.

In the case of plant species, these are distinguished as follows: mature trees (with diameters above 20 cm), young trees, scrubland and grassland species.

3. **Mass, volume or surface involved in the accident.** The user should introduce the mass, volume or surface involved in the accident in tonnes, cubic metres or hectares, respectively.

### 3. How is habitat damage introduced in the IDM estimation module?

With regard the IDM estimation module, the habitat is considered as the group of natural resources that may be affected by the environmental damage.

This is due to the fact that the habitat has components that are abiotic (such as the soil) and biotic (such as the flora and fauna species). Therefore, with the aim of avoiding counting the damages to certain resources twice, the resource "habitat" does not specifically appear on the selection screen of affected resources, but rather together with the resource species, thus integrating habitat to the biotic part of same. The abiotic part is referred to via soil resources and, if it comes to that, water; in these cases they are specifically included.

### 4. What are the revision and control costs?

The coefficient Ecr is the revision and control costs estimator.

The revision and control costs refer to the costs that will have to be incurred with the aim of monitoring the adopted remedial measures and evaluate the compliance of outlined objectives.

By way of example, some of the revision and control activities will be the following: water and soil sampling and laboratory analysis, fauna monitoring equipment, creation of reforestation monitoring reports, probing and groundwater analysis, etc.

### 5. How should mixes of substances be considered?

In theory it is difficult to design a valid universal rule for all operators, situations and substances regarding how to deal with mixtures in terms of remediation. The most toxic substance, or the substance with the greatest presence within the mixture could be taken as a reference, but in all cases the operator carrying out the risk analysis should make the decision about which agent to select to do the calculations.

### 6. In the case of instantaneous leakages, what unit of time are we talking about?

Instantaneous leakages, considered as volumes released in a negligible time, refer to the occasional release of high amounts of the agent, such as tank breakages or due to explosions.

## **11. MODULE OF DAMAGE ECONOMIC EVALUATION (MORA)**

### **11.1. MORA RATIONALE AND METHODOLOGY**

MORA was developed with the main objective of helping operators in the economic valuation of the environmental damages the accident scenarios identified within their facilities may cause.

The MORA methodology was carried out by the Directorate General for Environmental Quality and Assessment.

In December 2022, the cost model used by the MORA Software tool for the preparation of environmental damage remediation budgets was updated.

This latest version uses costs in euros referring to the year 2019, while the previous costs referred to the year 2011. For this reason, the budgets obtained in each of the versions of the tool would not be comparable with each other.

The reports started in the previous MORA version —created before December, 2022— may be finalized using the data model available at that time —cost model referring to 2011—. These reports cannot be duplicated nor will it be possible to create new reports in that version, but both functionalities will be available using the updated data model —cost model referring to 2019—.

### **11.2. ACCESS TO THE MORA MODULE**

The user can access to the MORA module through the menu of the MORA Application navigator to the left of SIRMA, using the “Description”, “Create a New Report” or “Reports Repository”.



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**Environmental Liability Information System (SIRMA)**  
MORA Application - Description

Law 26/2007 Information	Description
Legal Basis	<p>Based on the methodology developed by the General Directorate of Environmental Quality and Assessment, this voluntary tool to support the monetization of environmental damage, which allows calculating the cost of the remedial measures (primary, compensatory and complementary) necessary to return the natural resources and the services they provide to their original status (baseline condition).</p> <p>To do this, the computer application selects the most appropriate environmental damage repair techniques for each risk scenario, from the catalog of repair measures created. In addition, the application offers flexibility to allow the costs of repair techniques to be justifiably adapted to the circumstances of each modeled risk scenario, as well as the use of new repair techniques.</p> <p>Additionally, and due to the preventive vocation of Law 26/2007, of October 23, the calculation of recovery costs associated with risk scenarios, provides operators with a tool that will allow them to carry out an adequate management of the risks of its installation.</p> <p>The primary repair costs calculated with the Environmental Liability Supply Model software application (MORA for its acronym in Spanish) of the reference scenario selected with the IDM application, allow determining the amount of the mandatory financial security, to which the prevention and avoidance costs must be added.</p> <p>The monetization of environmental damage can be done through the MORA application, either manually or automatically, allowing other external applications to connect to MORA through a Web Service, so that they can access the systems functionalities.</p>
Risk Analysis	
Financial Security	
Implementation reports and environmental liability enforcement	
Publications	
FAQs	
<b>ARM, IDM and MORA computer applications</b>	<p><b>Documentation</b></p> <p><a href="#">MORA methodological document</a></p> <p><a href="#">User's guide</a></p> <p><a href="#">Annexes</a></p> <p><a href="#">MORA Web Service Specifications</a></p>
Introduction and aim	
Global ARM-IDM-MORA Project	
ARM Application	
IDM Application	
MORA Application	
<b>Geographic viewer</b>	
<b>Description and access</b>	
<b>Transport Module</b>	
Description	
Event tree	
Query log	
Administration	
My Profile	

**Figure 11.2-1.** Access to the MORA Application. Source: SIRMA.

**MORA Application**

Description

Create a New Report

Reports Repository

**Figure 11.2-2.** MORA navigation panel. Source: SIRMA.

The description section includes a brief summary of the MORA module functionalities, and has links to the MORA methodological document, the user manual and the Specification document of the MORA web service.

## **11.3. CREATING A NEW MORA REPORT**

### **11.3.1. GENERAL OPERATION**

A MORA report includes information regarding only one accident scenario, that can include one or several agent-resource damaged combinations.

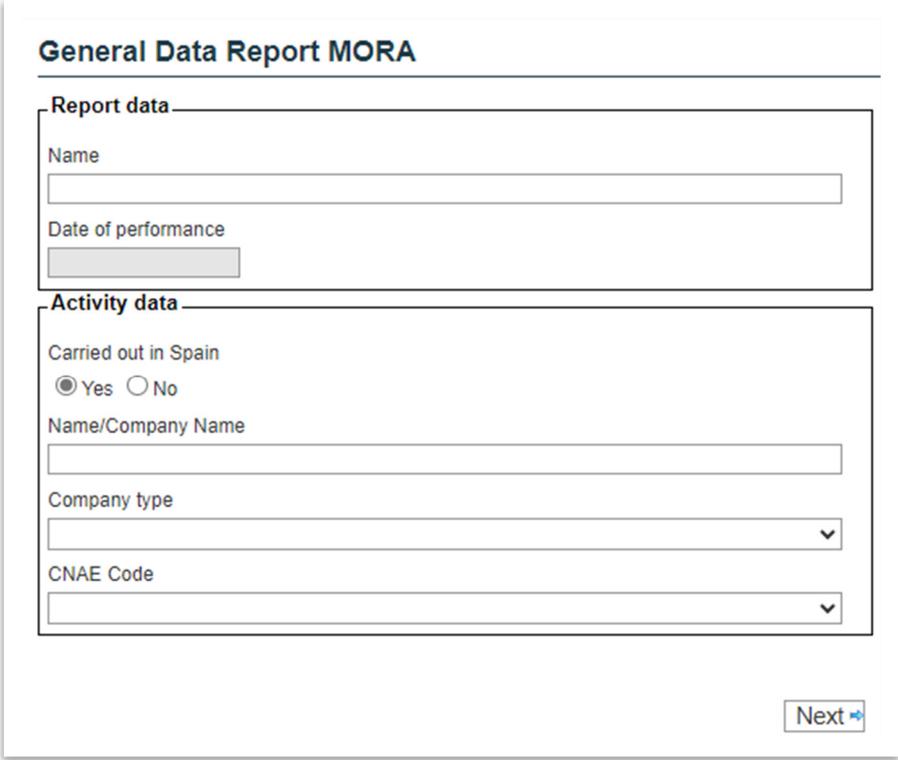
For each combination, MORA will provide the user the primary, complementary and compensatory remedial measures for each agent-resource combination, as well as its value in euros. It will also take into account the cost of access to the damaged area.

The primary remediation cost will be used for the determination of the mandatory financial security according to article 33 of the Regulation of partial development of Law 26/2007, adding to it the prevention and avoiding measures (not provided by MORA), with a minimum of 10% of the primary remediation cost.

It is also important remind that Law 26/2007 establishes that operators causing a significant environmental damage will have to fully restore the damage caused, independently of the financial security the operator might have. Therefore the complementary and compensatory remedial measures and costs. This information is also very important for the management of the environmental risks of the facility.

### **11.3.2. GENERAL DATA REPORT**

Clicking on 'Make new report' takes you to the report's general data screen. As mentioned earlier, this screen gathers data that is common to all agent-resource combinations involved in the accidental scenario.



**Figure 11.3.2-1.** General data report MORA. Source: SIRMA.

The fields shown on the screen are following:

Report data, which includes:

- Name. Please provide the name that you would like to receive the report under. It is recommended to choose a name that characterises the scenario being assessed.
- Date of performance Report completion date.
- User. User's name for the report.

Activity data, which includes:

- Carried out in Spain (Yes/No). This field enables the tool to determine whether the damage occurred within Spain and therefore, whether cartographic information from the MORA viewer is available. If the damage occurred abroad, the user must provide all requested geographic information.

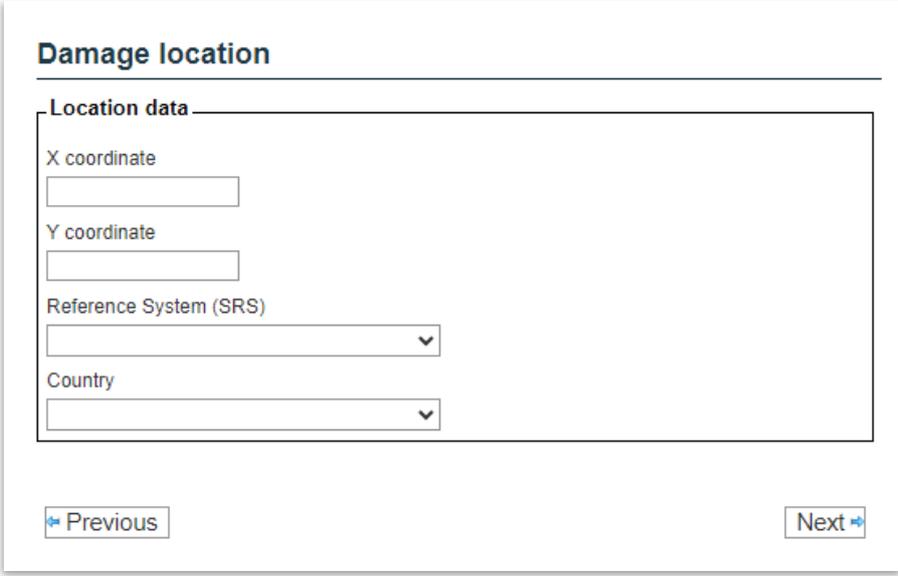
### **11.3.3. DAMAGE LOCATION**

After providing general data, the user must inform MORA of the estimated location of the environmental damage to proceed with its economic valuation.

If the user has indicated on the 'General data' screen that the environmental damage occurred outside of Spain, the 'Damage location' screen will prompt for the following information:

- The numeric data defining the X-coordinate of the damage must be provided.

- The damage's Y-coordinate must be provided as numeric data as well.
- When using the Reference System (SRS), the user must specify the system in which the entered coordinates are located.
- Select the country where the environmental damage occurred from the list of 195 countries in the drop-down menu.



**Damage location**

**Location data**

X coordinate

Y coordinate

Reference System (SRS)

Country

[← Previous](#) [Next →](#)

**Figure 11.3.3-1.** Inputting of damage location data for damage outside of Spain. Source: SIRMA.

The location screen offers the user, if the user has indicated that the environmental damage has occurred in Spain, the possibility to:

- If available, enter the coordinates of the damage site directly. The fields corresponding to 'X coordinate', 'Y coordinate' and 'Reference system (SRS)' must be filled in. The reference systems available in the application are WGS84 and ETRS89.
- You can access the map viewer by using the 'Locate' option. This will open the map viewer in a new window, allowing you to locate the site on the map and select the geographic point where the environmental damage occurred. This option is recommended. It allows you to visually check the correct location of the damage on the map.

### Damage location

**Location data**

X coordinate

Y coordinate

Reference System (SRS)  
UTM-ETRS 1989-30N

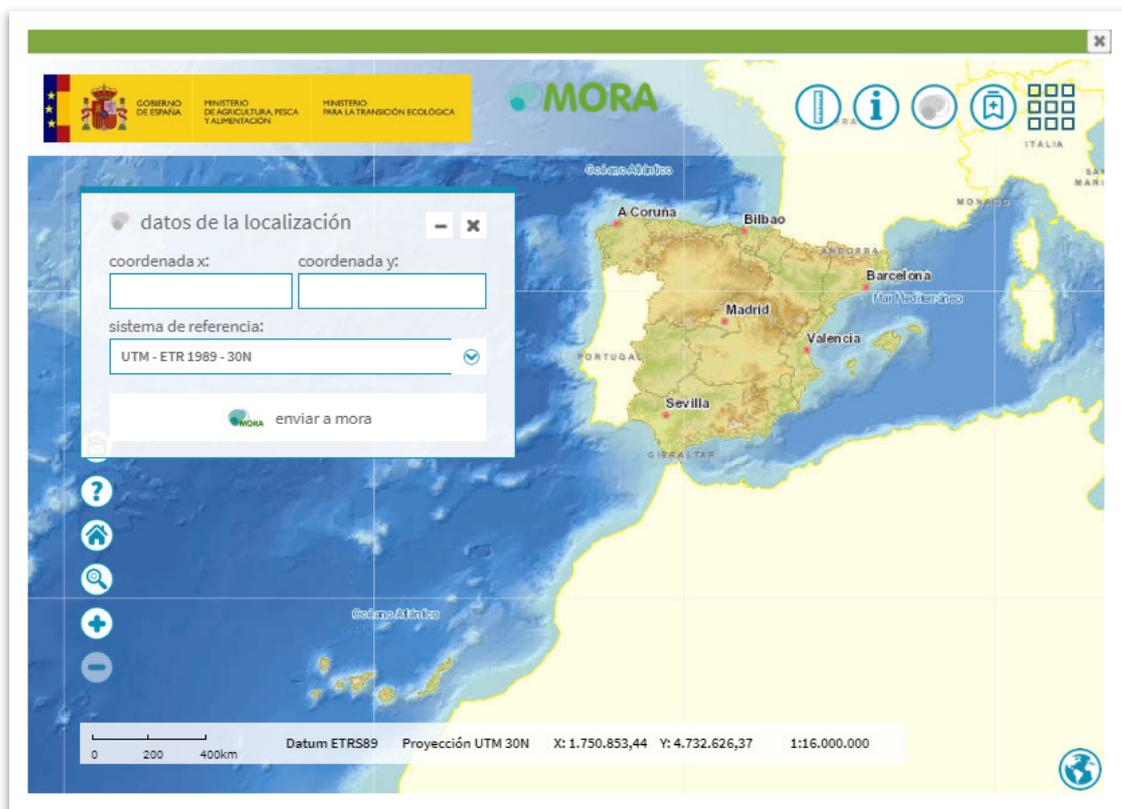
**Territory data**

Autonomous Community

Province

Municipality

**Figure 11.3.3-2.** Inputting of damage location data for damage in Spain. Source: SIRMA.



**Figure 11.3.3-3.** Entering the location of the damage through the map viewer. Source: SIRMA.

The application will display the parameters relating to the location of the damage by clicking on the 'Next' button. The software tool offers the data obtained from the digital maps available in the viewer if the location of the damage is in Spain. In the case of a claim abroad, these fields are blank and must be filled in by the user. The user must choose between the options offered for each field. Such a choice must be duly justified.

If more accurate information is available, all data collected on this screen can be modified by the user. However, this information should be properly documented. This is also the case for locations outside Spain.

It should be noted that in the process of calculating all the combinations of agents and resources, not all the parameters are used. If the damage to be monetised affects only one resource, to which the parameters on this screen do not apply, it is advisable to leave the default values. Otherwise, it would be necessary to justify the changes made. The slope and permeability parameters for seawater-only damage would be an example of this situation. All details must be completed to the best of one's knowledge in the case of damage outside Spain.

#### **11.3.4. SELECTION OF AGENTS AND RESOURCES**

##### **11.3.4.1. SELECTION OF AGENTS**

After determining the general parameters, the user must select the agent that causes the damage. The classification of the agents in MORA is the same of the IDM module, but in this case, there is a distinction between biodegradable and non-biodegradable agents.

As in the IDM module, it is possible to select several agents at the same time. Each of them will be assigned one or several resources that are affected by them. The analysis of each agent-resource combination will be carried out independently and the accidental scenario will be defined by all the combinations introduced.

### Damaging agents

---

**Agents**

- Physical
  - Extraction/Disappearance
  - Inert waste discharge
  - Temperature
- Fire
- Biological
  - GMO
  - Invasive alien species
  - Virus and bacteria
  - Fungi and insects
- Chemical
  - Biodegradable chemicals
    - Fuels and biodegradable NVOCs
    - Biodegradable halogenated VOCs
    - Non-halogenated biodegradable VOCs
    - Biodegradable halogenated SVOCs
    - Non-halogenated biodegradable SVOCs
    - Biodegradable explosives
    - Biodegradable inorganic substances
  - Non-biodegradable chemicals
    - Fuels and non-biodegradable NVOCs
    - Non-biodegradable halogenated VOCs
    - Non-biodegradable non-halogenated VOCs
    - Non-biodegradable halogenated SVOCs
    - Non-biodegradable non-halogenated SVOCs
    - Non-biodegradable explosives
    - Non-biodegradable inorganic substances

**Figure 11.3.4.1-1.** Screen for the selection of the agents causing the damage in the MORA module. Source: SIRMA.

### 11.3.4.2. RESOURCES AFFECTED BY THE AGENT

Once the agents involved in the accident have been selected, the application allows assessing the damages of each of the agent-resource couples.

In this screen you should select the resources that may be affected by the damage produced by the agent indicated at the top of the screen.

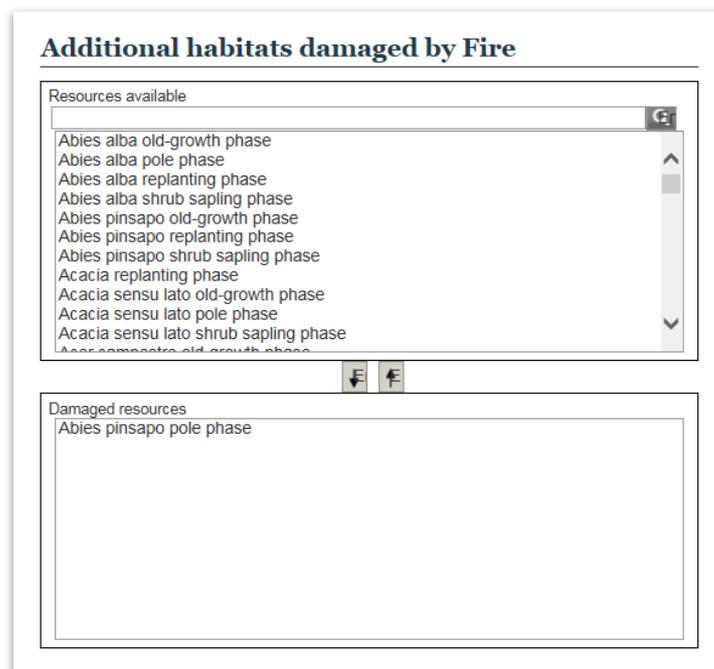
The application preselects those resources that, according to the information received from the cartography, may have been affected. The user can deselect those resources as well as select new ones.

The natural resources catalogue of the MORA module is in general the same as the one of the IDM module. However, there is a difference in the way flora is considered. In the IDM module there is a resource called “Plants”, whereas in the MORA module it is called habitat.

In the computer application field, the habitat includes the main tree species that are affected by environmental damage, as well as scrubland and grassland. In principle, the application shows by default the main tree species -from one to three- that appear in the Forest Map of Spain 1:50.000 (MFE50) for the selected point. Specifically, for each of the available species, it should be indicated in what state they were at the time before the environmental damage occurred - the state determines the stages of development of the populations. The application offers by default the state of the species according to the map. Going to the MFE50, four possible states can be distinguished, these are:

- a. *Repopulated*. State of a population born from seed since it germinates until the aerial parts of the adjacent planting feet are touched.
- b. *Wild Brush*. State of the mass in its first youth; that is, since they start touching the new cups of the plants until they reach the pole stage.
- c. *Pole stage*. State of the arboreal mass from 8 - 10 meters in height and until reaching the small tree state.
- d. *Small trees*. State of higher development of the forested mountains.

The user is allowed, by selecting the "select other habitats" box, access the following screen in a search engine through which to add new affected species and eliminate species not considered damaged. Within this same search engine, both the scrubland and the grassland can be selected- grouping all the generic species of both groups.



**Figure 11.3.4.2-1.** Tool for the selection of habitats in the MORA module. Source: SIRMA.

Species	Name MFE
<i>Heberdenia bahamensis</i>	Aderno
<i>Amelanchier ovalis</i>	Guillomo
<i>Frangula alnus</i>	Arraclán
<i>Rhamnus alaternus</i>	Aladierno
<i>Euonymus europaeus</i>	Bonetero
<i>Myrtus communis</i>	Mirto
<i>Acacia</i> spp.	Acacia
<i>Phillyrea latifolia</i>	Labiérnago
<i>Cornus sanguinea</i>	Cornejo
<i>Malus sylvestris</i>	Manzano silvestre
<i>Celtis australis</i>	Almez
<i>Taxus baccata</i>	Tejo
<i>Crataegus</i> spp.	Crataegus
<i>Pyrus</i> spp.	Peral silvestre
<i>Cedrus atlantica</i>	Cedro
<i>Chamaecyparis lawsoniana</i>	Chameciparis
Otras coníferas	Otras coníferas
Pinos	Pinos
<i>Pinus sylvestris</i>	Pino silvestre
<i>Pinus uncinata</i>	Pino uncinata
<i>Pinus pinea</i>	Pino piñonero
<i>Pinus halepensis</i>	Pino halepensis
<i>Pinus nigra</i>	Pino laricio
<i>Pinus pinaster</i>	Pino pináster
<i>Pinus canariensis</i>	Pino canario
<i>Pinus radiata</i>	Pino radiata
Otros pinos	Otros pinos
Mezcla de coníferas	Coníferas, excepto pinos
<i>Abies alba</i>	Pinabete
<i>Abies pinsapo</i>	Pinsapo
<i>Picea abies</i>	Píceas
<i>Pseudotsuga menziesii</i>	Seudotsuga
<i>Larix</i> spp.	Alerce
<i>Cupressus sempervirens</i>	Ciprés
<i>Juniperus communis</i>	Enebro común
<i>Juniperus thurifera</i>	Sabina albar
<i>Juniperus phoenicea</i>	Sabina negral
Quercus	Quercus
<i>Quercus robur</i>	Roble pedunculado
<i>Quercus petraea</i>	Roble
<i>Quercus pyrenaica</i>	Rebollo
<i>Quercus faginea</i>	Quejigo fagínea
<i>Quercus ilex</i>	Encina
<i>Quercus suber</i>	Alcornoque
<i>Quercus canariensis</i>	Quejigo bética

Species	Name MFE
<i>Quercus rubra</i>	Roble americano
Otros quercus	Otros quercus
Mezcla de árboles de ribera	Árboles ripícolas
<i>Populus alba</i>	Álamo
<i>Populus tremula</i>	Chopo temblón
<i>Tamarix spp.</i>	Taraje
<i>Alnus glutinosa</i>	Aliso
<i>Fraxinus angustifolia</i>	Fresno
<i>Ulmus minor</i>	Olmo
<i>Salix spp.</i>	Sauce
<i>Populus nigra</i>	Chopo
Otros árboles ripícolas	Otros árboles ripícolas
Mezcla de eucaliptos	Eucaliptos
<i>Eucalyptus globulus</i>	Eucalipto globulus
<i>Eucalyptus camaldulensis</i>	Eucalipto rostrata
Otros eucaliptos	Otros eucaliptos
<i>Eucalyptus nitens</i>	Eucalipto nitens
<i>Ilex aquifolium</i>	Acebo
<i>Olea europaea</i>	Acebucho
<i>Ceratonia siliqua</i>	Algarrobo
<i>Arbutus unedo</i>	Madroño
<i>Phoenix spp.</i>	Palmera
Mezcla de frondosas de gran porte	Frondosas de gran porte (no quercus)
<i>Fagus sylvatica</i>	Haya
<i>Castanea sativa</i>	Castaño
<i>Betula spp.</i>	Abedul
<i>Corylus avellana</i>	Avellano
<i>Juglans regia</i>	Nogal
<i>Acer campestre</i>	Arce
<i>Tilia spp.</i>	Tilo
<i>Sorbus spp.</i>	Sorbus
<i>Platanus hispanica</i>	Plátano
Laurisilva	Laurisilva
<i>Myrica faya</i>	Faya
<i>Ilex canariensis</i>	Acebiño
<i>Erica arborea</i>	Brezo arbóreo
<i>Persea indica</i>	Viñátigo
<i>Sideroxylon marmulano</i>	Marmulan
<i>Picconia excelsa</i>	Palo blanco
<i>Ocotea phoetens</i>	Til
<i>Apollonias canariensis</i>	Barbusano
Otras laurisilvas	Otras laurisilvas
Mezcla de pequeñas frondosas	Frondosas de pequeño porte
<i>Buxus sempervirens</i>	Boj
<i>Robinia pseudacacia</i>	Acacia robinia
<i>Pistacia terebinthus</i>	Cornicabra
<i>Laurus nobilis</i>	Laurel

Species	Name MFE
<i>Prunus spp.</i>	Prunus
<i>Rhus coriaria</i>	Zumaque
<i>Sambucus nigra</i>	Saúco negro
<i>Carpinus betulus</i>	Carpe
Otras frondosas	Otras frondosas
<i>Crataegus monogyna</i>	Majuelo
<i>Cedrus deodara</i>	Cedrus deodara
<i>Tetraclinis articulata</i>	Tetraclinis articulata
<i>Larix decidua</i>	Alerce común
<i>Cupressus arizonica</i>	Ciprés arizónica
<i>Juniperus oxycedrus</i>	Enebro oxicedro
<i>Juniperus turbinata</i>	Sabina canaria
<i>Quercus humilis</i>	Quercus humilis
<i>Quercus lusitanica</i>	Quejigueta
<i>Tamarix canariensis</i>	Tarajal
<i>Fraxinus excelsior</i>	Fresno excelsior
<i>Ulmus glabra</i>	Olmo montano
<i>Salix alba</i>	Sauce blanco
<i>Populus x canadensis</i>	Chopo híbrido
<i>Eucalyptus viminalis</i>	Eucalipto viminalis
<i>Arbutus canariensis</i>	Madroño canario
<i>Betula alba</i>	Abedul pubescens
<i>Juglans nigra</i>	Nogal
<i>Acer monspessulanum</i>	Arce de Montpellier
<i>Tilia cordata</i>	Tilo cordata
<i>Sorbus aria</i>	Mostajo
<i>Platanus orientalis</i>	Plátano oriental
<i>Ilex platyphylla</i>	Naranjero
<i>Erica scoparia</i>	Tejo, brezo arbóreo escopario
<i>Pleiomeris canariensis</i>	Delfino
<i>Buxus balearica</i>	Boj de Baleares
<i>Sophora japonica</i>	Acacia sofora
<i>Pistacia atlantica</i>	Cornicabra canaria
<i>Laurus azorica</i>	Laurel canario
<i>Prunus spinosa</i>	Espino negro
<i>Sambucus racemosa</i>	Saúco racemosa
<i>Ficus carica</i>	Higuera
<i>Crataegus laevigata</i>	Espino majuelo
<i>Cedrus libani</i>	Cedrus libani
<i>Thuja spp.</i>	Thuja
<i>Larix leptolepis</i>	Alerce leptolepis
<i>Cupressus lusitanica</i>	Ciprés lambertiana
<i>Juniperus cedrus</i>	Enebro canario
<i>Fraxinus ornus</i>	Fresno orno
<i>Ulmus pumila</i>	Olmo pumilo
<i>Salix atrocinerea</i>	Bardaguera
<i>Eucalyptus gomphocephalus</i>	Eucalipto gonfo

Species	Name MFE
<i>Chamaerops humilis</i>	Palmito
<i>Betula pendula</i>	Abedul péndula
<i>Tilia platyphyllos</i>	Tilo común
<i>Sorbus aucuparia</i>	Serbal de cazadores
<i>Rhamnus glandulosa</i>	Sanguino
<i>Prunus avium</i>	Cerezo silvestre
<i>Morus spp.</i>	Morera
<i>Crataegus lacinata</i>	Majoletto
<i>Larix x eurolepis</i>	Alerce híbrido
<i>Cupressus macrocarpa</i>	Ciprés americano
<i>Phoenix canariensis</i>	Palmera canaria
<i>Salix babylonica</i>	Sauce llorón
<i>Acer opalus</i>	Arce ópalus
<i>Sorbus domestica</i>	Serbal común
<i>Visnea mocanera</i>	Mocan
<i>Prunus lusitanica</i>	Loro / Hija
<i>Morus alba</i>	Morera
<i>Crataegus azarolus</i>	Espino
<i>Salix cantabrica</i>	Sauce cantábrico
<i>Dracaena drago</i>	Drago
<i>Acer pseudoplatanus</i>	Arce seudoplátano
<i>Sorbus torminalis</i>	Serbal torminal
<i>Prunus padus</i>	Prunus
<i>Morus nigra</i>	Morera
<i>Salix caprea</i>	Sauce cabruno
<i>Acer platanoides</i>	Arce platanoide
<i>Sorbus latifolia</i>	Serbal de hoja ancha
<i>Salix elaeagnos</i>	Sarga
<i>Sorbus chamaemespilus</i>	Serbal chame
<i>Salix fragilis</i>	Mimbre
<i>Salix canariensis</i>	Sauce canario
<i>Salix purpurea</i>	Mimbrera

**Table 11.3.4.2-1.** Tree species available in MORA. Source: Prepared by the authors from MFE50.

Within the framework of the Application, this group includes both endangered plant species and animal species:

- **Non-threatened species (fauna).**
- **Threatened species (flora and fauna).**

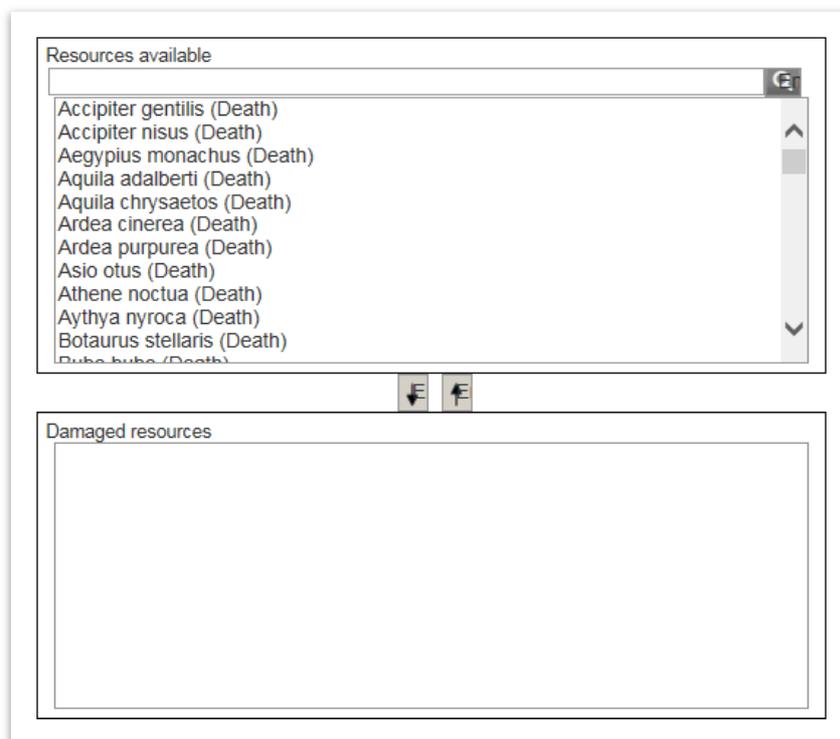
Therefore, when introducing damage to plant species, the user can go to the following classification.

For fauna species, the application presents on screen those species that may appear in the damaged area based on what is indicated by the National Biodiversity Inventory (NBI). Again, as in the case of habitats, the user is able to modify the affected species -both by adding new species, and by eliminating those presented by default- through a search engine for wildlife species.

Specifically, on the screen are collected the species -or groups of species- indicated by the NBI, each of them appearing as "dead" or "injured" individuals, depending on the damage caused to the specimens of the species. On the other hand, for the case in which they want to include as affected other species than those collected by the NBI for that point in the territory, a button labelled "other species" is collected that gives access to a search engine that assists the operator when adding new damaged species in the next screen of the application.

In the field of application, animal species are grouped according to the animal group to which they belong and their replacement cost. Thus, for each main group of species: amphibians, birds, mammals, inland fishes and reptiles, those species whose estimated cost of replacement is greater than € 300 are individually distinguished, while the rest of the species are grouped as other amphibians, other birds, other mammals, other continental fish and other reptiles - to which an average replacement cost of individuals for each group is attributed.

In the case of endangered flora species, only two subgroups are distinguished: threatened thickets and threatened herbaceous plants.



**Figure 11.3.4.2-2.** Tool for the selection of flora species in MORA. Source: SIRMA.

The fauna species included in MORA are.

Species	Group
Other amphibians	Amphibians
<i>Accipiter gentilis</i>	Birds
<i>Accipiter nisus</i>	Birds
<i>Aegypius monachus</i>	Birds
<i>Aquila adalberti</i>	Birds
<i>Aquila chrysaetos</i>	Birds
<i>Ardea cinerea</i>	Birds
<i>Ardea purpurea</i>	Birds
<i>Asio otus</i>	Birds
<i>Athene noctua</i>	Birds
<i>Aythya nyroca</i>	Birds
<i>Botaurus stellaris</i>	Birds
<i>Bubo bubo</i>	Birds
<i>Bulweria bulwerii</i>	Birds
<i>Buteo buteo</i>	Birds
<i>Calandrella rufescens</i> <i>sbsp.polatzekii</i>	Birds
<i>Calandrella rufescens</i> <i>sbsp.rufescens</i>	Birds
<i>Calonectris diomedea</i>	Birds
<i>Chlamydotis undulata</i>	Birds
<i>Ciconia ciconia</i>	Birds
<i>Ciconia nigra</i>	Birds
<i>Circus pygargus</i>	Birds
<i>Falco eleonora</i>	Birds
<i>Falco naumanni</i>	Birds
<i>Falco pelegrinoides</i>	Birds
<i>Falco peregrinus</i>	Birds
<i>Falco tinnunculus</i>	Birds
<i>Fringilla teydea</i>	Birds
<i>Fulica cristata</i>	Birds
<i>Gypaetus barbatus</i>	Birds
<i>Gyps fulvus</i>	Birds
<i>Hieraaetus fasciatus</i>	Birds
<i>Lanius minor</i>	Birds
<i>Marmaronetta angustirostris</i>	Birds
<i>Neophron percnopterus</i>	Birds
<i>Otis tarda</i>	Birds
<i>Pandion haliaetus</i>	Birds
<i>Phalacrocorax aristotelis</i>	Birds
<i>Phalacrocorax carbo</i>	Birds
<i>Podiceps cristatus</i>	Birds
<i>Puffinus mauretanicus</i>	Birds
<i>Rissa tridactyla</i>	Birds
<i>Strix aluco</i>	Birds
<i>Tadorna ferruginea</i>	Birds
<i>Turnix sylvaticus</i>	Birds
<i>Tyto alba</i>	Birds
<i>Uria aalge</i>	Birds

Species	Group
Otras Aves	Birds
<i>Canis lupus</i>	Mammals
<i>Capra pyrenaica</i>	Mammals
<i>Capreolus capreolus</i>	Mammals
<i>Cervus elaphus</i>	Mammals
<i>Dama dama</i>	Mammals
<i>Felis silvestris</i>	Mammals
<i>Lutra lutra</i>	Mammals
<i>Lynx pardinus</i>	Mammals
<i>Monachus monachus</i>	Mammals
<i>Ovies aries</i>	Mammals
<i>Sus scrofa</i>	Mammals
<i>Ursus arctos</i>	Mammals
Other Mammals	Mammals
Other Continental fishes	Continental fish
<i>Dermochelys coriacea</i>	Reptiles
<i>Gallotia bravoana</i>	Reptiles
<i>Gallotia simonyi</i>	Reptiles
<i>Iberolacerta aranica</i>	Reptiles
<i>Iberolacerta martinezricai</i>	Reptiles
Other Reptiles	Reptiles

**Table 11.3.4.2-2.** Species available in MORA. Source: SIRMA.

Once the user has selected the location of the damage and the agent causing it, the MORA module selects the natural resources potentially affected.

### Resources damaged by Inert waste discharge

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**Resources**

Soil

Sea bed

Continental water bed

**Figure 11.3.4.2-3.** Example of the selection of damaged resources. Source: SIRMA.

			Resource								
			Water			Continental shelf	Seabed	Soil	Sea and estuary banks	Species	
			Marine	Continental						Flora	Fauna
				Surface	Underground						
<b>Agent causing the damage</b>	<b>Chemical</b>	Halogenated VOC									
		Non-halogenated VOC									
		Halogenated SVOC									
		Non-halogenated SVOC									
		Fuels and NVOC									
		Inorganic substances									
	<b>Physical</b>	Explosives									
		Extraction/Disappearance									
		Inert waste discharge									
	<b>Fire</b>	Temperature									
	<b>Biological</b>	GMO									
		Invasive alien species									
		Virus and bacteria									
		Fungi and insects									

**Figure 11.3.4.2-4.** MORA agents-resources combinations. Source: Prepared by the authors.

### 11.3.5. AGENT-RESOURCE COMBINATION: DAMAGE DATA

At this point the application shows the first of the agent-resource pairs, requesting some of the data that the user must enter to begin with the monetization of the damage.

The main data requested are:

- **Amount of natural resource damaged.** The amount of the resource that is affected by the damage should be expressed in this section. Depending on the resource, this amount must be expressed in the units indicated below:
  - o Surface water in cubic meters (m<sup>3</sup>)
  - o Groundwater in cubic meters (m<sup>3</sup>)
  - o Seawater in cubic meters (m<sup>3</sup>)
  - o Soil in tonnes (t)
  - o Habitat in hectares (ha)
  - o Species in number of individuals (No. individuals).
  - o Bed - marine or continental - in tonnes (t)
- **Reversibility of the damage.** It refers to the possibility of recovering the damage, obtaining a resource equivalent to the damaged in terms of type, quality and quantity within a reasonable time frame.

In the case of damage caused by death to animal species, it is considered reversible through the captive breeding and subsequent release of individuals of the same species.

When the damage is caused by a chemical substance, the biodegradability indicator of the substance may offer useful information to estimate the parameters of duration and reversibility of the contamination. This indicator is available in the scientific data bases of chemical substances<sup>3</sup>.

If in this section the box corresponding to a "reversible" damage is marked, the remediation will be made through primary and compensatory measures, while if the "irreversible" damage check is made, the remediation will be carried out by means of complementary measures only.

**Damage data**

Quantity damage (t)

Discharged volume (t)

**Reversibility data**

Reversible  Non-reversible

**Figura 11.3.5-1.** Damage data screen (example). Source: SIRMA.

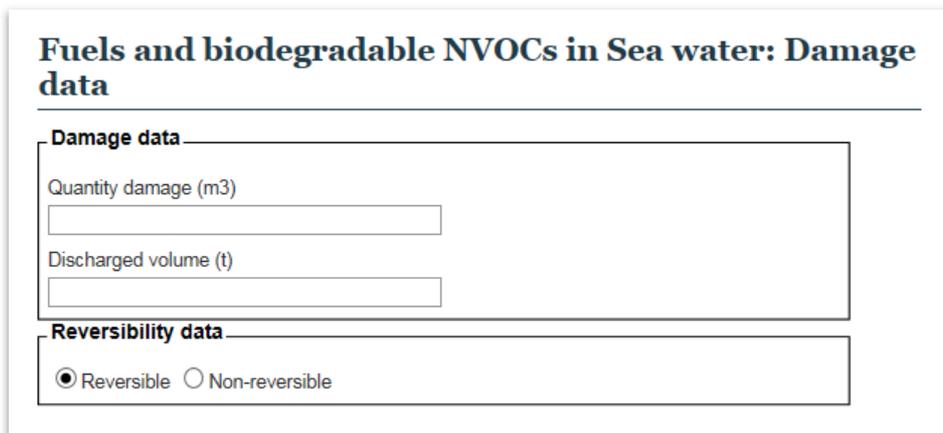
<sup>3</sup> Some examples are: IUCLID (International Uniform Chemical Information Database), SRC (Syracuse Research Corporation), Chemfinder, IPCS (International Programme on Chemical Safety) y OECD Existing Chemicals.

In addition to these two main data, depending on the damage that has occurred, the application can request at the same time:

- **Quantity dumped.** This parameter is requested only in the case of damage by spillage of inert to the ground and to the bed of surface waters (marine and continental) and by organic chemical agents-halogenated and non-halogenated COV, halogenated and non-halogenated COSV, and fuels and CONV - to the marine waters and the shore of the sea and the estuaries. This is due to the direct relationship between the amount of agent discharged and the amount of resource damaged in the cases cited, established in the MORA databases.

The data entered must be:

- Tonnes of inert materials poured
- Tonnes of organic chemical agent discharged



**Fuels and biodegradable NVOCs in Sea water: Damage data**

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**Damage data**

Quantity damage (m3)

Discharged volume (t)

**Reversibility data**

Reversible  Non-reversible

**Figure 11.3.5-2.** Damage data request screen on the quantity of the agent dumped (example).

Source: SIRMA.

- **Type of impact.** It refers to the type of damage caused by organic chemical agents-halogenated and non-halogenated COV, halogenated and non-halogenated COSV, and fuels and CONV-to the riparian of the sea and the estuaries. There are two options:
  - a. Total impact. It involves the formation of pits, roofs or layers of pollutant with continuous or discontinuous distribution and with a thickness greater than one millimetre.
  - b. Partial impact. It supposes the formation of spots or films of polluting agent with patchy or sporadic distribution with a thickness less than one millimetre.

### Fuels and biodegradable NVOCs in Shore of the sea and estuaries: Damage data

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**Damage data**

Quantity damage (t)

Discharged volume (t)

Impact  
 ▼

**Reversibility data**

Reversible  Non-reversible

**Figure 11.3.5-3.** Damage data request screen on the type of impact. Source: SIRMA.

- **Planting density.** This information is requested exclusively in the case of damage to habitats. Represents the number of trees that must be recovered in the affected extension. The data entered should be the number of feet (individuals) per hectare of the species being considered. The application offers default data that can be modified if more accurate information is available.

In the case that the affected habitat is a threatened grassland, it is recommended to fill this parameter with a zero, and in the case of a scrubland, if the user does not have more accurate information, it is suggested to include a value of 863 trees per hectare.

- **Type of soil.** This information is requested exclusively in the case of damage to habitats. It represents the type of soil in which the repopulation works must be carried out and affects the type of technique to be used. Information must be provided as if the soil is:
  - a. Stony (irregular)
  - b. Transit (compacted)

It must be entered if it is stony soil -irregular- or transit -compacted-. Applying a conservative criterion, the tool offers by default the value of "stony" but this data can be modified in case that more accurate information is available.

- **Fraction of total covered capacity.** This information is requested exclusively in the case of damage produced on habitat. It represents the degree of covering of the soil by the vertical projection of the treetops, that is, the fraction of the plot occupied by the vertical projection of the canopy of the trees.

The data must be entered as a percentage. The application offers default data that can be modified if more accurate information is available.

In the event that the affected habitat is threatened grassland or scrubland, this parameter must be filled out with the value zero.

### Fire in *Quercus ilex* pole phase: Damage data

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**Damage data**

Quantity damage (ha)

Density (pies/ha)

Soil type  
 ▼

Total canopy cover fraction (%)

**Reversibility data**

Reversible
  Non-reversible

**Figure 11.3.5-4.** Damage data request screen on the density, type of soil and Fraction of total covered capacity (example). Source: SIRMA.

### 11.3.6. EVALUATION OF THE ENVIRONMENTAL DAMAGE

The MORA methodology treats reversible and irreversible damages in two different ways. For damages that are combined-partly reversible and partly irreversible-the user must first enter the reversible part and then the irreversible part, obtaining the total value by aggregation of both.

#### A. Daños reversibles

In the case of reversible damage, monetization through the software tool follows the steps described below.

**a) Agent - Resource combination: Primary Remediation Technique.** Once the amount of resource that has been affected by the damage has been reported, the application provides in order of priority the technique or techniques recommended, according to the information provided, for the adequate damage remediation.

In a lower panel, a drop-down appears with the full battery of techniques available in the application for the treatment of the resource being analysed -although they are not considered as the most appropriate techniques for the recovery of the damage that is being analysed, since they are not specific to repair damage caused by the particular agent that caused the damage.

Finally, if the user does not agree with any of the techniques offered by the tool, it may include new remediation techniques on which the corresponding information must be provided and duly justify its use. The parameters of the techniques introduced by the user on which it is mandatory to report throughout the assessment are:

- *Name of the technique*
- *General description*

- *Cost of application of the technique*
- *Resource recovery time*
- *Effectiveness*

### Fuels and biodegradable NVOCs en Soil: Primary Remediation Technique

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**Recommended techniques**

**Available techniques**

**Own technique**

Technique name

Remarks

**Figure 11.3.6-1.** Primary remediation selection screen (example). Source: SIRMA.

**a) Agent - Resource combination: Primary Remediation data**

The remediation data that appear in this section are the following:

- *Fixed cost of execution by contract ( $Cost_f$ )*. They are those execution costs of the remediation project that do not depend on the amount of resource to be repaired, but are an amount determined by remediation, regardless of the volume to be treated.
- *Unit cost of execution per contract ( $Cost_u$ )*. Those execution costs of the remediation project that evolve in parallel with the volume of resource treated.
- *Multiplier ( $p$ )*. Is a multiplying coefficient that varies according to the remediation technique. It only takes a non-zero value in techniques applied to marine or continental beds.
- *Exponent ( $q$ )*. It is an exponential coefficient that varies depending on the remediation technique. It only takes a non-zero value in techniques applied to marine or continental beds.
- *Unit of time*. Months or years.
- *Wait time*. Time that elapses from the moment of the accident until the remediation begins. It must be entered in whole units of time.
- *Recovery time*. Period of time that elapses from the beginning of the remediation until the affected resources are returned to their original state. It must be entered in whole units of time.

- *Type of effectiveness.* It refers to the effectiveness of the remediation technique in relation to the agent and resource that is being analysed. It can take two values:
  - a. Limited
  - b. Demonstrated

Specifically, the equation used to calculate the cost of primary remediation is shown below:

$$Cost_R = Cost_f + (Cost_u \times Q) + (p \times Q^q)$$

Where:

$Cost_R$ , is the cost of recovering the resource

$Cost_f$ , is the fixed cost

$Cost_u$ , is the variable cost

$Q$ , is the amount of resource damaged or the amount of agent discharged - depending on the agent-resource partner that is being monetized and the remediation technique to be used-

$p$ , is a multiplying coefficient that varies depending on the remediation technique

$q$ , is an exponential coefficient that varies depending on the remediation technique

### Fuels and biodegradable NVOCs in Soil: Primary Remediation Data

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**Remediation expenses**

Cost<sub>R</sub>

Fixed cost outsourcing (Cost<sub>f</sub>)

Unit cost outsourcing (Cost<sub>u</sub>)

Multiplier (p)

Exponent (q)

---

**Remediation data**

Time unit  ▼

Waiting time

Recovery time

Efficiency type  ▼

**Figure 11.3.6-2.** Primary Remediation data screen. Source: SIRMA.

**b) Agent - Resource combination: Primary Remediation Budget**

Una vez calculado el coste de ejecución por contrata de la reparación del daño, únicamente restaría añadir a dicho presupuesto el Impuesto sobre el Valor Añadido (IVA) y el porcentaje de seguridad por contingencia —costes asociados a la aparición de contingencias e imprevistos derivados de la ejecución del proyecto—.

En el ámbito de la aplicación los porcentajes dados por defecto son:

- VAT: currently set at 21% of the CEB (Contract Execution Budget).
- Percentage of safety by contingency. 20-40% of the estimate of the total cost
- estimated—range collected in the justifying report of the Royal Decree project for which the Regulations of partial development of Law 26/2007 of 23 October are approved for Environmental Responsibility—. For the determination of the safety percentage by contingency in each case, the criterion chosen is the following:
  - For techniques in which a specific agent-resource pair have a *limited* recovery efficiency, the percentage of contingency safety will be the maximum, which is 40%.
  - For techniques in which a specific agent-resource pair possess a *demonstrated* recovery efficiency, the percentage of contingency safety will be the minimum, which is 20%.

These percentages provided by the MORA application may be modified by the user in the event that the latter has better information. These modifications must be justified in the final report. To see the changes made in the percentages reflected in the amount, click on the "Recalculate" button.

This screen includes, in turn, consulting and revision and control costs of the remediation. Both are filled out by default depending on the agent and the damaged resource, although they can be modified by the user. Again, these costs are reflected as contract execution costs (CEB) and the percentages of VAT and contingency safety explained above are applied to them --21% and 20 40% respectively.

### Fuels and biodegradable NVOCs in Soil: Primary remediation breakdown

**Breakdown**

Concept	%	Amount (€)
<b>Estimated Costs of Implementation Remediation technique</b>		2,605.50
% Contingency Security	20.00	521.10
% VAT	21.00	656.59
<b>Total Remediation Technique</b>		3,783.19
<b>Estimated Costs of Implementation Cosultancy</b>		6,452.82
% Contingency Security	20.00	1,290.56
% VAT	21.00	1,626.11
<b>Total Consultancy</b>		9,369.49
<b>Estimated Costs of Implementation Revision and Control</b>		1,868.00
% Contingency Security	20.00	373.60
% VAT	21.00	470.74
<b>Total Revision and Control</b>		2,712.34
<b>Total Remediation</b>		15,865.02

MORA is a voluntary tool that provides the monetization of environmental damages under Law 26/2007 of 23 October on Environmental Liability (Ley 26/2007, de 23 de octubre, de Responsabilidad Medioambiental). MORA results are non-binding.

**Figure 11.3.6-3.** Primary remediation budget (example). Source: SIRMA.

**c) Agent - Resource combination: Compensatory Remediation Technique**

Once the budget of the primary remediation has been calculated, and if it does not have an immediate effect -in the scope of the MORA Application, immediate effect is understood as the recovery time of less than one month-, the application begins with the calculation of the compensatory measure.

By default, the application takes as a technique to develop compensatory remediation the same technique used to carry out primary remediation, although it allows the selection of a different one between the remediation technologies available or the introduction of a new one.

**d) Agent - Resource combination: Compensatory Remediation Technique data**

Based on the data entered for primary remediation -mainly: amount damaged, waiting time and recovery time- and applying the discount rate, the application calculates through the Resource

Equivalency Analysis methodology (REA) the additional amount of resources to be generated through remediation in order to compensate the temporary losses related to the environmental damage.

As happened in the Primary Remediation, the data collected in this section are the following:

- *Fixed cost of execution by contract (Cost<sub>i</sub>)*. They are those execution costs of the remediation project that do not depend on the amount of resource to be repaired, but are an amount determined by remediation, regardless of the volume to be treated.
- *Unit cost of execution per contract (Cost<sub>u</sub>)*. Those execution costs of the remediation project that evolve in parallel with the volume of resource treated.
- *Multiplier (p)*. Is a multiplying coefficient that varies according to the remediation technique. It only takes a non-zero value in techniques applied to marine or continental beds.
- *Exponent (q)*. It is an exponential coefficient that varies depending on the remediation technique. It only takes a non-zero value in techniques applied to marine or continental beds.
- *Unit of time*. Months or years.
- *Wait time*. It is the time that elapses from the occurrence of the accident until the compensatory remediation begins. It must be entered in whole units of time.
- *Recovery time*. Period of time that elapses from the beginning of the remediation until the affected resources are returned to their original state. It must be entered in whole units of time.
- *Annual discount rate*. 3%.
- *Type of effectiveness*. It refers to the effectiveness of the remediation technique in relation to the agent and resource that is being analysed. It can take two values:
  - a. Limited
  - b. Demonstrated

**Remediation expenses**

Coster

Fixed cost outsourcing (Coster)

Unit cost outsourcing (Coster<sub>u</sub>)

Multiplier (p)

Exponent (q)

---

**Remediation data**

Time unit

Waiting time

Recovery time

Annual discount rate (%)

Efficiency type

**Figure 11.3.6-4.** Compensatory remediation data screen (example). Source: SIRMA.

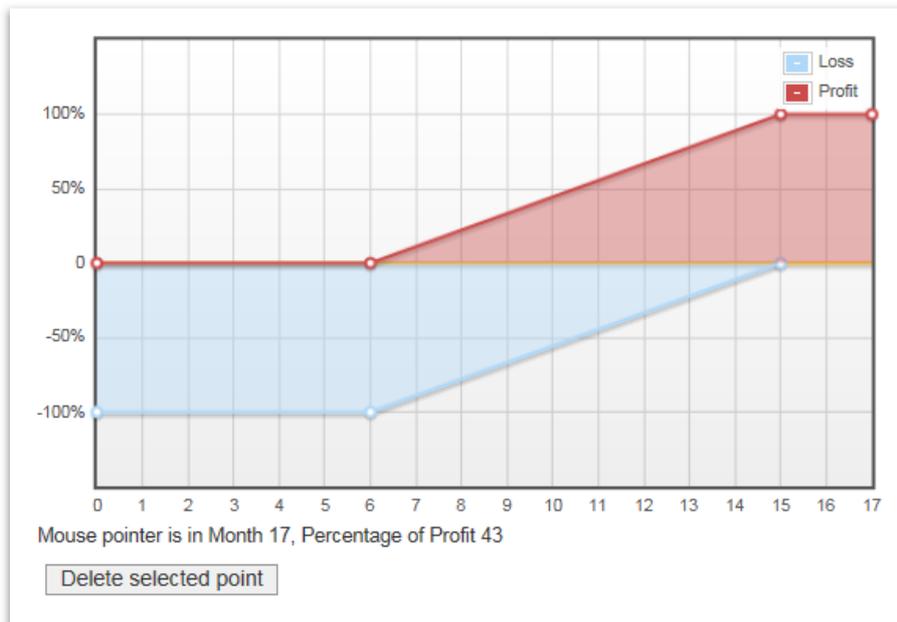
**e) Agent - Resource combination: Compensatory Remediation Graph**

In this screen, the application of the REA methodology to the specific damage that is being analysed is presented graphically.

In general, the basis on which the REA methodology is based is that the area that represents the level of loss of resources or services originated with the accident and the level of resources or services generated by the remediation project - profits - must be compensated. Therefore, the quotient between the sum of the discounted losses -debit- and the sum of the discounted profits generated by the remediation -credit- provides the additional amount of resources or services that will have to be created to compensate the company affected by the provisional or irreversible losses.

In the graphic displayed, the user has the possibility of modifying the points of passage in case the concrete curve of recovery of the resource by means of the selected technique is known. To do this you must place the cursor on the area where you want to enter a waypoint and double click with the mouse. The minimum period for which intermediate waypoints can be created is one month, meaning they cannot be created in the middle of a monthly interval. To delete the created waypoints, you must select that point and press the "Delete selected point" button below the graphic. In no case it is possible to modify the start and end points of the remediation -defined- by the data previously entered-.

The lower part of the graph shows the physical units that must be recovered through primary remediation -the amount of damage introduced by the user- and the additional physical units that must be recovered through compensatory remediation measures -calculated based on the methodology of the REA-.



**Figure 11.3.6-5.** Detail of compensatory remediation graph screen (example). Source: SIRMA.

**f) Agent - Resource combination: Compensatory remediation budget**

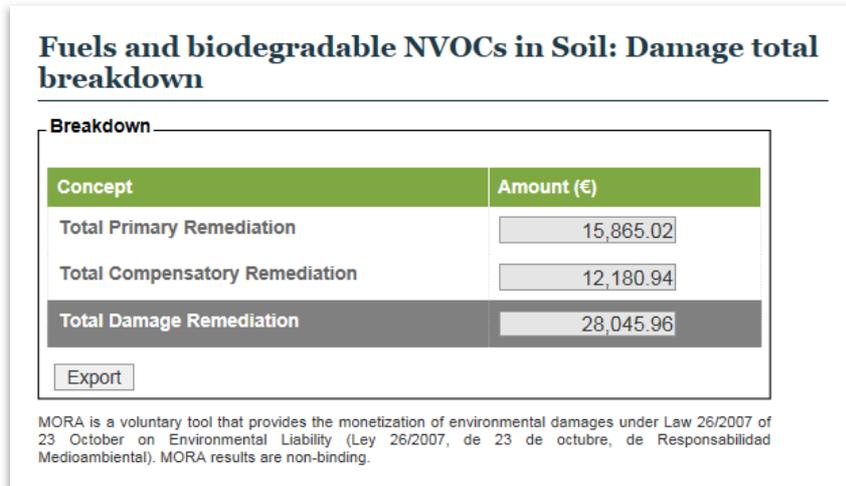
To calculate the cost of the compensatory remediation, equations analogous to those used in primary remediation are used. The only data that varies with respect to this is the amount to be repaired, which on this occasion is the one calculated through the REA as physical compensatory remediation units.

For the preparation of the budget, the same costs and percentages used in primary remediation are used.

**g) Agent - Resource combination: Total damage breakdown**

En esta pantalla aparece reflejado, en forma de resumen:

- The total cost of primary remediation -primary remediation cost, consulting cost of primary remediation and cost of revision and control of primary remediation-.
- The total cost of the compensatory remediation -compensatory remediation cost, consulting cost of the compensatory remediation-
- The final remediation cost of the damage -sum of the total costs of primary and compensatory remediation-.



**Figure 11.3.6-6.** Total damage breakdown: Primary Remediation and Compensatory Remediation. (example). Source: SIRMA.

## B. Irreversible damage

In case of irreversible damage, the valuation is carried out through complementary remediation measures.

### a) Agent - Resource combination: Complementary Remediation Technique

Once the amount of resource that has been affected by the damage has been irreversibly introduced, the application facilitates the technique or techniques recommended, according to the information provided, for the remediation of the damage.

In this case, what the MORA methodology proposes is to apply the remediation technique that would have been used in case of reversible damage. In other words, using this technique to recover similar damage is prepared in a geographically linked location in which the damaged resource can be repaired.

Again, as with the selection of the primary measure, there is a lower panel that collects the complete battery of techniques available in the application for the treatment of the resource being analysed, although they are not identified as most appropriate for the treatment of the specific damage that is being analysed.

Also, if the user decides not to choose any of the available techniques, they may include new remediation techniques, about which they should report properly. The parameters of the techniques introduced by the user that must be filled in are:

- *Name of the technique*
- *General description*
- *Cost*

- *Recovery time*
- *Effectiveness*

Again, to calculate the amount of resource to be repaired, the REA methodology is used, which calculates the total resource units to be restored to compensate for the irreversible damage.

#### **b) Agent - Resource combination: Complementary Remediation Data**

The data of the complementary remediation are analogous to those included in the data section of the compensatory remediation:

- Fixed cost of execution by contract (Cost  $i$ ). They are those execution costs of the remediation project that do not depend on the amount of resource to be repaired, but are an amount determined by remediation, regardless of the volume to be treated.
- Unit cost of execution per contract (Cost  $u$ ). Those execution costs of the remediation project that evolve in parallel with the volume of resource treated.
- Multiplier (p). Is a multiplying coefficient that varies according to the remediation technique. It only takes a non-zero value in techniques applied to marine or continental beds.
- Exponent (q). It is an exponential coefficient that varies depending on the remediation technique. It only takes a non-zero value in techniques applied to marine or continental beds.
- Unit of time. Months or years.
- Wait time. Time that elapses from the moment of the accident until the remediation begins. It must be entered in whole units of time.
- Recovery time. Period of time that elapses from the beginning of the remediation until the affected resources are returned to their original state. It must be entered in whole units of time.
- Annual discount rate. 3%.
- Type of effectiveness. It refers to the effectiveness of the remediation technique in relation to the agent and resource that is being analysed. It can take two values:
  - a. Limited
  - b. Demonstrated

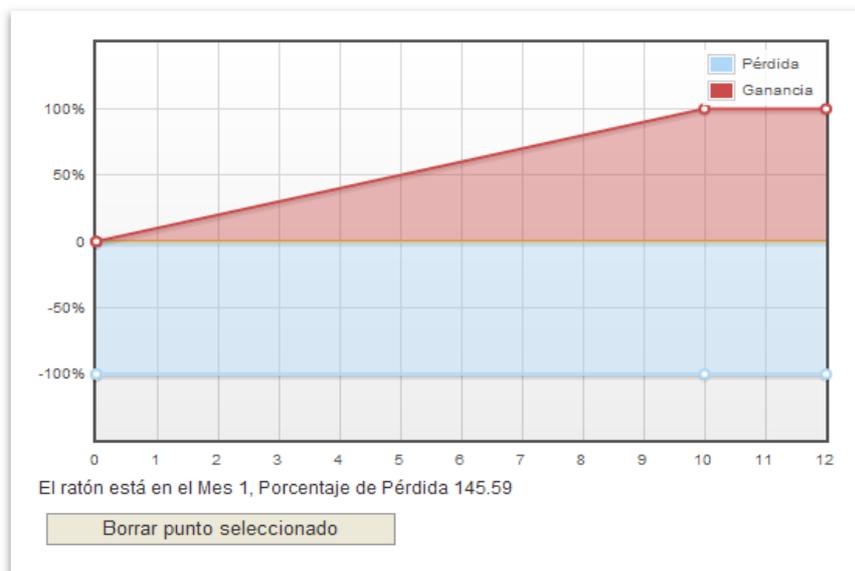
#### **c) Agent - Resource combination: Complementary Remediation Graph**

In this screen, the application of the REA methodology to the irreversible damage that is being analysed is presented graphically.

In the graphic displayed, as in the case of compensatory remediation, the user has the possibility of modifying the points of passage, in case he knew the concrete curve of recovery of the resource by means of the selected technique. To do this you must place the cursor on the area where you want to enter a waypoint and double click with the mouse. The minimum period for which

intermediate waypoints can be created is one month, meaning they cannot be created in the middle of a monthly interval. To delete the created waypoints, you must select that point and press the "Delete selected point" button below the graphic. In the case of the complementary remediation, the lower part of the graph that equals the losses -in blue- cannot be modified since it represents the irreversibility of the damage caused to the resource. It is also not possible to modify the start and end points of the remediation -defined by the data previously entered-.

In the lower part of the graph, the physical units that must be recovered through the complementary remediation -calculated based on the REA methodology- are shown.



**Figure 11.3.6-7.** Detail of the graphic screen of the complementary remediation (example).

Source: SIRMA.

**d) Agent - Resource combination: Complementary Remediation Budget**

To calculate the cost of the complementary remediation, equations analogous to those used in primary remediation are used. The only data that varies is the amount to be repaired, which on this occasion is the one calculated through the REA as physical units of complementary remediation.

For the creation of the budget, the same costs and percentages used for primary remediation are used.

**e) Agent - Resource combination: Total damage breakdown**

On this screen it appears reflected, in summary form:

- The total cost of the complementary remediation - cost of complementary remediation, cost of consulting of the complementary remediation and cost of revision and control of the complementary remediation-.

- The final cost of the remediation of the damage -equivalent to the total cost of the complementary remediation-.

Once the assessment of the first agent-resource pair is completed, the application allows continuing with the next resource affected by the first agent, if it existed, or going on to assess the damage produced by the next agent causing the damage. Therefore, all agent-resource pairs produced in the accident being evaluated could be monetized.

### 11.3.7. ROAD CONSTRUCTION BUDGET

At the end of the assessment of a damage using the MORA application, the construction cost of an access road to the damaged area should be calculated as a last step, should this be necessary.

In case the affected area has an adjacent road, this cost will be zero. Otherwise, the meters that go from the damaged place to the nearest communication channel will be used as a basis for calculating the road's construction budget. The equation used is the following:

$$Cost_{CC} = Cost_u \times Dist$$

Where:

$Cost_{CC}$ , is the cost of road contract execution (€).

$Cost_u$ , is the unit cost in Euros of construction of each meter of road in execution budget per contract (€/m).

$Dist$ , in the distance in meters from the damaged place to the nearest access road (m).

As was the case with the remediation costs, once the cost of contract execution of the road was calculated, it would be necessary to add the Value Added Tax (VAT) and the percentage of contingency security - both modifiable by the user - to said budget.

Finally, road construction consulting costs are included. The data is filled in by default, although it can be modified by the user.

**Breakdown**

Concept	%	Amount (€)
<b>Total Road Construction</b>		0.00
% Contingency Security	20.00	0.00
% VAT	21.00	0.00
<b>Total Road Execution</b>		0.00
<b>Estimated Costs of Implementation Consultancy</b>		0.00
% Contingency Security	20.00	0.00
% VAT	21.00	0.00
<b>Total Consultancy</b>		0.00
<b>Total Road Construction</b>		0.00

Export

MORA is a voluntary tool that provides the monetization of environmental damages under Law 26/2007 of 23 October on Environmental Liability (Ley 26/2007, de 23 de octubre, de Responsabilidad Medioambiental). MORA results are non-binding.

[Previous](#)
[Recalculate](#)
[Next](#)

**Figure 11.3.7-1.** Road construction budget breakdown. Source: SIRMA.

### 11.3.8. FINANCIAL SECURITY

After adding to the total damage estimate the costs of building an access road to the area to be repaired, if such were necessary, the application displays a screen that makes it easier for users to determine the resulting financial security based on the data entered into the tool.

This screen is optional, therefore first the user is asked if he/she wants to calculate the financial security that would result from repairing the damages entered.

If the user responds in the negative, the report will continue to be finished. On the other hand, if the user answers in the affirmative, the application firstly displays a validation box where he/she may indicate whether he/she has an ISO or EMAS certificate, and then a summary table with the costs that should include the financial security put in place for the aforementioned damages. Specifically, the concepts included are:

- Primary repairs. This is the sum of all the primary repairs required to repair the environmental damage caused.
- Road Construction. Construction cost of the access road to the area to be repaired (if it is not necessary, this cost shall be nil).
- Primary repairs + Road Construction. Sum of the primary repairs and road construction costs, if any.

- % Prevention and Avoidance. This percentage is pre-set in the application as 10% of the sum of the primary repairs and the road construction cost, given that it is the minimum set out in the regulations. This figure is editable and can be increased if the users so wish.

As a result of this table, a total cost is shown as a financial security proposal.

Besides this information, the application determines, according to the information the user has entered, whether or not it is mandatory to provide this financial security according to Law 26/2007.

### Financial security

---

**Setting of the financial security**

Do you want to include the financial security proposal?  
 Yes  No

ISO or EMAS certified

Concept	%	Amount (€)
Primary Remediations		
Road Construction		
Primary Remediations + Road Construction		
% Prevention and Avoidance	<input type="text" value="10.00"/>	
<b>Financial security proposal</b>		

According to the data entered and in accordance with the provisions of article 24.1 of Law 26/2007, the operator of a facility included in article 37.2 of its development regulations will not be obliged to constitute a financial guarantee for complying with any of the exemptions established in letters "a" or "b" of article 28 of the law.

[← Previous](#)
[Recalculate](#)
[Next →](#)

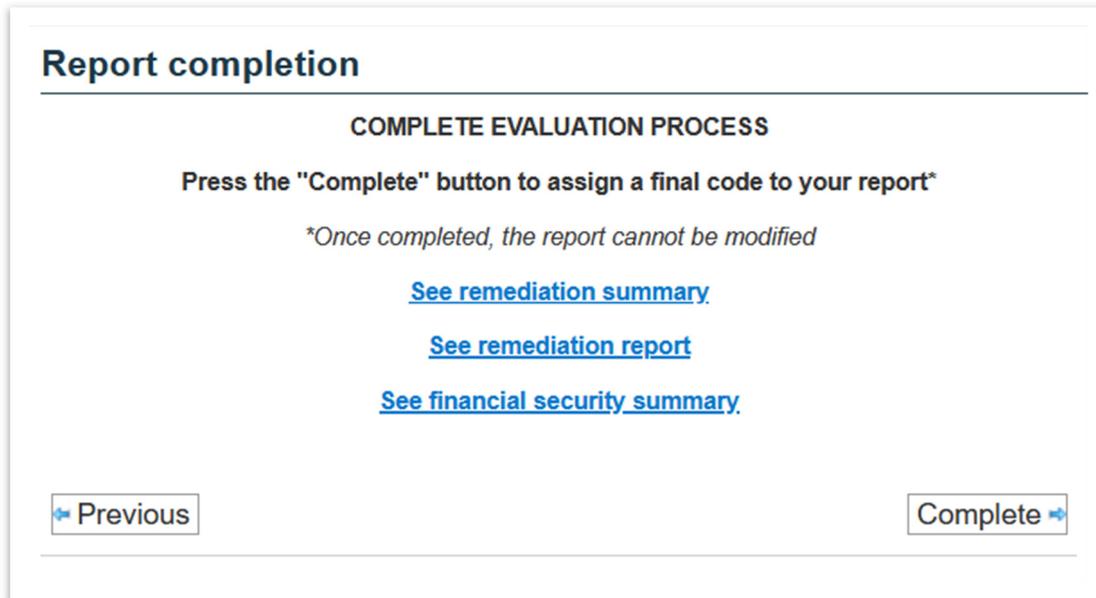
**Figure 11.3.8-1.** Screen for putting in place a financial security - an example of a case where there is no requirement to put in place a financial security. Source: SIRMA.

### 11.3.9. FINAL REPORT

Once all the agent-resource pairs that have been selected for the analysis have been treated, the application allows finishing the process and the creation of the final report with the results, using the button "Complete". The reports that have been completed can not be modified.

This report contains both the data that the user has entered, as well as those provided by the application and those modified by the analyst -which should be properly justified-. In addition to

this, it provides the results obtained by the application and the monetization made by it. It is possible to see the report created by clicking on “See remediation summary” as well as clicking on the “printing” icon in the navigation menu. The report generated is in PDF format. It is also possible to consult the financial security obtained by using MORA Application clicking on “See financial security summary”.



**Figure 11.3.9-1.** Detail of the report completion screen. Source: SIRMA.

At the same time, on this screen the operator is allowed to access, through the "See remediation summary" link, to the summary table of the remediation costs obtained by means of the assessment of damages for each agent/resource pair analysed. Using the “Export” Button it is possible to transfer the results to a Microsoft Excel file.

Remediation summary		
Agent-resource combinations of the accidental scenario	Action type	Amount (€)
Non-halogenated biodegradable SVOCs-Groundwater	Primary remediation	233.579.32
	Compensatory remediation	231.669.34
	Complementary remediation	0.00
	<b>Subtotal</b>	<b>465.248.66</b>
Non-halogenated biodegradable SVOCs-Continental surface water	Primary remediation	162.566.68
	Compensatory remediation	70.655.38
	Complementary remediation	0.00
	<b>Subtotal</b>	<b>233.222.06</b>
Non-halogenated biodegradable SVOCs-Soil	Primary remediation	75.923.09
	Compensatory remediation	12.792.31
	Complementary remediation	0.00
	<b>Subtotal</b>	<b>88.715.40</b>
Road Construction Budget		0.00
Primary remediation total (including road construction)		472.069.09
Compensatory remediation total (without including road construction)		315.117.03
Complementary remediation total (without including road construction)		0.00
<b>Remediation total</b>		<b>787.186.12</b>

**Figure 11.3.9-2.** Summary of the remedial costs (example). Source: SIRMA.

## 11.4. REPORTS REPOSITORY

The “Reports Repository” menu of the navigator in the MORA module gathers all the reports (completed and still not completed) carried out by the user.



**Figure 11.4-1.** Access to the repository of reports created in MORA. Source: SIRMA.

There is a list with all the reports created. The information on each report is:

- Name. The name given to the report by the user.
- Date of performance. Date in which the report was created.
- Version. Version of the MORA software that was used to create the report.
- Completed. Indicates if the report is completed or not. The reports that have been completed can not be edited.
- Duplicate. This option is available in the reports completed and create a copy that can be edited. It allows the user to open a completed version of a report for its correction, update or creating another report.
- Modify/See. It allows the user to modify the report (if it is not completed) or see it (if it is completed).
- Delete. It allows the to delete reports, selecting them and clicking on “Delete”.
- Print. Allows printing the report in PDF format.

### Consultation of MORA reports

- Searching panel -

Name  Date from  Date to  Completed

[Entry data of Report](#)

Name	Date of performance	Version	Completed	Duplicate	Modify / See	Delete	
Empresa	04/22/2015	v2011/1	No			<input type="checkbox"/>	
Prueba práctica_1491212462204	04/12/2016	v2011/1	No			<input type="checkbox"/>	
Prueba práctica_1535098618727	04/12/2016	v2011/1	No			<input type="checkbox"/>	
Prueba práctica_1516876010636	04/12/2016	v2011/1	No			<input type="checkbox"/>	
Prueba práctica	04/12/2016	v2011/1	Yes			<input type="checkbox"/>	
Consulta robo aves	05/23/2016	v2011/1	Yes			<input type="checkbox"/>	
Consulta 12.05.2016_solo reparación primaria	05/23/2016	v2011/1	No			<input type="checkbox"/>	
Consulta 12.05.2016_solo reparación primaria con unidades compensatoria incluidas	05/23/2016	v2011/1	Yes			<input type="checkbox"/>	
Consulta 12.05.2016	05/23/2016	v2011/1	Yes			<input type="checkbox"/>	
Oil tank breakage_situation 1	04/03/2017	v2011/1	No			<input type="checkbox"/>	
Oil tank breakage_situation 2	04/03/2017	v2011/1	No			<input type="checkbox"/>	

**Figure 11.4-2.** Information in the MORA reports repository. Source: SIRMA.

In the repository of reports, it is possible to sort the reports clicking on the title of the column that wants to be used to sort them) and the option to search reports using the field and the “lens” button.

## 11.5. FREQUENTLY ASKED QUESTIONS ON THE MORA MODULE

It must be taken into account that before using the MORA Computer Application, the analyst must have basic information from their risk analysis and quantification.

Below are some of the most frequently asked questions that may arise prior to using the MORA Application.

1. What scenarios should be monetized using the MORA application?
2. What are the necessary input data for the calculation of replacement cost?
3. How are primary remediation techniques selected?
4. How are remediation techniques for compensatory and complementary measures selected?
5. How are the replacement costs calculated in the scope of the MORA application?
6. What are the revision and control costs?
7. Should compensatory measures have consulting and revision and control costs?

---

### 1. What scenarios should be monetized using the MORA application?

Specifically, the user must know the accident scenarios that are **relevant** in their case. That is, some of the damage that an economic activity is likely to cause, can be considered negligible when dealing with recovery through remediation techniques. To determine whether it can be addressed if damage is relevant, depending on the resource, the **amount** of it that has been affected, the **duration** of the damage as well as the **likelihood** that it occurs.

As an example, we could determine that a damage caused by a semi-volatile chemical agent to surface waters that, due to the effect of dilution and evaporation, is transformed into a harmless substance in less than a day, is a damage that should not be considered with respect to your assessment.

In the case of wildlife species, the damage is considered relevant based on the number of individuals that have been affected in relation to the total size of the population of said species. That is to say that, whilst for endangered species the damage to just one individual may be crucial, for general species, a large number of individuals must be affected in order for the population balance of said species to be altered.

## 2. What are the necessary input data for the calculation of replacement cost?

Once the relevant scenarios that you want to monetize have been selected, it will be necessary to know, for each of them, the following information:

1. **Agent** that has caused the environmental damage. The analyst can use the following table to aid the selection of the damage causing agent.

Agent causing the damage	The agent has an associated toxicity threshold ( <b>chemical agents</b> )	The agent is not an explosive substance	Organic agent	BP < 325 °C	BP <sup>4</sup> < 100 °C	The agent contains halogenated elements	Damage by halogenated VOC
						The agent does not contain halogenated elements	Damage by non-halogenated VOC
					BP < 100 °C	The agent contains halogenated elements	Damage by halogenated SVOC
						The agent does not contain halogenated elements	Damage by non-halogenated SVOC
				BP > 325 °C	Fuel	Damage by fuel	
					Other substances	Damage by non-volatile organic compounds (NVOCs) [CONV]	
		Inorganic agent	<i>Damage by inorganic substances</i>				
		The agent is an explosive substance	<i>Damage by explosive substances</i>				
	The agent does not have an associated toxicity threshold	<b>Physical Agents</b>	<i>Damage by extraction or disappearance of a natural resource</i>				
			<i>Damage by inert waste discharge</i>				
<i>Damage by temperature increase</i>							
<b>Fire</b>		<i>Damage by fire</i>					
<b>Biological Agents</b>		<i>Damage by genetically modified organisms</i>					
		<i>Damage by exotic invasive species</i>					
		<i>Damage by virus and bacteria</i>					
		<i>Damage by fungi and insects</i>					

**Figure 11.5-1.** Matrix for selecting the damage causing agent. Source: Prepared by the authors

2. **Resources affected** by the environmental damage that has occurred. These may be:
  - a. Water:
    - i. Continental surface water.

<sup>4</sup> Boiling point

- ii. Groundwater.
- iii. Sea water.
- b. Shore of the sea and estuaries.
- c. Sea bed.
- d. Continental water bed.
- e. Soil.
- f. Habitat. In the damages that affect the habitat resource, it will be necessary to indicate the vegetable species that have been affected.

Specifically, for each of the available species, it should be indicated in what state they were at the time before the environmental damage occurred - the state determines the development phase of the regular populations. Going to the MFE50, four possible states can be distinguished, these are:

- *Repopulated*. State of a population born from seed from its germination until the aerial parts of the adjacent feet are touched.
- *Wild Brush*. State of the mass in its first youth; that is, since they start touching the new cups of the plants until they reach the pole stage.
- *Pole stage*. State of the arboreal mass from 8 - 10 meters in height and until reaching the small tree state.
- *Small trees*. State of higher development of the forested mountains.
- g. Species. This group includes both threatened plant species and animal species.
  - i. Non-threatened species (fauna).
  - ii. Threatened species (flora and fauna).

Again, as in the case of habitats, it will be necessary to indicate the animal species that have been affected - For each species of fauna affected depending on the agent causing the damage, "dead" or "injured" individuals may be selected, taking into account the damage caused to the specimens of the species.

In the case of threatened plant species, only two subgroups are distinguished: threatened grassland and threatened herbaceous plants.

- 3. **Amount of resource affected.** The analyst must have the amount of resource that has been affected by the damage. The units in which each resource is measured are:

- a. Water in cubic meters (m<sup>3</sup>).  
Due to the specificity of the remediation techniques for organic compound damage to seawater, it will be necessary to report in tonnes (t) in addition to the amount of polluting agent discharged.
- b. Seashore and estuaries in tonnes (t).

Due to the specificity of the remediation techniques for damage by organic compounds to the shore of the sea and estuaries, it will be necessary to report in addition to the amount of pollutant discharged in cubic meters (m<sup>3</sup>).

- c. Seawater bed in tonnes (t).
- d. Bed of continental surface waters in tonnes (t).
- e. Soil in tonnes (t).
- f. Habitat in hectares (ha).

For the habitat resource, in addition to the amount damaged in hectares, it is also necessary to report on:

- i. The density of the affected vegetation measured in feet per hectare (foot/ha).
- ii. The type of soil. There are only two options: stony or transit.
- iii. The fraction of total covered capacity, expressed as a percentage (%).

When the selected coordinates match a tile of the Forest Map of Spain, the application will offer by default the data collected in it for these fields.

- g. Species in affected individuals (no. ind). The number of individuals that have been killed and/or the number of injured animals of each species must be reported.

4. **Reversibility of the damage.** The classification of the damage as reversible or irreversible is a fact that determines the development of the report. If it is considered that the damage is reversible, the remediation will be made through primary and compensatory measures, while, if on the contrary it is classified as irreversible, the remediation will be through complementary measures.

Damage can be characterized as irreversible if:

If it is able to be repaired, requires an unreasonable time period for its complete recovery or,

Its cost is disproportionate in relation to the environmental benefits that the resource would provide once repaired.

### **3. How are primary remediation techniques selected?**

Based on the damage characterization data provided by the operator, the MORA application offers the techniques that are *a priori* the most suitable in order to remediate the introduced scenario.

The technique selected by default is the one that is considered most appropriate due to the application of the selection criteria of techniques included in Annex II of Law 26/2007.

At the same time, whenever there is more than one applicable technique for the agent-resource combination that is being analysed, two techniques in addition to the selected technique are offered in the same drop-down menu. These two additional techniques are the following best positioned after applying the criteria of the Law in the case of damage caused by non-biodegradable agents. For the damages produced by biodegradable agents, one of the remediation options included in the drop-down is always the natural recovery.

In case the analyst considers that none of the proposed techniques is applicable to his specific case, there is the option of selecting, in a second menu, any of the techniques available in the Application for the resource being analysed.

Likewise, it offers the possibility of introducing new remediation techniques that must be reported and documented by the user. If this alternative is chosen, the reason for the choice must be justified. The data on the remediation technique necessary for the operation of the application are: description of the technology, time necessary for the recovery of the resource and unit cost of application --Euros per unit of treated resource--.

### **4. How are remediation techniques for compensatory and complementary measures selected?**

Compensatory and complementary measures are estimated as the amount of additional resource to be repaired as compensation for the temporary or definitive loss of a resource.

In the MORA application, the technique selected by default as the most appropriate to perform the compensatory remediation will be the same as the one chosen to carry out the primary remediation. Without prejudice to this, the user may modify said pre-selection, arguing the reason for the change.

For the complementary measures, the application offers pre-selected techniques that would be more suitable as primary remediation if this could be done. Again, the analyst may modify this preselection, justifying the reason for that change.

For damages caused to wildlife species, the minimum amount of compensatory or complementary measure will be of an individual. The operator must determine in each case whether the calculated measure is relevant or could be considered negligible - in case the amount obtained with the Resource Equivalency Analysis is very low.

## 5. How are the replacement costs calculated in the scope of the MORA application?

The equation that the Application uses to calculate the remediation cost is the following:

$$Coste_R = Coste_f + (Coste_v \times Q) + (p \times Q^q)$$

Where:

CostR, is the cost of recovering the resource

Costf, is the fixed cost of execution by contract. It represents those execution costs of the remediation project that do not depend on the amount of resources to be repaired, but are an amount determined by remediation, regardless of the volume to be treated.

Costv, is the variable cost of execution per contract. Those execution costs of the remediation project that evolve in parallel with the volume of resource treated.

Q, is the amount of resource damaged or the amount of agent discharged - depending on the agent-resource partner that is being monetized and the remediation technique to be used.

p, is a multiplying coefficient that varies depending on the remediation technique.

q, is an exponential coefficient that varies depending on the remediation technique.

Once the Contract Execution Budget (CEB) of damage remediation has been calculated, it is necessary to add the Value Added Tax (VAT) and the percentage of safety due to contingency - costs associated with the appearance of contingencies and unforeseen events associated with the execution of the project-. The percentages applied are:

VAT: currently set at 21% of the CEB (Contract Execution Budget).

Percentage of safety by contingency. 20-40% of the estimate of the total cost —range collected in the justifying report of the Royal Decree project for which the Regulations of partial development of Law 26/2007 of 23 October are approved for Environmental Responsibility—. For the determination of the safety percentage by contingency in each case, the criterion chosen is the following:

For techniques in which a specific agent-resource pair have a limited recovery efficiency, the percentage of contingency safety will be the maximum, which is 40%.

For techniques in which a specific agent-resource pair possess a demonstrated recovery efficiency, the percentage of contingency safety will be the minimum, which is 20%.

These percentages facilitated by the MORA application may be modified by the user in the event that the latter has better information. These modifications must be justified in the final report.

The costs of consulting and the costs of revision and control of the remediation must also be included. Both have a default value depending on the agent and the damaged resource -calculated through the Tragsa Rates-, although they can be modified by the user. Again, these costs are

reflected as the cost of execution by contract (CEB) and the percentages of VAT and safety for contingency explained above are applied to them --21% and 20-40% respectively.

## **6. What are the revision and control costs?**

The costs of revision and control considered in MORA refer to the costs in which it would be necessary to incur in order to monitor the remedial measures adopted and assess compliance with the intended objectives. The revision and control tasks included in MORA are a function of the applied remediation technique and the resource affected by the damage - as a general rule, the techniques based on natural recovery entail a higher cost of revision and control.

By way of example, some of the revision and control activities compiled in the model are as follows: water and soil samples and laboratory analysis, fauna monitoring equipment, forest, creation of repopulation monitoring reports, surveys, and underwater analysis.

## **7. Should compensatory measures have consulting and revision and control costs?**

In principle, if it is considered that the compensatory measure is an extension of the primary remediation measure, this fact should be taken into account with regard to the costs of consulting and revision and control of the project. More specifically, if the compensatory measure is established as a small extra amount of application of the technique chosen for primary remediation in the same location in which it is carried out, it can be considered that the costs of consulting and revision and control are collected in the items budgeted for this purpose in the primary measure. Therefore, these costs could be annulled in the budget of the compensatory measure. Following a conservative criterion, MORA calculates by default the costs of consulting and revision and control of compensatory measures. In any case, these considerations must be assessed and justified by the user who makes the report.

## 12. TRANSPORT MODULE

### 12.1. TRANSPORT MODULE RATIONALE AND METHODOLOGY

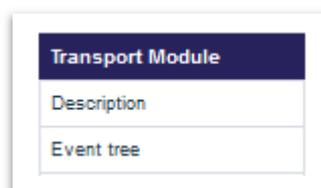
The transport module aims to help operators calculate the probability of accident scenarios in the road transportation of goods. This module combines all the critical aspects necessary for constructing event trees, including identifying various accident scenarios and their associated probabilities.

The accident scenario probability calculation model is based on the methodology developed in the sector's MIRAT: MITERD has prepared road freight transport activities. This methodology is developed in section IX.4. Pages 80 to 104 of the document contain protocols for allocating probabilities to moving parts. Before calculating the equations in the MIRAT methodology, we conducted a thorough cartographic analysis to identify the resources along each road route and the likelihood of impacting them. The probability is mathematically expressed as the quotient of the length travelled over the territory with a certain characteristic (e.g. length over surface water) and a reference length (in this example, the total length of the route).

The Transport module proposes calculating routes between all municipalities within Spain's mainland.

### 12.2. ACCESS TO THE TRANSPORT MODULE

Access to the module for calculating the probability of accident scenarios for road freight transport must be through the SIRMA browser. To access the 'Event tree' menu button, go to the 'Transport Module' section located at the bottom left-hand side of the application screen in the MORA module.



**Figure 12.2-1.** The 'Transport Module' can be accessed from the navigation panel. Source: SIRMA.

The description section provides a concise summary of the freight module's usefulness. Additionally, it provides hyperlinks to the MIRAT for road freight transport activities, the user manual of the SIRMA tool, and the annexes.

## Description

The functionality developed through the "Transport Module" makes it easier for operators to calculate the probabilities of the environmental risk analyzes of the [MIRAT for road freight transport activities](#).

By entering the municipality of origin and destination of the transport itineraries and the type of vehicle load, the operators will obtain as a result the final list of accident scenarios generated in the corresponding transport itinerary and the probability of occurrence of each accident scenario.

For the selection of the reference transport itineraries that will be studied in the environmental risk analysis, the user is recommended to consult section "IX.1.2. Procedure for the selection of relevant itineraries of the operators activity as a whole" (Pages 61-72 of the MIRAT report).

In relation to the information on the vehicles load, the "Transport Module" requires the user to specify whether the vehicle is empty or transports some type of load and whether or not it is flammable. For this, it is recommended to consult the section "IX.1 Sources of danger" (Pages 57-58 of the MIRAT report).

With the above information, the "Transport Module" makes it possible to build and visualize the event tree associated with a specific itinerary, and to automate the calculation of the final probability of each accidental scenario as a result of the composition of the probability of the initiating event and the conditioning factors of its evolution, among them, the probability of affection to the different natural resources present in the transport itinerary.

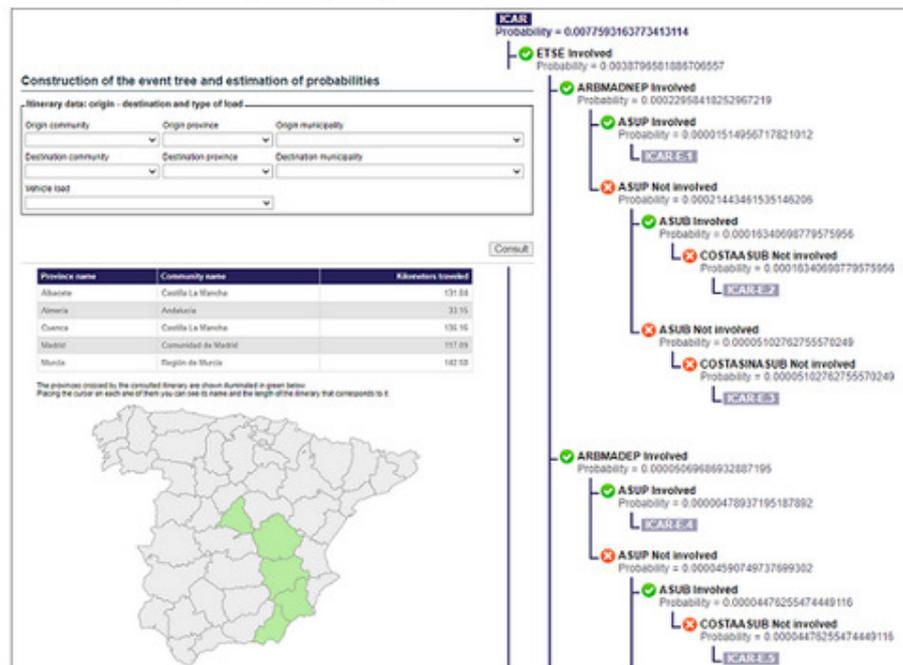
Lastly, and to complete the construction of the event tree into which an initiating event ends, the operator must enter the amount of agent causing the damage associated with the initiating event and its evolution until reaching the amount that would finally be involved in each scenario. accidental. To this end, it is also recommended to consult the technical guidelines in section "IX.5. Protocols for calculating the amount of agent causing the damage" (Pages 104-112 of the MIRAT report).

With the information resulting from the "Transport Module" and the calculation of the volume released associated with each accident scenario, the operator can continue the analysis of environmental risks by calculating the environmental damage index (IDM) for each accident scenario, selecting the reference scenario, and calculate the cost of the primary repair measures thereof, through the Environmental Liability Offering Model (MORA).

## Documentation

[User's guide](#)

[Annexes](#)



**Figure 12.2-2.** Description of the 'Transport Module' in SIRMA. Source: SIRMA

The information generated is not stored by this module. To display the event tree for a specific itinerary again on the screen, it will be necessary to repeat the request. It is possible to print a document containing the information generated for a specific route.

## 12.3. EVENT TREES

### 12.3.1. CONSTRUCTING AN EVENT TREE AND ESTIMATING PROBABILITIES

The transport module's goal is to determine the likelihood of various accident scenarios for a specific route between two municipalities. Each scenario may have implicit resources that could be affected.

To construct event trees for a goods transport route, the application requires the following fields to be completed:

- **Origin community.** Use this drop-down menu to select the Autonomous Community where the route begins.
- **Origin province.** To indicate the province where the journey begins, click on the drop-down menu. This option is available only after selecting the Autonomous Community.
- **Origin municipality.** From a drop-down list, you can select the municipality where the goods transport route being analysed begins. The municipality must belong to the indicated province and Autonomous Community.
- **Destination community.** Once again, you can use the drop-down menu to select the Autonomous Community where the route ends.
- **Destination province.** To indicate the province where the journey ends, simply click on the drop-down menu within the previously selected Autonomous Community.
- **Destination municipality.** Finally, you can select the municipality where the goods transport route being analysed ends. This municipality should belong to the indicated province and Autonomous Community.
- **Vehicle load.** The final drop-down on the screen enables the user to indicate if the vehicle transporting the goods is empty or loaded. If loaded, the user can specify if the load is flammable or not. This information will determine the type of event tree(s) that the application creates. The available choices are:
  - **The vehicle is moving empty:** no cargo is being transported. Any potential accidents would likely involve the vehicle's fuel, such as fuel tank spillage or a vehicle fire.
  - **The vehicle transports flammable cargo:** as the cargo is flammable, any accidents may involve cargo spillage or fire, or a vehicle fire due to the fuel. In this case, fuel tank spillage is not considered relevant as the possibility of cargo spillage, which

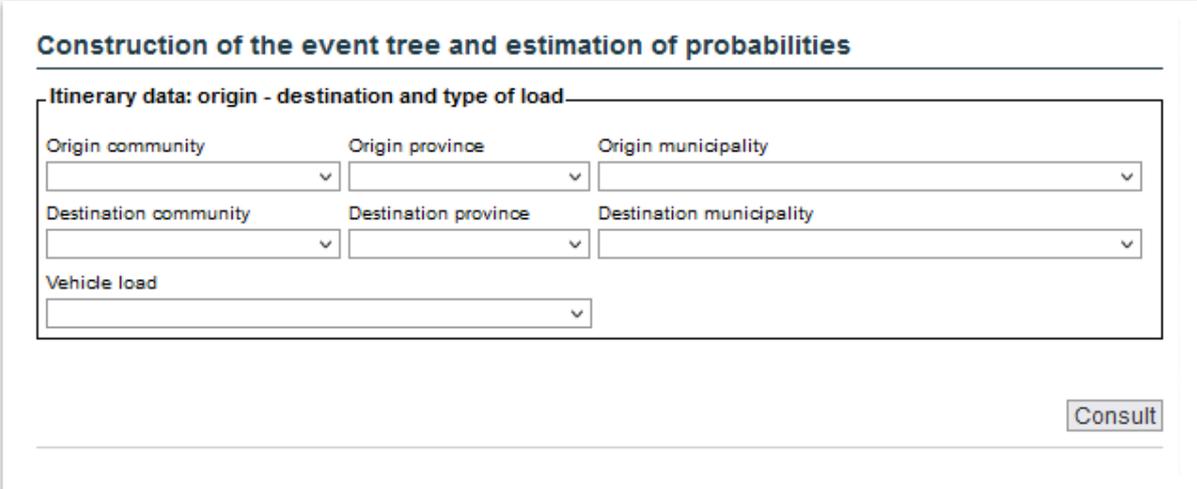
has a much greater environmental impact, is assessed, as indicated in the methodology developed in MIRAT.

- The vehicle transports non-flammable cargo: in this case, the possibility that the vehicle is carrying a loaded non-flammable load would be considered, so that the accident scenario would be related to the load - spillage - or to the fuel - vehicle fire. Again, fuel tank spillage is not considered relevant as the possibility of cargo spillage, which has a much greater environmental impact, is assessed, as indicated in the methodology developed in MIRAT.



**Figure 12.3.1-1.** Drop down menu for vehicle load type. Source: SIRMA.

Below this box, on the right-hand side of the screen, is the **'Consult'** button. Clicking on this button will take you to the 'Estimation of the probability of the initiating event' screen.



**Figure 12.3.1-2.** Initial screen of the 'Transport module'. Source: SIRMA.

### 12.3.1.1. ESTIMATION OF THE PROBABILITY OF THE INITIATING EVENT

In the 'Estimation the probability of the initiating event' screen, you will first find the itinerary data entered in the previous step of 'Construction of the event tree and estimation of probabilities'. In

addition to the Autonomous Communities, Provinces and Municipalities of origin and destination, the 'Itinerary data' box contains the total length in kilometres of the route entered.

### Estimation of the probability of the initiating event

[Back to consultation](#)

**Itinerary data**

Origin community	Origin province	Origin municipality
Andalucía	Córdoba	Peñarroya-Pueblonuevo
Destination community	Destination province	Destination municipality
Comunidad de Madrid	Madrid	Alcorcón
Vehicle load	Itinerary length (km)	
The vehicle transports flammable cargo	438.33	

[Itinerary provinces map](#) [Itinerary natural resources](#)

Code	Outcome/event name	Probability	Conditioning factors	Accident scenarios
ICAR	Cargo fire	0.0183686579579145015		
VEH	Vehicle fire	0.053305125054340122		
VCAR	Cargo spill	0.48742974711851553		

**Figure 12.3.1.1-1.** 'Estimation of the probability of the initiating event' screen. Source: SIRMA.

There are two buttons in the centre of the screen, below the route data table:

- **Itinerary provinces map:** By clicking on this button, you can access a new data query screen which, in addition to the basic data of the route, allows you to find out the Autonomous Communities and Provinces crossed by the route you have entered, as well as the number of kilometres covered by each of them.

### Map of provinces that the itinerary crosses



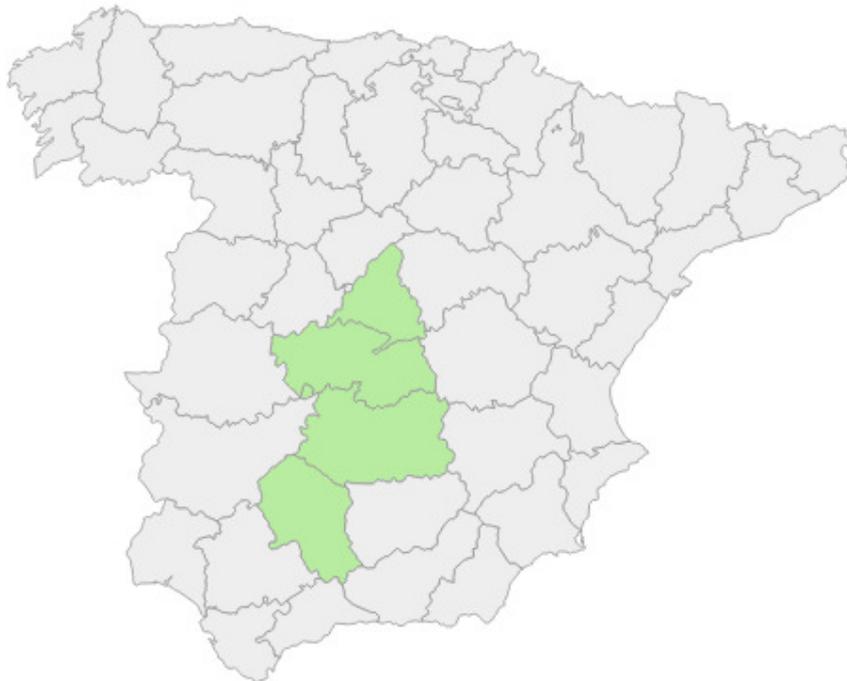
[Back to outcomes](#)

#### Itinerary data

Origin community	Origin province	Origin municipality
Andalucía	Córdoba	Peñarroya-Pueblonuevo
Destination community	Destination province	Destination municipality
Comunidad de Madrid	Madrid	Alcorcón
Vehicle load	Itinerary length (km)	
The vehicle transports flammable cargo	438.33	

Province name	Community name	Kilometers traveled
Ciudad Real	Castilla La Mancha	141.49
Córdoba	Andalucía	154.48
Madrid	Comunidad de Madrid	24.22
Toledo	Castilla La Mancha	118.14

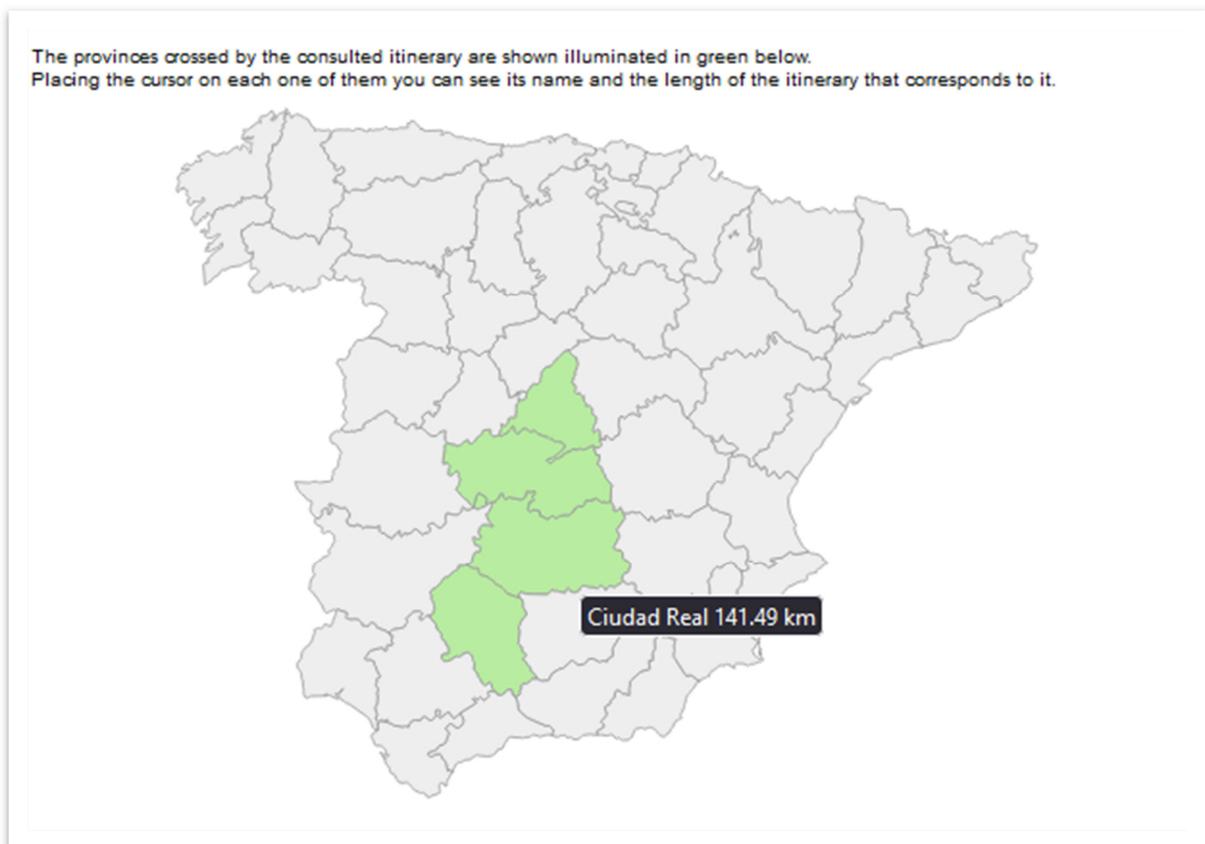
The provinces crossed by the consulted itinerary are shown illuminated in green below. Placing the cursor on each one of them you can see its name and the length of the itinerary that corresponds to it.



**Figure 12.3.1.1-2.** Itinerary provinces map. Source: SIRMA.

In addition to the data table, the screen contains a map. The following message appears on the map: "The provinces crossed by the consulted itinerary are shown illuminated in green below. Placing the cursor on each one of them you can see its name and the length of the itinerary that corresponds to it". As indicated in the text, the map shows the Spanish provinces crossed by the route, marked in green, and if you move the cursor over each

one, a label appears with the name of the province and the length in kilometres of the route crossed.



**Figure 12.3.1.1-3.** Itinerary provinces map (detail). Source: SIRMA.

Click on the hyperlink in the top left-hand corner of the screen: By clicking on 'Back to outcomes', you will go back to the 'Estimation of the probability of the initiating event' screen.

- **Itinerary natural resources:** By clicking on this button, the application will open a new query screen that will again show the basic data of the route and, in the form of a table, the probability for the entered route to have an impact on each of the natural resources under consideration.

### Itinerary natural resources 🖨️ ✕

[← Back to outcomes](#)

**Itinerary data**

Origin community	Origin province	Origin municipality
Andalucía	Córdoba	Peñarroya-Pueblonuevo
Destination community	Destination province	Destination municipality
Comunidad de Madrid	Madrid	Alcorcón
Vehicle load	Itinerary length (km)	
The vehicle transports flammable cargo	438.33	

Structural type code	Structural type name	Probability	Resource code	Resource name	Probability
ARBMAADNEP	Mature woodland no protected area	0.08399132028275555405	ASUP	Agua superficial	0.019831255795
			ASUB	Agua subterránea	0.124987480326
			COSTAASUB	Costa con agua subterránea	0.00
			COSTASINASUB	Costa sin agua subterránea	0.00
ARBMADEP	Mature woodland protected area	0.16385795049224444595	ASUP	Agua superficial	0.0738788935914
			ASUB	Agua subterránea	0.38686962285
			COSTAASUB	Costa con agua subterránea	0.00
			COSTASINASUB	Costa sin agua subterránea	0.00

**Figure 12.3.1.1-4.** Itinerary natural resources (detail). Source: SIRMA.

The fields in the resource tally table for the route are as follows:

- Structural type code: It reflects the structural type of code according to the maximum current Forest Map of Spain, which is obtained by combining the Forest Map of Spain at 1:50,000 with the new provinces that are generated from the Forest Map of Spain at 1:25,000. The code is also an indication of whether the site is in a secure space. The following codes may appear in the table:

Structural type code	Structural type name
ARBMAADNEP	Mature woodland no protected area
ARBMADEP	Mature woodland protected area
ARBJOVNEP	Young woodland no protected area
ARBJOVEP	Young woodland protected area
HERBNEP	Grassland no protected area
HERBEP	Grassland protected area
SUELONEP	Natural soil without forest vegetation or artificial soil no protected area
SUELOEP	Natural soil without forest vegetation or artificial soil protected area
HUMNEP	Wetland no protected area
HUMEP	Wetland protected area

**Table 12.3.1.1-1.** Codes and names of the types of structures that are used in the 'Transport Module'. Source: SIRMA.

- Structural type name: The name of the type of structure, again in accordance with the Forest Map of Spain (see table above).
- Probability: This is the probability that the structure type in question will be affected. It is calculated as the ratio of the length of the route that runs along this type of structure to the total length of the route.
- Resource code: For each structural type identified, it indicates the resources that can be contained in each of them. In this case, they are indicated by an identifying code.

Resource code	Resource name
ASUP	Superficial water
ASUB	Groundwater
COSTAASUB	Coast with groundwater
COSTASINASUB	Coast without groundwater

**Table 12.3.1.1-2.** 'Transport Module' codes and names of natural resources. Source: SIRMA.

- Resource name: For each structural type identified, it again lists the names of the resources that can be contained in each of them. (See the table above).

- **Probability:** The probability of an accident occurring in a particular type of resource from those listed in the table above is given for each type of structure. The final probability of the accident scenarios is calculated from these probabilities.

Again, using the hyperlink at the top left of the screen: By clicking on 'Back to outcomes', you will go back to the 'Estimation of the probability of the initiating event' screen.

The screen contains a table with the following information below the two buttons described above:

- **Code:** It specifies, by means of a code, the type of accident outcome and hence the type of event tree through which the accident scenarios are obtained for each initiating event. The codes are the same as those shown in the table below.

Code	Name
ICAR	Cargo fire
IVEH	Vehicle fire
VCAR	Cargo spill
VDEP	Vehicle fuel tank spill

**Table 12.3.1.1-3.** 'Transport Module' codes and names of natural resources. Source: SIRMA.

- **Name of event/delay:** Depending on whether the vehicle is empty or not and whether it is carrying a flammable load, it represents the type(s) of outcome(s) of a given accident (see table above).
- **Probability:** This is the probability associated with each initiating event. It is calculated using the MIRAT method for the road transport sector.
- **Conditioning factors:** This section of the table contains a Report icon which allows you to access the Conditioning Factors screen described in the following paragraph '12.3.1.2. Conditioning factors of the outcome' for each initiating/disrupting event.
- **Accidental scenarios:** This table cell contains a report icon to access the Accident Scenarios screen described in section '12.3.1.3. Accident scenarios (by outcome and effect of conditioning factors)' for each initiating/disrupting event.

Click on the hyperlink in the top left-hand corner of the screen: by clicking on the 'Back to outcomes' button, you can return to the initial screen and enter a new itinerary.

### 12.3.1.2. CONDITIONING FACTORS OF THE OUTCOME

As mentioned in the previous section, if you click on the report icon in the 'Conditioning factors' section of the table that appears in the 'Estimation of the probability of the initiating event' screen

for a particular trigger, the application will open a query window showing the conditioning factors that modify the probability of that trigger.

### Conditioning factors of the outcome 🖨️ ✕

[\\* Back to outcomes](#)

**Itinerary data**

Origin community	Origin province	Origin municipality
Andalucía	Córdoba	Peñarroya-Pueblonuevo
Destination community	Destination province	Destination municipality
Comunidad de Madrid	Madrid	Alcorcón
Vehicle load	Itinerary length (km)	
The vehicle transports flammable cargo	438.33	
Outcome name	Code	Probability
Cargo fire	ICAR	0.0183686579579145015

Code	Name	Performance parameters	Fail probability
ETSE	Early extinction by emergency services	Acts first	0.50

**Figure 12.3.1.2-1.** Factors conditioning the outcome. Source: SIRMA.

The screen contains a table with the following information in addition to the general route data table:

- **Code:** It is the code assigned to this conditioning factor. It corresponds to the acronym of the name of the factor according to the table:

Code	Name
CTT	Early containment by crew
CTSE	Early containment by emergency services
ETT	Early extinction by crew
ETSE	Early extinction by emergency services

**Table 12.3.1.2-1.** Conditioning factor codes and names used in 'Transport Module' .

Source: SIRMA.

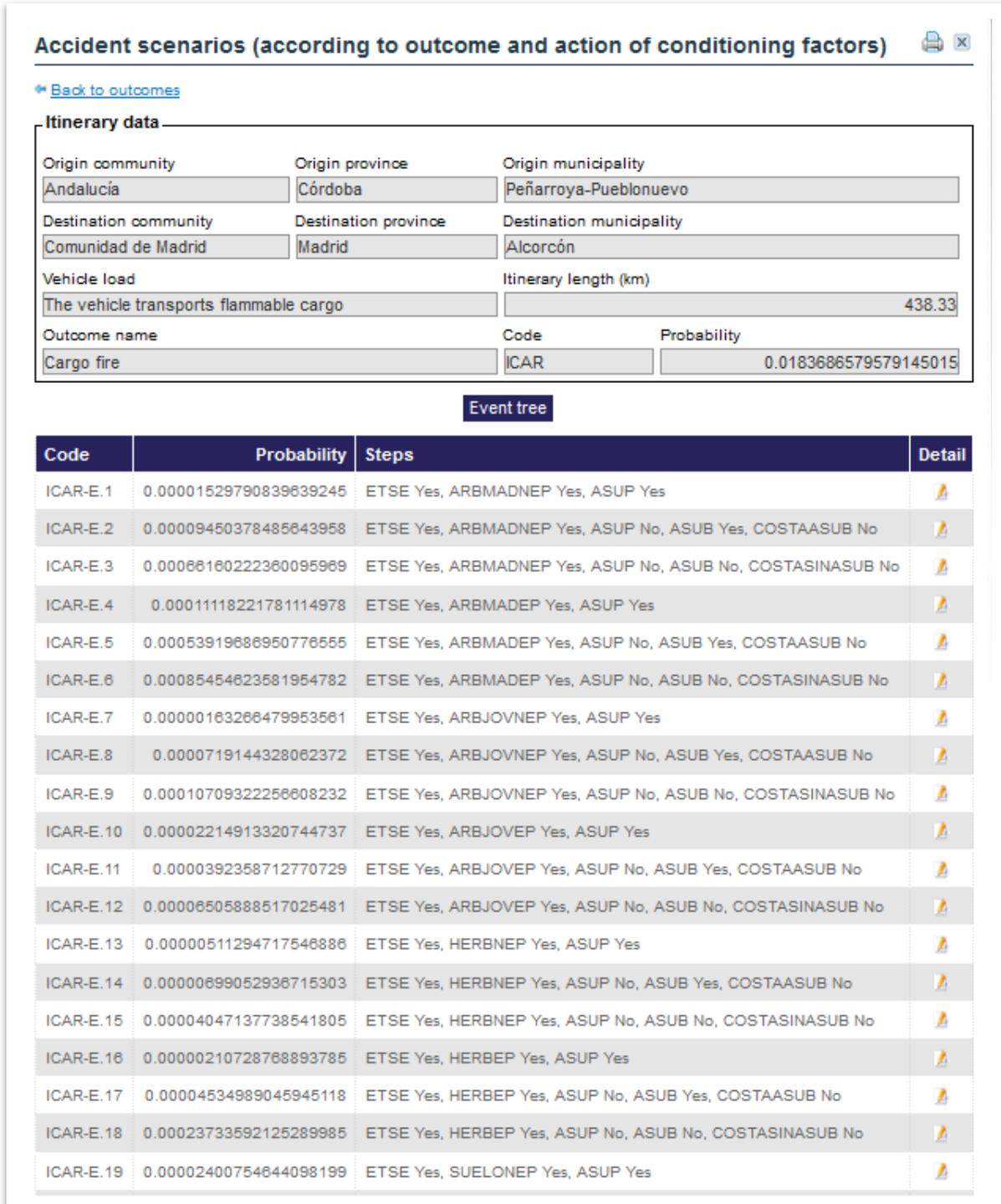
- **Name:** Indicates the full name that has been assigned to the conditioning factor in question (see the table above).
- **Action parameters:** It shows how the conditioning factors are applied in relation to the type of event tree that has been used: the order of actions and the success or failure of those actions.

- **Failure probability**: It represents the probability that the conditioning factors involved will fail.

It is possible to return to the 'Estimation of the probability of the initiating event' screen using the 'Back to outcomes' link at the top left of the screen.

### **12.3.1.3. ACCIDENT SCENARIOS (ACCORDING TO OUTCOME AND ACTION OF CONDITIONING FACTORS)**

Finally, as indicated in section 12.3.1.1, for a given initiating event, by clicking on the report icon in the 'Accident scenarios' section of the table in the 'Estimation of the probability of the initiating event' screen, the application opens a query window showing the occurrence scenarios derived from this initiating event after applying the conditioning factors.



**Figure 12.3.1.3-1.** Accident scenarios – according to outcome and action of conditioning factors - (detailed). Source: SIRMA.

In addition to the general route data table present in all the 'Transport Module' screens, this screen contains a table with the following information:

- **Code**: This is an alphanumeric code. It is used to identify the accident scenario. It consists of the initiating event code from which it is derived. It is separated by a hyphen from the scenario number assigned to it.
- **Probability**: By applying the event tree, this is the final probability calculated for the scenario.
- **Steps**: These are the steps that have been in place to have the probability of the accident scenario. Example: ETSE Involved, ARBMADEP Involved, ASUP Not Involved, ASUB Not Involved, COSTASINASUB Not Involved; would indicate that early extinguishing by the emergency services has been successful, that mature forest in a protected area is affected, that there is no surface or ground water and that there is no coastline.
- **Detail**: By clicking on the report icon, the application displays a new screen showing, besides the general itinerary data, a table containing:
  - **Element**: Displays each of the elements in the event tree construction process that are determinants of the accident scenario. This is the case for both the conditioning factors that are applicable to the initiating event and the natural resources that may be affected by the accident scenario.
  - **Involved**: Indicates whether the element is part of the assessment of the accident scenario which is being queried.
  - **Probability variation**: Records the specific probability value of the element in question.
  - **Probability**: After applying the element in question, this reflects the change in the final probability of the scenario.

### Detail of the accident scenario

[\\* Back to scenarios](#)

**Itinerary data**

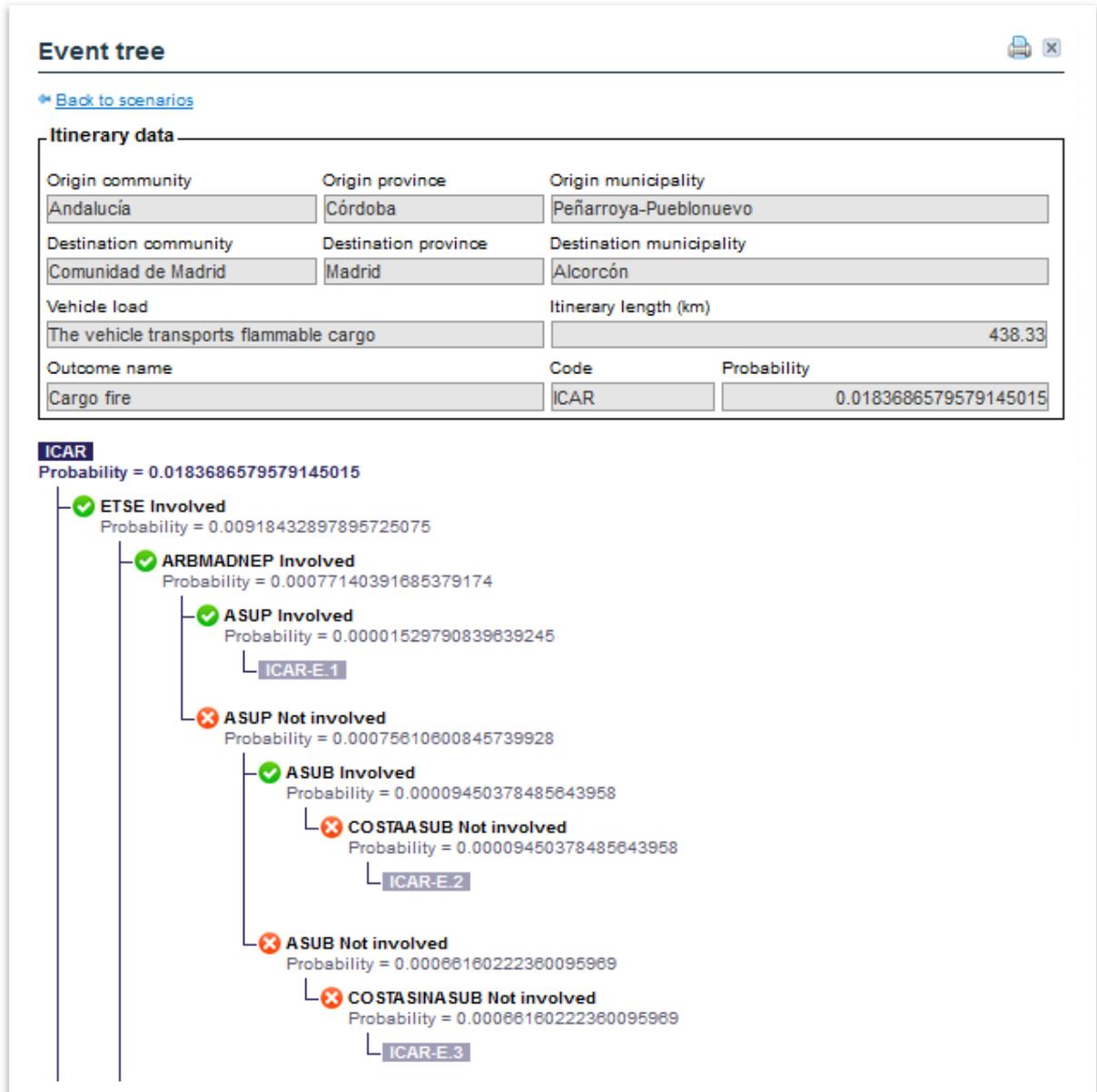
Origin community	Origin province	Origin municipality
Andalucía	Córdoba	Peñarroya-Pueblonuevo
Destination community	Destination province	Destination municipality
Comunidad de Madrid	Madrid	Alcorcón
Vehicle load	Itinerary length (km)	
The vehicle transports flammable cargo	438.33	
Outcome name	Code	Probability
Cargo fire	ICAR	0.0183686579579145015
Scenario	Probability	
ICAR-E.3	0.00066160222360095969	

	Element	Involved	Probability variation	Probability
1	ETSE	Yes	0.50	0.00918432897895725075
2	ARBMADNEP	Yes	0.08399132028275555405	0.00077140391685379174
3	ASUP	No	0.980168744205	0.00075610600845739928
4	ASUB	No	0.875012519674	0.00066160222360095969
5	COSTASINASUB	No	1.00	0.00066160222360095969

**Figure 12.3.1.3-2.** Detail of the accidental scenario. Source: SIRMA.

It is possible to return to the 'Accident scenarios (according to outcome and action of conditioning factor)' screen by clicking on the 'Back to scenarios' link at the top left of the screen.

In the central part of the Accident Scenarios screen derived from a given initiating event, between the route data and the accident scenarios table, is the 'Event tree' button. Clicking on it will open the window with the event tree diagram for the trigger event being consulted. The screen re-displays the route data and, immediately afterwards, the drawing of the accident tree to be consulted, with all the involved elements to the definition of the accident scenarios derived from it.



**Figure 12.3.1.3-3.** Event tree. Source: SIRMA.

It is possible to return to the 'Accident scenarios (according to outcome and action of conditioning factor)' screen by clicking on the 'Back to scenarios' link at the top left of the screen. Once you are on this screen, it is possible to go back in the report by clicking on the 'Back to outcomes' hyperlink.

## 12.4. PRINTABLE REPORT

The 'Transport Module' does not store the queries made by the user, but it does allow the generated report to be saved or printed using the 'Printer' icon () located in the top right-hand corner of the screens. Therefore, by clicking on this icon, the application allows the user to view the report that has been generated so far. It can then be archived or printed if the user so wishes.

### Transport Module - Event tree

#### Itinerary data

Origin community	Origin province	Origin municipality
Andalucía	Córdoba	Peñarroya-Pueblonuevo
Destination community	Destination province	Destination municipality
Comunidad de Madrid	Madrid	Alcorcón
Vehicle load	Itinerary length (km)	
The vehicle transports flammable cargo	438.33	

#### Provinces that the itinerary crosses

Province name	Community name	Kilometers traveled
Ciudad Real	Castilla La Mancha	141.49
Córdoba	Andalucía	154.48
Madrid	Comunidad de Madrid	24.22
Toledo	Castilla La Mancha	118.14

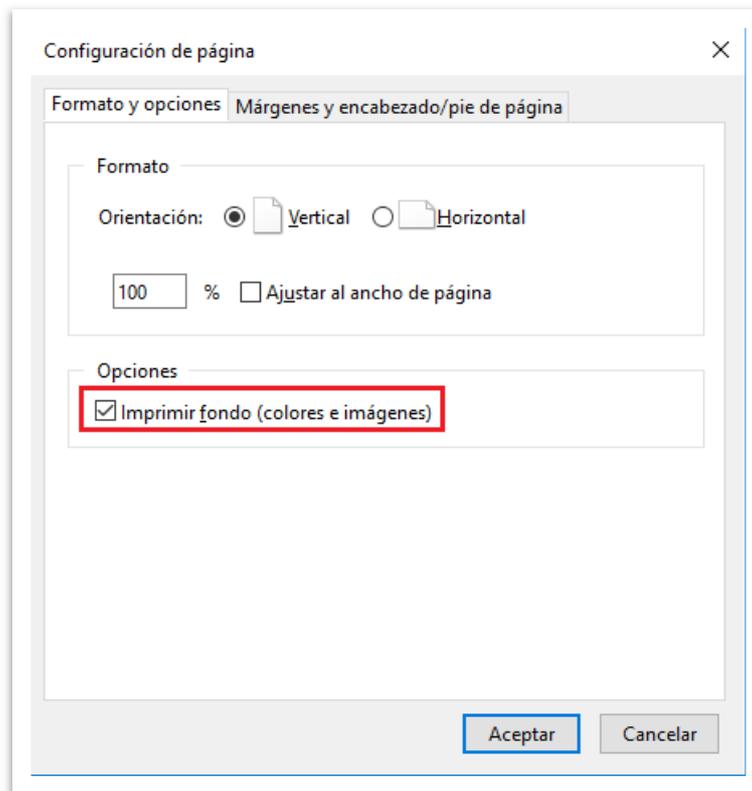
#### Itinerary natural resources

Structural type code	Structural type name	Probability	Resource code	Resource name	Probability
ARB MAD NEP	Mature woodland no protected area	0.0839913202827555405	ASUP	Agua superficial	0.019831255795
			ASUB	Agua subterránea	0.124987480326
			COSTAASUB	Costa con agua subterránea	0.00
			COSTASINASUB	Costa sin agua subterránea	0.00

**Figure 12.4-1.** 'Transport Module' printable report (detail). Source: SIRMA.

Use the print option in the browser menu to print/save as a PDF. Among the configuration options offered by the browsers, the user must ensure that the option that allows images to be printed is enabled, as described in the figures below (depending on the browser used).

**Mozilla Firefox:**



**Figure 12.4-2.** Mozilla Firefox configuration screen for printing report. Source: Mozilla Firefox.

Google Chrome:

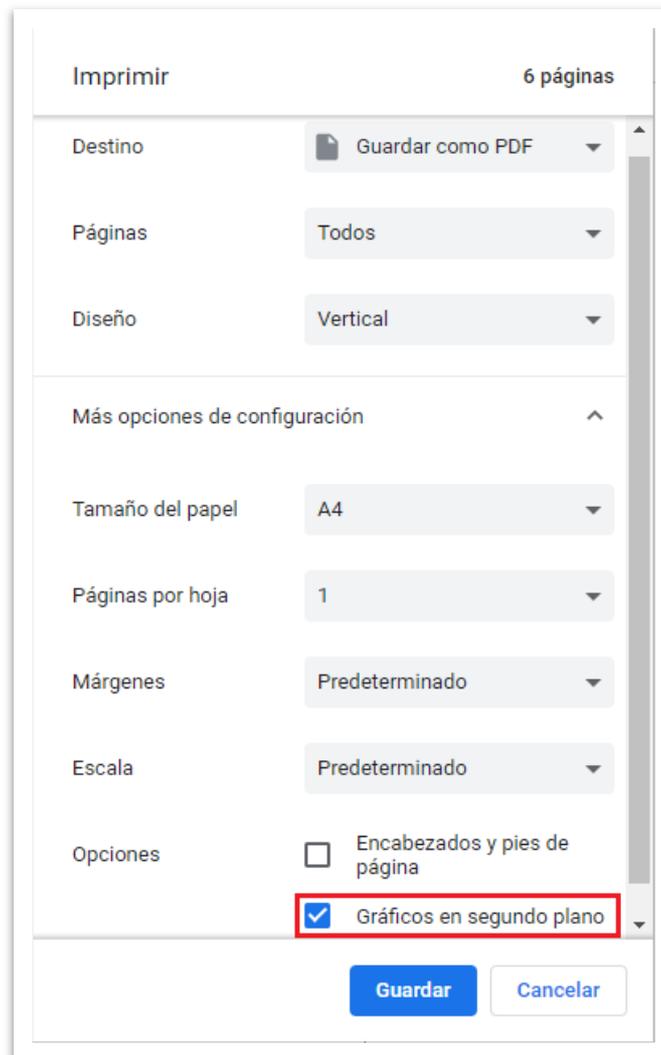


Figure 12.4-3. Google Chrome configuration screen for printing report. Source: Google Chrome.

Internet Explorer:

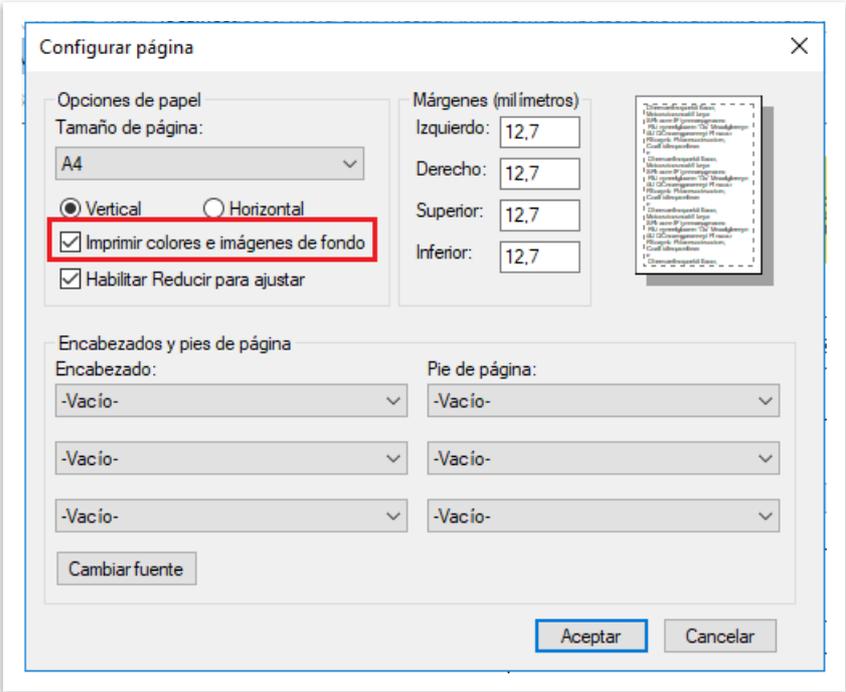


Figure 12.4-4. Internet Explorer configuration screen for printing report. Source: Internet Explorer.

## 13. GEOGRAPHIC VIEWER

### 13.1. DESCRIPTION AND BASICS OF THE GEOGRAPHIC VIEWER

The Environmental Responsibility Information System (SIRMA) geographic viewer provides a range of general coverages, equivalent to those found in the MORA geographic viewer (Accessibility, Hydrographic Districts, PNOA Orthophotos, Permeability, Forest Map of Spain, Wealth of Species, etc.), as well as specific coverages with topic-specific information related to the application of environmental responsibility regulations in Spain.

The section on 'Quality and Environmental Assessment' includes specific coverages. The environmental liabilities of the geographic viewer are classified into two groups:

#### 1. Affidavits

Shows the available information corresponding to the affidavits presented by the operators obligated in the different autonomous communities.

A coverage is included with the total number of facilities that have submitted the affidavit, and three other coverages that show the number of facilities that have submitted for each priority level (priority 1, 2, and 3), established in Order ARM/1783/2011, of 22 June.

#### 2. Financial securities

Shows the information available on the financial securities the operators have established for their facilities in the different autonomous communities.

On one hand, a series of coverages are included with the number and percentage of facilities that have constituted financial security, as well as those that have been exempt by benefiting from sections a) and b) of article 28 of law 26/2007 (damages whose repair is evaluated for an amount less than 300,000 euros, or between 300,000 and 2,000,000 euros and can accredit adherence either to the EU Eco-Management and Audit System (EMAS) or to the current UNE-EN ISO 14001 environmental management system).

On the other hand, a series of coverages are included that show the amount insured by the financial securities provided.

In both cases, the aggregated information is shown with the total number of facilities, as well as disaggregated by each priority level (priority 1, 2, and 3) established in Order ARM/1783/2011, of 22 June.

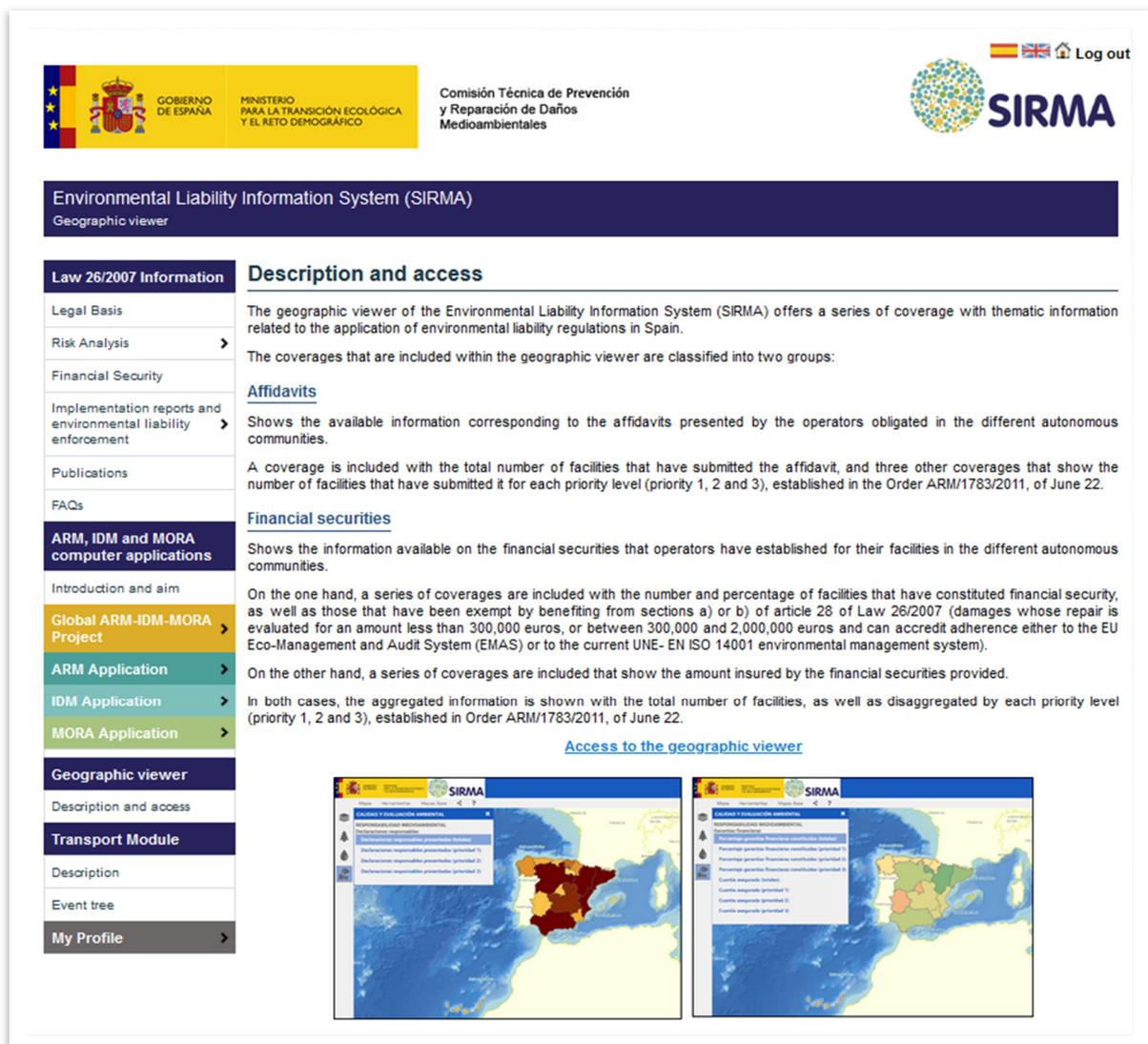
### 13.2. ACCESS TO THE GEOGRAPHIC VIEWER

Access to the geographic viewer section should be done through the SIRMA browser. To access the 'Description and access' menu button, go to the 'Geographic viewer' section located at the bottom left-hand side of the application screen in the MORA module.

**Geographic viewer**  
 Description and access

**Figure 13.2-1.** Access the 'Geographic viewer' section from the navigation panel. Source: SIRMA.

The 'Description and access' screen features a hyperlink labelled 'Access to geographic viewer'. Clicking on this hyperlink will open the viewer in a new window of the internet browser.



**Environmental Liability Information System (SIRMA)**  
 Geographic viewer

**Law 26/2007 Information**  
 Legal Basis  
 Risk Analysis  
 Financial Security  
 Implementation reports and environmental liability enforcement  
 Publications  
 FAQs

**ARM, IDM and MORA computer applications**  
 Introduction and aim  
 Global ARM-IDM-MORA Project  
 ARM Application  
 IDM Application  
 MORA Application

**Geographic viewer**  
 Description and access  
 Transport Module  
 Description  
 Event tree  
 My Profile

**Description and access**  
 The geographic viewer of the Environmental Liability Information System (SIRMA) offers a series of coverage with thematic information related to the application of environmental liability regulations in Spain.  
 The coverages that are included within the geographic viewer are classified into two groups:  
**Affidavits**  
 Shows the available information corresponding to the affidavits presented by the operators obligated in the different autonomous communities.  
 A coverage is included with the total number of facilities that have submitted the affidavit, and three other coverages that show the number of facilities that have submitted it for each priority level (priority 1, 2 and 3), established in the Order ARM/1783/2011, of June 22.  
**Financial securities**  
 Shows the information available on the financial securities that operators have established for their facilities in the different autonomous communities.  
 On the one hand, a series of coverages are included with the number and percentage of facilities that have constituted financial security, as well as those that have been exempt by benefiting from sections a) or b) of article 28 of Law 26/2007 (damages whose repair is evaluated for an amount less than 300,000 euros, or between 300,000 and 2,000,000 euros and can accredit adherence either to the EU Eco-Management and Audit System (EMAS) or to the current UNE- EN ISO 14001 environmental management system).  
 On the other hand, a series of coverages are included that show the amount insured by the financial securities provided.  
 In both cases, the aggregated information is shown with the total number of facilities, as well as disaggregated by each priority level (priority 1, 2 and 3), established in Order ARM/1783/2011, of June 22.

[Access to the geographic viewer](#)

**Figure 13.2-2.** Access to the 'Geographic Viewer'. Source: SIRMA.

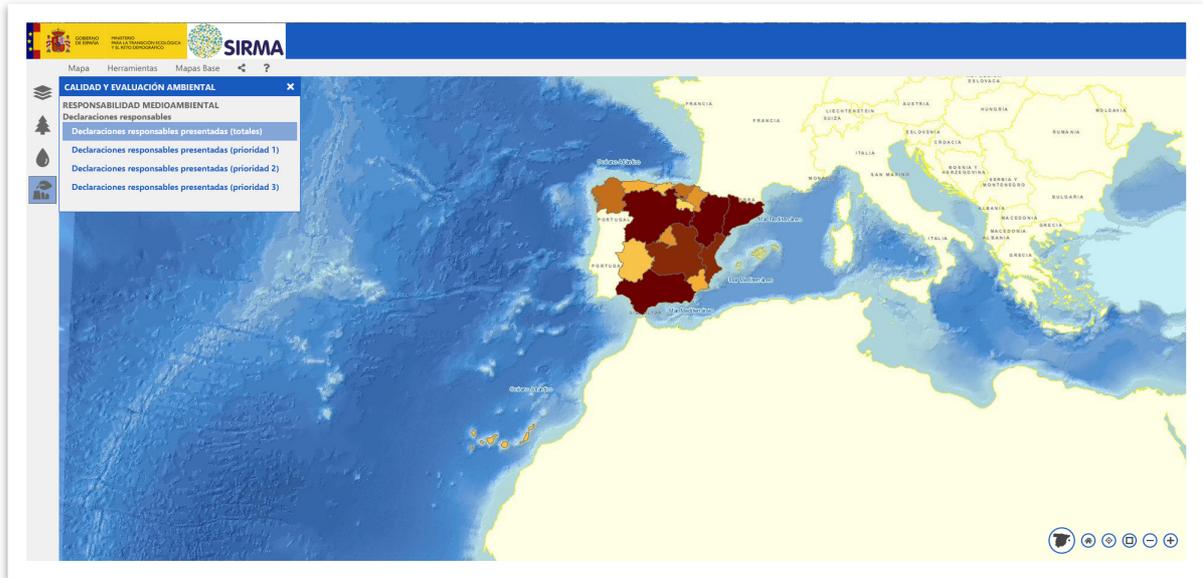


Figure 13.2-3. Geographic Viewer Source: SIRMA.

### 13.3. GEOGRAPHIC VIEWER USER GUIDE

To understand how to use the SIRMA geographic viewer's features and tools, refer to the user manual of the Geoportal. The Geoportal provides access to the cartography published by the Ministry for Agriculture, Fisheries and Food (MAPA) and the Ministry for Ecological Transition and Demographic Challenge (MITERD).

The manual can be accessed through the following link:

[https://sig.mapama.gob.es/Docs/geoportal/ayuda/manual\\_usuario\\_geoportal.pdf](https://sig.mapama.gob.es/Docs/geoportal/ayuda/manual_usuario_geoportal.pdf)

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