DEMINE
Decreasing the Impact of Abandoned Mines

DELIVERABLE D.1.4

Environmental impact analysis – The DEMINEtool

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Partner in charge: Fundació Universitària Balmes - BETA

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Definitions and Abbreviations

BAT	Best Available Techniques
EC	Electrocoagulation
EPA	Environmental Protection Agency
LCA	Life Cycle Assessment
METP	Mining Effluent Treatment Process
EF	Environmental Footprint

Executive summary

As part of the Action D1, for dissemination planning and public awareness, of DEMINE project, sub-Action D1.4 aimed to produce a simplified tool that help to foresee the environmental benefits that the use of DEMINE technology could provide in a given site. This action is under the lead of Fundació Universitària Balmes – BETA Tech. centre, and the contribution of the partners involved in the implementing actions.

This deliverable, hence, presents the DEMINE tool developed by Fundació Universitària Balmes (FUB) in sub-Action D1.4 and provides detailed information regarding its technical and usage aspects. The DEMINE tool was developed in two different versions. The first is the professional version, aimed to help environmental managers in industry and administration in the decision on the best technology for the management of waste effluents, and is the focus of this report. This tool is based on the results of the sustainability assessment, which were conducted as part of the work of sub-action C 1.2 of DEMINE project. The second one is a more didactic and simplified version for the younger public and, more specifically, to be used as part of the "*End-user experience*" (For further details on this version, please see deliverable D B.5).

The environmental results implemented in the tool are developed under the Life Cycle Assessment framework and follow the criteria established by the ISO 14040 and ISO 14044. This assessment comprises a complete inventory of all materials, energy and chemicals needed for the construction and operation of the DEMINE Mining Effluent Treatment Process (METP).

1. Before Starting

Impacts across the three sustainability domains (economic, social and environmental) govern the potential benefits and risks that may accrue to society, especially local communities that are closely associated, or indirectly affected, by adoption of new technological systems, such as the DEMINE mining effluent treatment process (METP). The main objective of action C1 is to demonstrate and validate the potential benefits of the DEMINE project concept (process and technology) through a sustainability assessment. Within action D for the Dissemination planning and development of the dissemination, the development of a simplified tool was foreseen as part of the project's dissemination efforts.

The DEMINE tool targeted public administrations, industries and institutions and is intended as an instrument for decision-makers on technological options for the management of waste effluents. The DEMINE tool could be also considered an additional tool to help end-users of the technology to decide the final configuration of the METP, so it is a way to demonstrate the advantages of the process.

The DEMINE tool was tested, and a demonstration of its usefulness was done in a real case with the collaboration of the Government of Principality of Asturias. Furthermore, the didactic version of the tool was part of the features in the End-User Experience - The case of Principality of Asturias (see Deliverable B.5). Also, the DEMINE tool has been shown in networking activities and dissemination activities.

The DEMINE tool consists of a simplified life cycle assessment (LCA) of the DEMINE technology to quantify the potential environmental impacts of the mining effluent treatment process in different water streams where the technology could be installed. It is an excel running tool that models the potential benefits of installing the METP in a given area by comparing the environmental burdens of 3 scenarios: i) adopting the technology, ii) adopting the technology and using only green energy, and iii) not adopting the technology and keeping the pollution source. Furthermore, it also shows the potential pollutant removal when using the technology and compares the results with current regulatory limits for metals in water bodies and water for human consumption.

The DEMINE tool is available on the DEMINE website and can be used under an Attribution-Non-Commercial license (CC BY-NC). And this document generally presents the DEMINE tool and provides a basic and practice step guide for the user.

2. Setting-up excel

2.1 Enable Macros

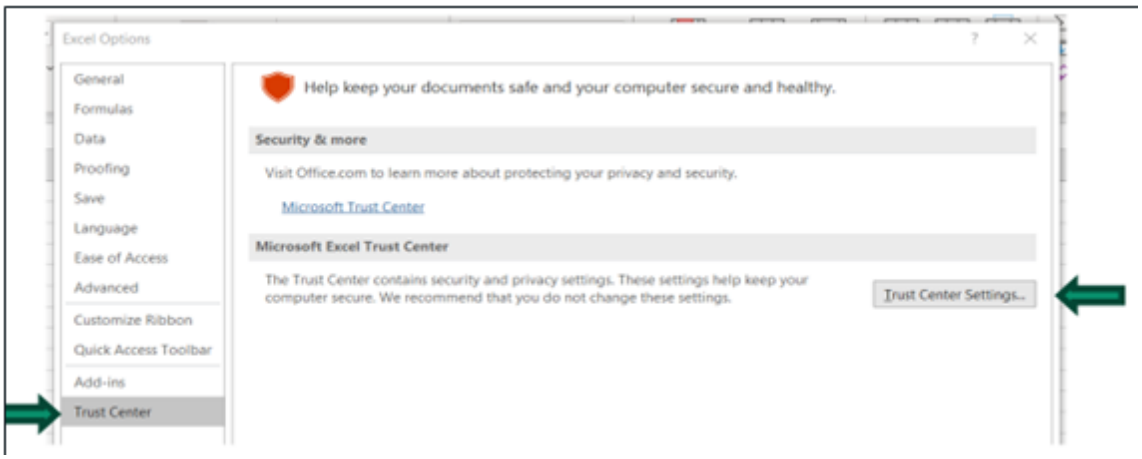
Right after opening the DEMINEtool a yellow message bar appears with a shield icon and the "Enable Content button". Click on the button to enable the use of macros.

2.1 Trust access to the VBA project object model

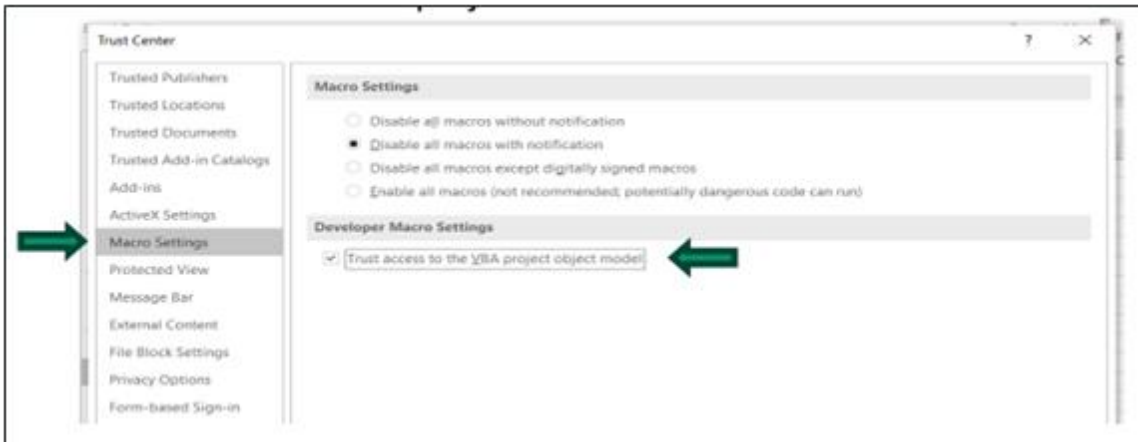
Once the use of macros has been enabled you must trust the access of the VBA project mode; to do so follow, the steps below.

1.- In Excel, click the File tab.

2.- Click Options > Trust Centre > Trust Centre Settings



3.- Then click Macro settings and under the Developer Macro settings tick the box to Trust the access to the VBA project model.

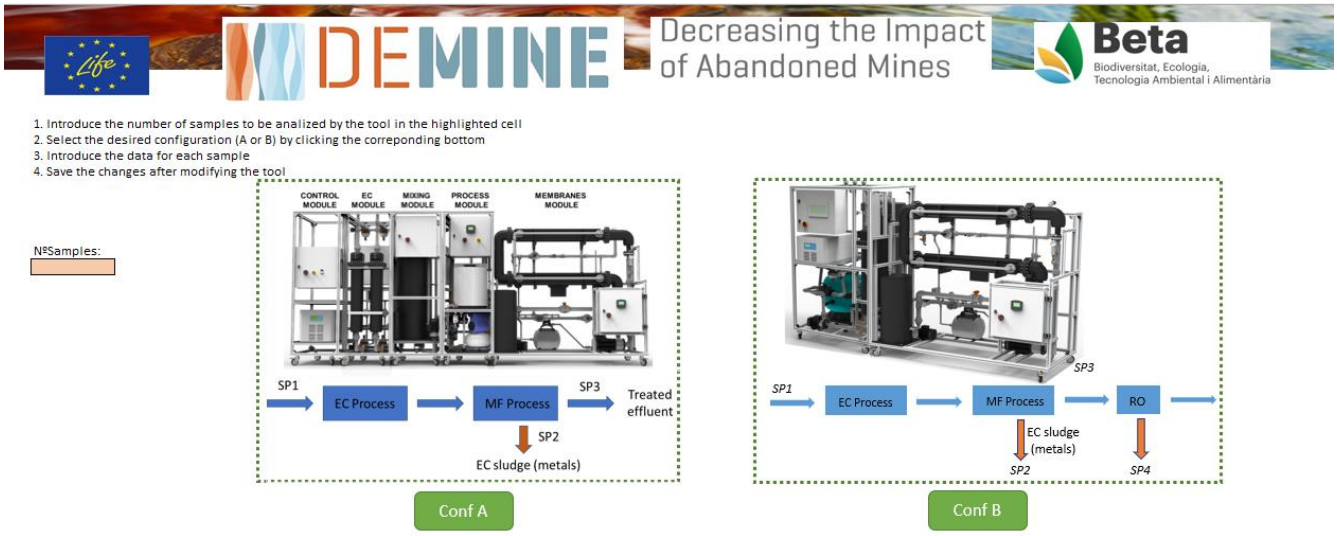


4.-finally click okay and you are ready to go

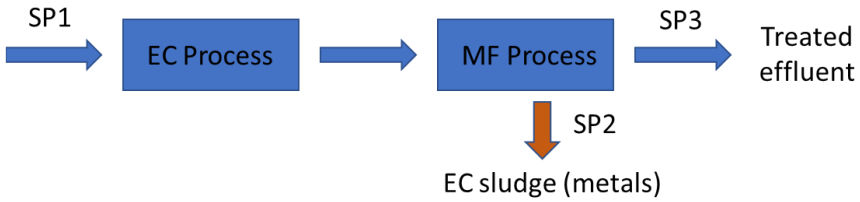
3. DEMINE tool_pro

Once the excel is set up, the tool is ready to run. The first page will display the instructions for use, then only 4 steps are required to run the DEMINE tool:

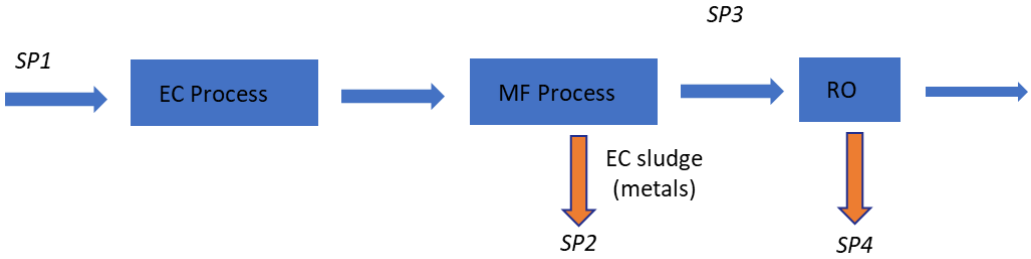
1. Introduce the number of samples to be analyzed by the tool in the highlighted cell (in orange).
2. Select the desired configuration (A or B) by clicking the corresponding button.
3. Introduce the data for each sample
4. Save the changes after modifying the tool



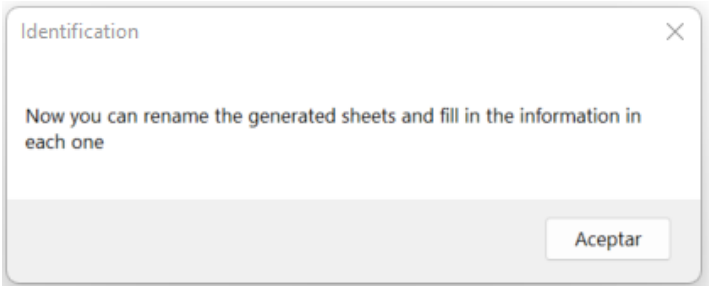
Configuration A corresponds to the METP set-up using the electrocoagulation module and the microfiltration module, as shown below.



Configuration B corresponds to the METP set-up using the electrocoagulation, microfiltration and reverse osmosis module, as shown below.



Once the new tabs are created below, sing will appear:

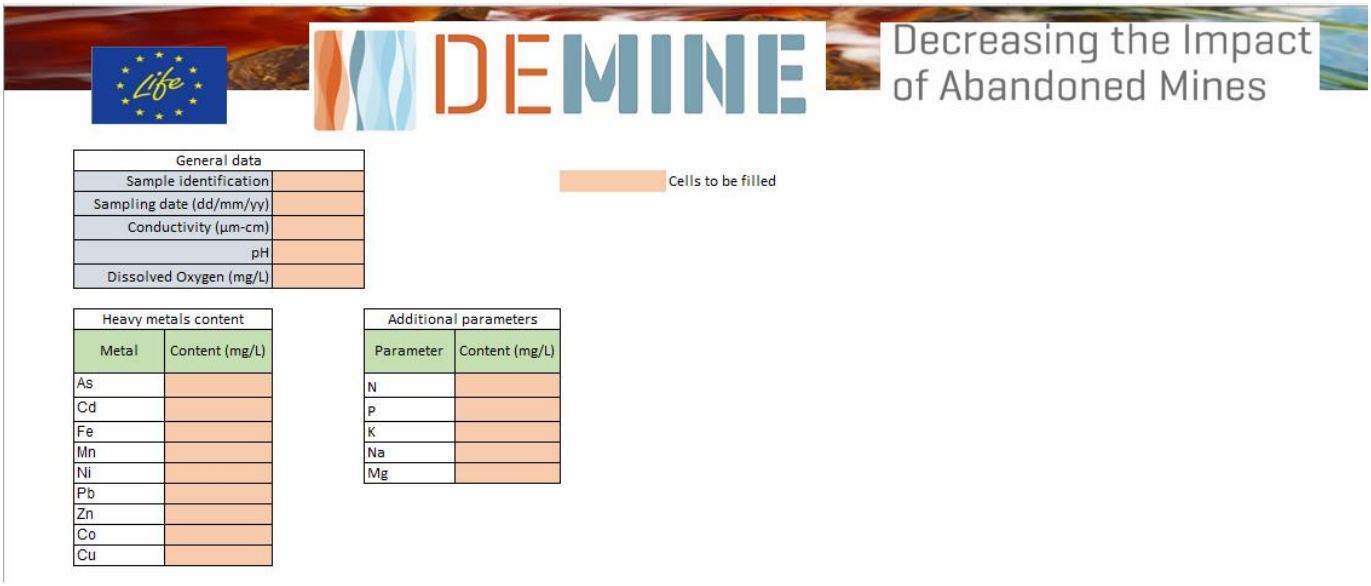


And in the lower left part of the screen, you will find a unique tab for each one of the study site data (so called samples) highlighted in yellow, as appear below for the example 2 sites (samples) for configuration B and 3 for configuration A.

Is important to mention that each time you need new "sample tabs", you only need to go again to the input data tab and create the new tabs.

3.1 Sample tabs

The sample tabs are created to input the general and parameter data, to run the DEMINE tool.



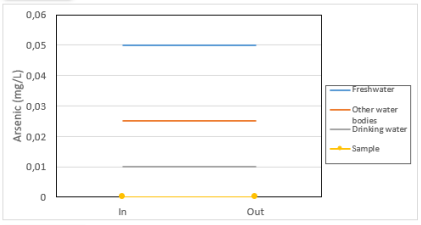
General data	
Sample identification	
Sampling date (dd/mm/yy)	
Conductivity (µm-cm)	
pH	
Dissolved Oxygen (mg/L)	

Heavy metals content	
Metal	Content (mg/L)
As	
Cd	
Fe	
Mn	
Ni	
Pb	
Zn	
Co	
Cu	

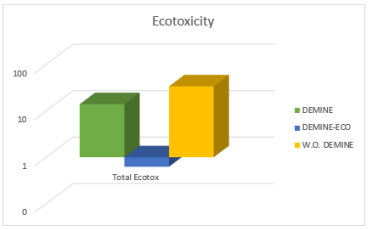
Additional parameters	
Parameter	Content (mg/L)
N	
P	
K	
Na	
Mg	

Once the data is filled in the orange cells, automatically the results for that sample will appear in bellow cells of the same tab for each one of the elements evaluated and for the impact categories included in the assessment. Furthermore, results will be displayed in absolute terms in the tables, and graphs for impact assessment and comparative figures for metal limits in European regulation against results will automatically appear.

Arsenic

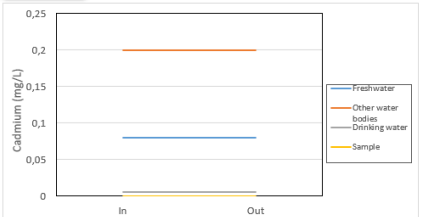


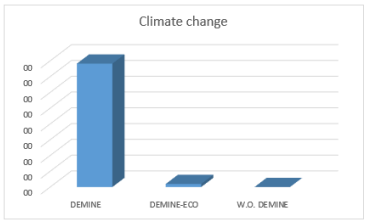
Outlet system (mg/L)	
As	0,000
Cd	0,000
Fe	0,000
Mn	0,000
Ni	0,000
Pb	0,000
Zn	0,000
Co	0,000
Cu	0,000
K	0,000
Na	0,000
Mg	0,000



Ecotoxicity			
Parameter	DEMINE	DEMINE-ECO	W.O. DEMINE
As	0,0	0,0	0,0
Cd	0,0	0,0	0,0
Fe	0,0	0,0	0,0
Mn	0,0	0,0	0,0
Ni	0,0	0,0	0,0
Pb	0,0	0,0	0,0
Zn	0,0	0,0	0,0
Co	0,0	0,0	0,0
Cu	0,0	0,0	0,0
Eco Metals:	0,0	0,0	0,0

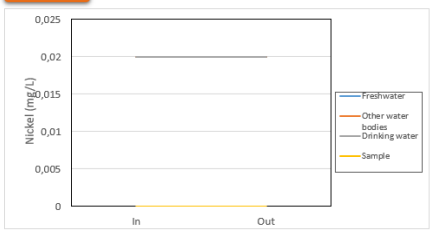
Cadmium

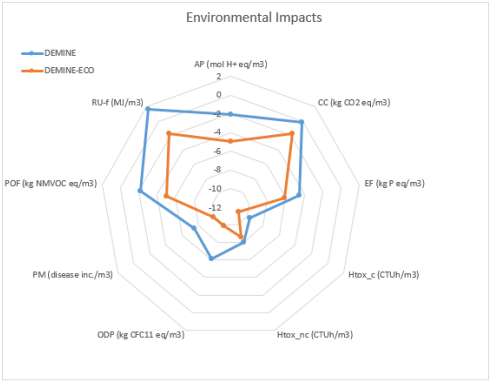




	DEMINE	DEMINE-ECO	W.O. DEMINE
Climate change	0,4	0,0	0,0
Ecotoxicity	13,9	0,6	33,6
Eco metals	0,0	0,0	0,0
Total Ecotox	13,9	0,6	33,6

Nickel

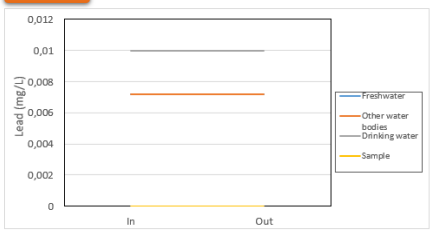




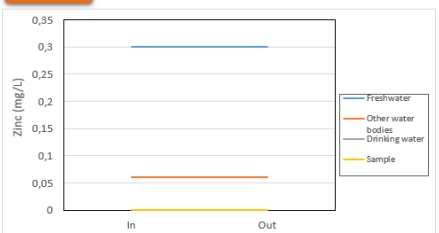
Data shown in Log10 scale

AP: Acidification
CC: Climate change
EF: Eutrophication, freshwater
Htox_c: Human toxicity, cancer
Htox_nc: Human toxicity, non-cancer
ODP: Ozone depletion
PM: Particulate matter
POF: Photochemical ozone formation
RU-f: Resource use, fossils

Lead



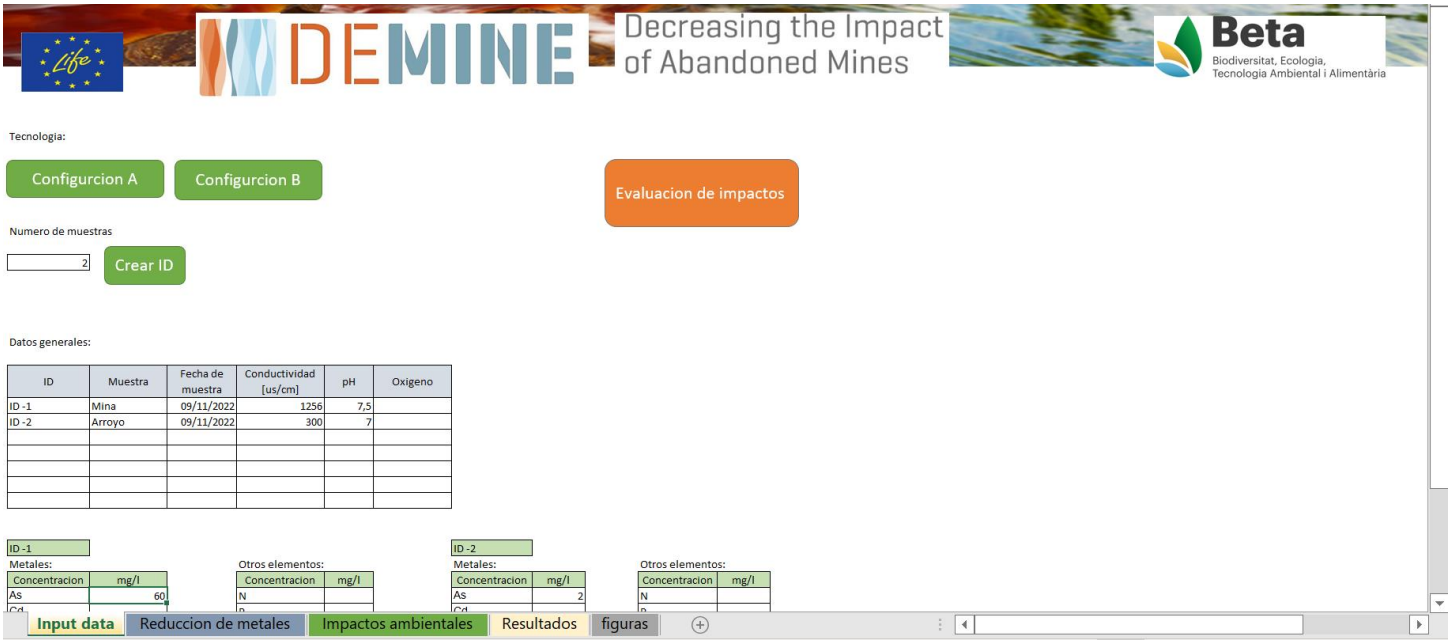
Zinc



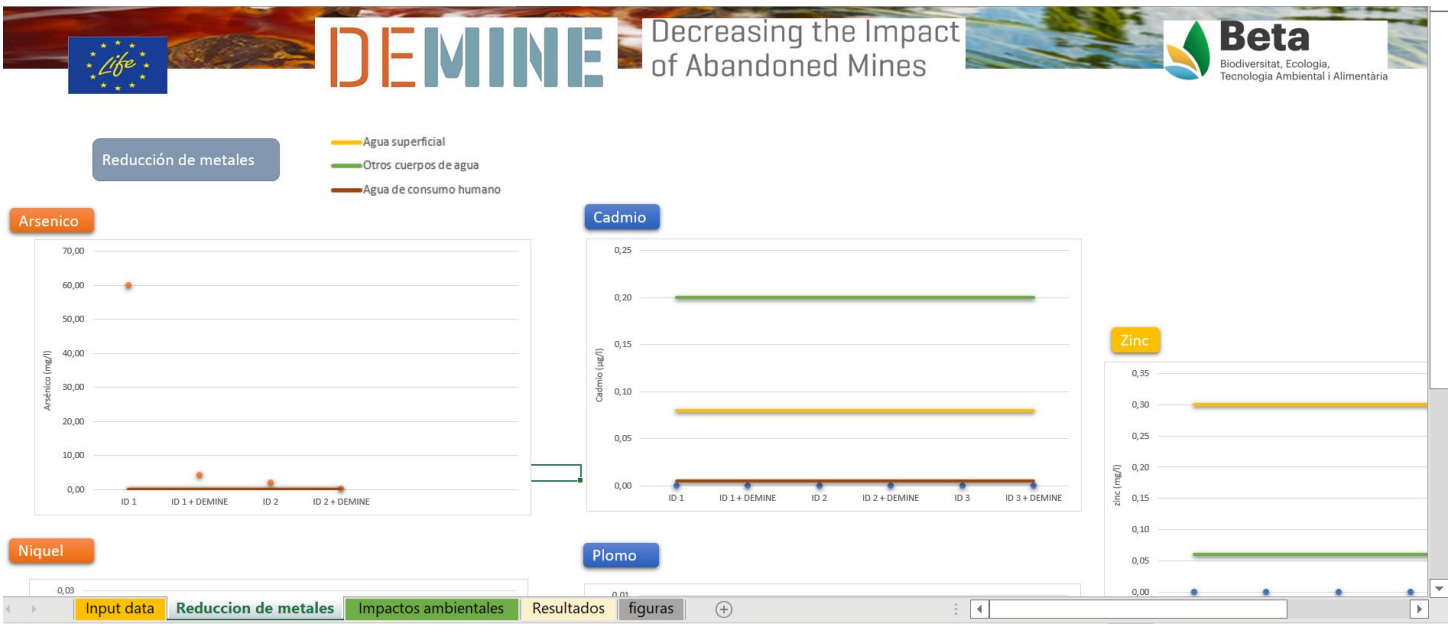
4. Didactic version of the DEMINE tool

The didactic version of the DEMINE tool operates similarly, is a more user-friendly and simpler version that displays results with common examples that help the younger audience to understand environmental impacts and the potential benefits of the implementation of the DEMINE technology; the overall look is presented below.

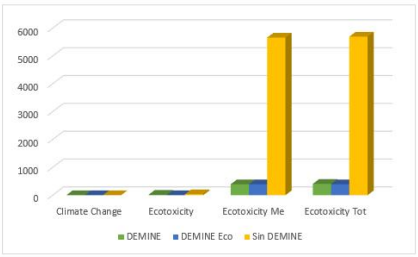
- Front page for input data:



- Results for metal remotion and comparison with current regulation:



Results by impact category:



	DEMINE	DEMINE Eco	Sin DEMINE
Climate Change	0,391	0,00958	0
Ecotoxicity	13,9	0,624	33,6
Ecotoxicity Me	391,82051	391,82051	5660,2229
Ecotoxicity Tot	405,72051	392,44451	5693,8229