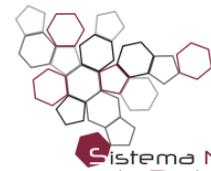




**ISPRA**

Istituto Superiore per la Protezione  
e la Ricerca Ambientale



Sistema Nazionale  
per la Protezione  
dell'Ambiente



# Rome Plus

*ReasOnable Maximum Exposure Plus*

v 1.1

november 2021

Rome Plus software has been created by ISPRA and by ARPAs within the activities of the 9 bis Working Group of the National System for the Protection of the Environment (SNPA) and represents **the SNPA validated official tool** for the compliance with the guideline documents "*Procedure for the evaluation and use of soil gas data in the risk assessment of contaminated sites*" (Linee Guida SNPA 17/2018) and "*Design of vapour monitoring in contaminated sites*" – Appendix B "*Active Flux Chambers monitoring*" (Linee Guida SNPA 15/2018).

The suite includes two calculation tools:

- **"San Giovanni"** for risk assessment starting from soil gas data
- **"Fori"** for risk assessment starting from emission flux measurements

For detailed technical information on the choices and assumptions underlying the calculations made by the software, please refer to the documents cited above. In the appendix to this operating manual, all the calculation equations adopted by the software in accordance with the documents issued by the SNPA are reported.

The software has been tested, verified and validated within the WG 9bis by the technicians of the following agencies:

- ARPA Campania: Valentina Sammartino, Gianluca Ragone
- ARPAE Emilia-Romagna: Adele Lo Monaco, Fabrizio Cacciari
- ARPA Lombardia: Madela Torretta, Sara Puricelli, Marco Lucchini
- ARPA Piemonte: Maurizio Di Tonno, Chiara Ariotti
- ARPA Toscana: Federico Mentessi
- ARPA Valle d'Aosta: Fulvio Simonetto
- ARTA Abruzzo: Lucina Luchetti

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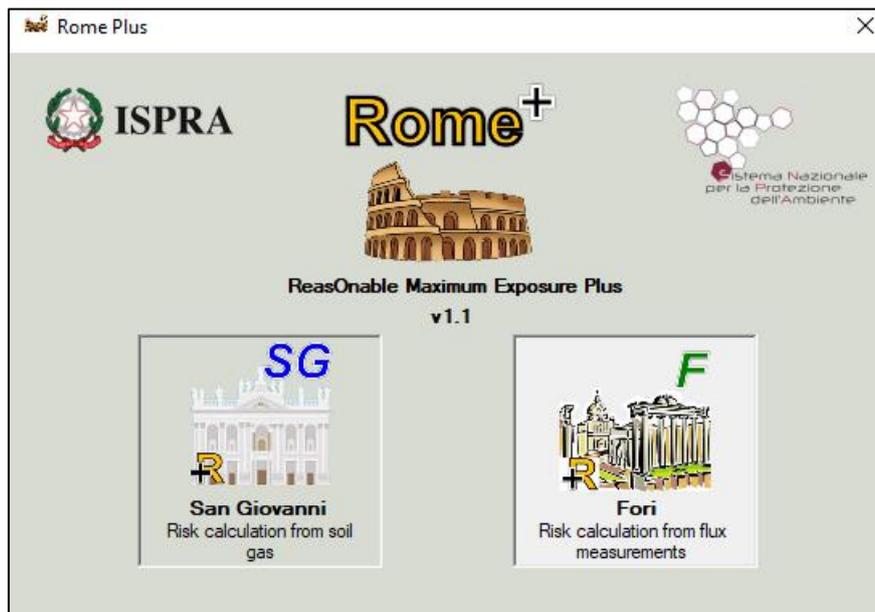
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# THE ROME PLUS SUITE

Rome Plus is made up of various applications, each of them carries out specific assessments.

When starting Rome Plus, a screen appears that summarizes all the applications belonging to the suite, allowing to choose the one to be used.



**San Giovanni:** Risk assessment application to data from soil gas survey, according to the document *"Procedure for the evaluation and use of soil gas data in the risk assessment of contaminated sites"*.

**Fori:** Risk assessment application to gas emission data from soil measured through flux chambers, according to the document *Appendix B "Active Flux Chambers monitoring"* to the document *"Design of vapour monitoring in contaminated sites"*.

## CONDITIONS OF USE

This piece of work, intended as the Rome Plus application with all the products that make up the suite including this manual, is subject to the Creative Commons Attribution-ShareAlike 4.0 International license (CC BY-SA 4.0).

Through the following links you can consult in internet the [License Deed](#) and the [Legal Code](#).

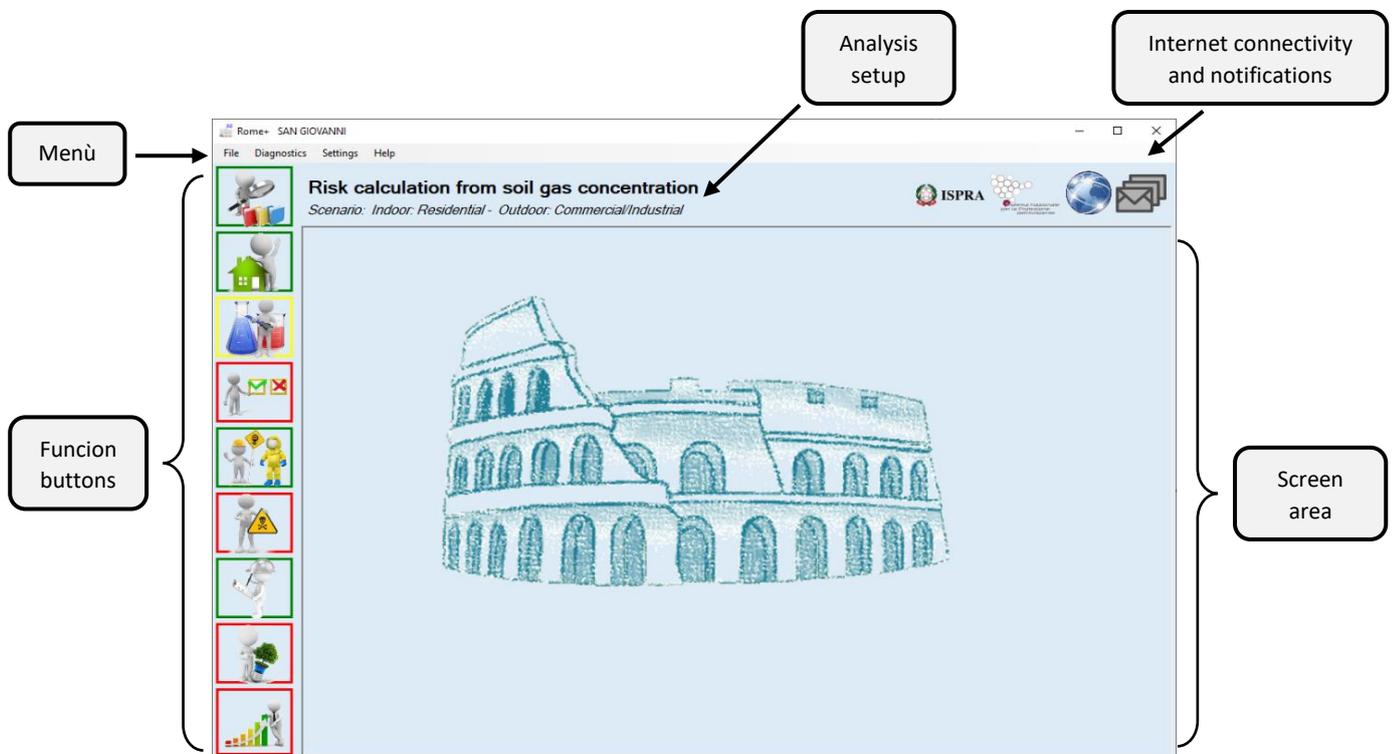


# SAN GIOVANNI

## RISK CALCULATION FROM SOIL GAS DATA

### USE OF THE APPLICATION AND FUNCTIONS

#### MAIN SCREEN



The main screen of San Giovanni is made up of various sections.

At the top, as in most Windows applications, there is a menu that allows to save and load a project or to start a new project, and to access to other settings and screens.

Immediately below, there is the description of the project setting including the pathway and the exposure scenario selection. This description is shown in all the screens to always have a clear reference context in all the phases of the evaluation.

The screen is mainly occupied by the so-called "Screen Area", in which the various panels progressively used during the project will be displayed..

At the top right, two icons show the current connectivity to Rome Plus web services, and the presence of any messages notified to users (e.g. if a more recent version of the application has been released). For more details, see the "Configuration and connectivity" chapter.

On the left, a series of buttons allow to access the various subsections of the project; each one is characterized by a specific screen within the Screen Area. Each button can be highlighted with different colors:

- A **red** highlight indicates that that feature is currently disabled, as it is necessary to complete other previous preparatory subsections.
- A **yellow** highlight indicates that it is necessary to enter inputs or select settings within the specific subsection.
- A **green** highlight indicates that the information or settings in the specific subsection are complete.

Below a brief description of the menu, the buttons, and the related subsections is reported. For details, refer to the corresponding chapter of this manual.

#### "File" menu

- **New project:** start a new project with all default settings.
- **Load project:** allows to load a previously saved project, keeping all the selections and settings made, and all the values used in the calculations: pathway and scenarios, contaminants and related inputs, site characteristics, exposure parameters, etc.
- **Save project:** allows to save a project so that it can be reused in the future, keeping all the selections and settings made, and all the values used in the calculations: pathway and scenarios, contaminants and related inputs, site characteristics, exposure parameters, etc.



#### Input files settings

In this screen, the software default input files are set. Most of the times, this box is highlighted in green to indicate that all input files are set correctly. In case there is something that needs to be corrected, this box is highlighted in yellow and all other features are disabled until the necessary corrections are made.

Usually, once the input files are set up correctly, they should be kept in all subsequent sessions.



#### Scenario and pathway selection

When creating a new project, the first thing to do is to select the scenario (residential, commercial/industrial or recreational) and the pathway (indoor inhalation, outdoor on-site and/or outdoor off-site inhalation). If this box is highlighted in yellow, it means that the selection has not yet been made, and in this case, many other features are disabled until this operation is completed. If it is green, it means that the selection has been made correctly.



### **Contaminants selection and input of concentrations**

This screen allows the user to select the contaminants to be assessed and, for each of them, to indicate the concentration measured in the soil gases, the type of sampling installation, the soil type subjected to monitoring, and other information necessary for carrying out the calculations.



### **Comparison with threshold values**

Here it is possible to compare each previously entered contaminant concentration measured in each soil gas sample with the relative threshold value defined for the selected pathway and scenario, in order to verify if the volatilization pathway can be excluded from site-specific risk assessment.



### **Exposure parameters**

Here the default values of the exposure parameters for each available scenario can be viewed and changed if necessary.



### **Toxicological parameters**

Here it is possible to view the toxicological parameters of each contaminant previously entered.



### **Site characteristics**

Here it is possible to view the default values of the site characteristics parameters, which, in some cases, may be necessary for the calculations, and to modify them if necessary.



### **Attenuation factors - alfa**

Here it is possible to view the default values of the alpha attenuation factors according to the type of soil gas sampling installation, the characteristics of the monitored pollutants and the characteristics of soils involved in the sampling. In addition, there is the possibility to modify them.



### **Viewing the results**

Here it is possible to view the results of the analysis, in terms of the risks associated with the concentrations measured in the gases and the site-specific soil gas intervention objectives (acceptable C), based on all the settings made in the previous screens.

## INPUT FILES SETTINGS

Select input files		
ISS-INAIL database	C:\Users\Public\Documents\RomePlus\InstalledFiles\InputFiles\Banca dati ISS-INAIL_2018.xlsx	...
Extra chemicals data	C:\Users\Public\Documents\RomePlus\InstalledFiles\InputFiles\Caratteristiche aggiuntive sostanze.xlsx	...
Threshold values	C:\Users\Public\Documents\RomePlus\InstalledFiles\InputFiles\Concentrazioni soglia soil gas.xlsx	...
Exposure parameters	C:\Users\Public\Documents\RomePlus\InstalledFiles\InputFiles\Parametri esposizione.xlsx	...
Attenuation factors (Alpha)	C:\Users\Public\Documents\RomePlus\InstalledFiles\InputFiles\Fattori attenuazione.xlsx	...
Site characteristics	C:\Users\Public\Documents\RomePlus\InstalledFiles\InputFiles\Caratteristiche sito.xlsx	...
Translations	C:\Users\Public\Documents\RomePlus\InstalledFiles\InputFiles\Traduzioni.xlsx	...

In order to function, the application requires some excel files containing:

- the ISS-INAIL database of March 2018 containing the chemical-physical and toxicological characteristics of the compounds defined as "of interest" for the volatilization process
- the characteristics of mutagenicity and biodegradability of the substances
- the threshold values defined for all exposure scenarios included in the software
- the default exposure parameters for all exposure scenarios included in the software
- the attenuation factors defined according to the type of sampling installation, the type of the investigated soil and the characteristics of biodegradability of the substances
- the site characteristics needed for risk assessment in case the outdoor off-site scenario has been selected
- English/Italian translations of the names and terms contained in the various excel files

These excel files are installed with the application and set as default files. Consequently, once the application is started, this screen should be already filled in and there should be no need to take any action.

However, in particular cases, a user may need to set different or modified excel files. In these situations, this screen allows the user to specify a different pathway or file name for each of the expected input files.

It should be highlighted that, by specifying a different file, it is necessary that this file has the same structure and template as the original file, otherwise the application will not be able to read its content.

### TO SET UP A NEW EXCEL FILE:

For each of the seven types of the input files in this screen, the name of the currently selected file is indicated together with a button. By pressing the button, it is possible to choose the new file to use.

### AT THE END OF THE CHANGES:

If the user needs to make any changes, at the end of the changes it is necessary to confirm the performed operations, using the "Confirm" button at the bottom of the screen.

Unconfirmed changes will be ignored and discarded.

In addition, if the user has made unconfirmed changes and inadvertently changes the screen, the application warns him that such unconfirmed changes may be lost. The user can then decide whether to cancel his choice to change the screen or continue and thus lose the changes.

## SCENARIO AND PATHWAY SELECTION

In this screen it is possible to select the exposure pathway, choosing between Indoor, Outdoor, or both (Indoor-Outdoor).

For each of the selected pathways, it is necessary to indicate the scenario: Residential, Recreational or Industrial/Commercial.

In addition, in the case of the Outdoor pathway, it is also possible to evaluate an off-site scenario (outside the source area) different from the on-site one (inside the source area), if necessary.

Using the "Units" button, the screen for setting the measurement units can be accessed (see page 12).

Once the pathways and related scenarios have been selected, and this selection confirmed, the application will show these settings in all subsequent phases, at the top of the screen:

*Scenario: Indoor: Residential - Outdoor: Commercial/Industrial*

### SETTING PATHWAY AND SCENARIO:

"Indoor", "Outdoor" or "Indoor-Outdoor" can be selected as the "Exposure pathway". Based on the selected item, the corresponding panels below will be activated.

If "Indoor" or "Indoor-Outdoor" have been selected, the Indoor panel will be active, and the selection of the relevant scenario is needed, choosing between "Residential", "Recreational" or "Industrial / Commercial".

If "Outdoor" or "Indoor-Outdoor" have been selected, the Outdoor panel will be active, and the selection of the related on-site scenario is needed, choosing between "Residential", "Recreational" or "Industrial / Commercial". Furthermore, at the user's discretion, it will also be possible to indicate a different off-site scenario, with the same choices.

#### AT THE END OF THE CHANGES:

If the user needs to make any changes, at the end of the changes it is necessary to confirm the operations carried out, using the "Confirm" button at the bottom of the screen.

Unconfirmed changes will be ignored and discarded.

In addition, if the user has made unconfirmed changes and inadvertently changes the screen, the application warns him that such unconfirmed changes may be lost. The user can then decide whether to cancel his choice to change the screen or continue and lose the changes.

## UNITS

Select the units:		
CONCENTRATION	LENGTH	VOLUME
Current units		
<b>mg/m<sup>3</sup></b>	<b>m</b>	<b>m<sup>3</sup></b>
Select the new units to be used:		
<input checked="" type="checkbox"/> mg/m <sup>3</sup>	<input checked="" type="checkbox"/> m	<input checked="" type="checkbox"/> m <sup>3</sup>
<input type="checkbox"/> µg/m <sup>3</sup>		
<input type="checkbox"/> ng/m <sup>3</sup>		
<input type="button" value="Cancel"/>	<input type="button" value="Default"/>	<input type="button" value="OK"/>

This screen allows to specify the measurement units to use.

The application uses default units, but if the user prefers to use different units, he can change them in this screen. In addition, once the units have been changed, the user can return to this screen and click on "Default" to set the initial units again.

The application shows the main quantities used in the various stages of analysis and, if possible, provides choices for each of them.

In addition, in the upper part, the screen shows the current set of units, thus allowing the user to compare the current ones with those that he is eventually modifying.

**SETTING THE UNITS:**

Click on " Units" to open the relevant screen.

The user can select the "concentration" unit by clicking the desired one from the three listed.

Alternatively, the user could set the predefined units again by clicking on the "Default" button.

**AT THE END OF THE CHANGES:**

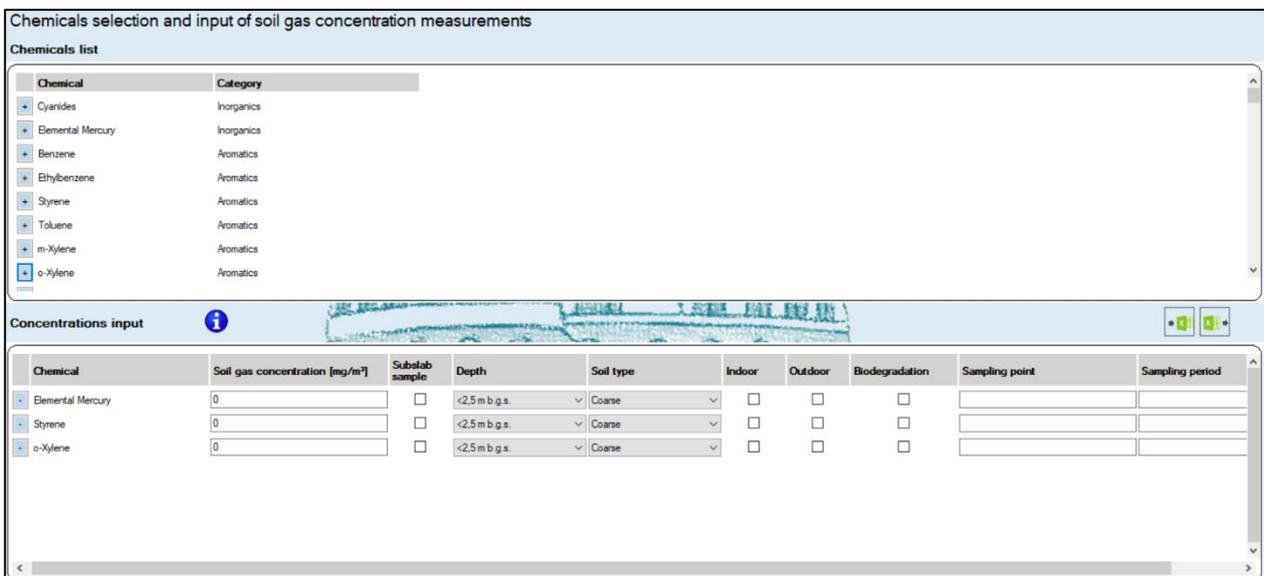
If the user needs to make any changes, at the end of the changes it is necessary to confirm the operations carried out, using the "OK" button.

By clicking OK, the selected units of measure will be set as current.

Unconfirmed changes will be ignored and discarded.

In addition, if the user has made unconfirmed changes and inadvertently changes the screen, the application warns him that such unconfirmed changes may be lost. The user can then decide whether to cancel his choice to change the screen or continue and lose the changes.

**SELECTION AND SETTING OF CONTAMINANTS**



This screen allows to select the contaminants to be assessed. For each contaminant it is necessary to enter the measured concentration in soil gases, the corresponding characteristic of the sample taken (type and depth), the characteristic of the investigated soil, the relevant pathway (indoor and/or outdoor) for which the data are used and, if necessary, the identification of the sampling point and the sampling period, in order to carry out the subsequent calculations.

The chemicals list shows all the substances "of interest" for volatilization pathway included in the ISS INAIL database of March 2018, grouped according to the Category defined in the same database.

By selecting the substances from the upper list (using the  button), they will be added to the lower list ("Concentration input"), where they can be integrated with all the necessary information.

Conversely, it is possible to remove unnecessary substances from the lower list (using the  button).

If the analysis should be carried out for different sampling points or sampling periods, it is possible to enter several times the list (complete or partial) of the analytes that have been subjected to monitoring, specifying each time the sampling point or period to which the reported soil gas concentrations refer.

#### ADDING A NEW CONTAMINANT:

Search for the contaminant in the upper list ("List of substances"), and once found, click on the corresponding button  to add it to the list below ("Concentration input").

#### REMOVING AN ALREADY ADDED CONTAMINANT:

Search for the contaminant to be eliminated in the list below ("Concentration input"), and once found, click on the corresponding button .

#### HOW TO INSERT INFORMATION ABOUT AN ALREADY ADDED CONTAMINANT:

Find the contaminant in the list below ("Concentration input").

Once found, the following pieces of information can be set or modified:

- **Soil gas concentration:** the contaminant concentration measured in the soil gases must be inserted, using the shown unit. This value is mandatory for every selected contaminant.  
*note. If needed, the user may change the current unit for concentration values. To do this, go to the "Scenario and pathway selection" screen and click the "Units" button (see pg. 12).*
- **Subslab sample:** in an indoor scenario, it is possible to indicate whether the sampling took place under the slab (subslab). Please note that subslab samples are valid for indoor scenarios only.
- **Depth:** for each measured contaminant concentration, the related depth range must be indicated. If a specific sample is subslab, then the depth must be set to "<2.5 m b.g.s.".
- **Soil type:** for each measured contaminant concentration, the related soil granulometric classification must be indicated.
- **Indoor use:** it is necessary to indicate if the sample will be used for the evaluation of the indoor scenario. This can only be indicated if the exposure pathway selected in the previous screens is "Indoor" or "Indoor-Outdoor".
- **Outdoor use:** it is necessary to indicate whether the sample will be used for the evaluation of the outdoor scenario. This can only be indicated if the exposure pathway selected in the previous screens is "Outdoor" or "Indoor-Outdoor".
- **Biodegradation:** it is possible to indicate for some contaminants in some samples the possibility of evaluating the effects of aerobic biodegradation. The criteria for the evaluation of aerobic

biodegradation effetti are listed in the document *"Procedure for the evaluation and use of soil gas data in the risk assessment of contaminated sites"* (Linee Guida SNPA 17/2018)

- **Sampling point, Sampling period:** it is possible to enter details about each sample, to facilitate the reading of the input data and the results of the analysis. These fields are usually optional. However, they become mandatory if the same contaminant has been selected several times.

#### TO DUPLICATE AN ALREADY INSERTED LINE:

It is possible to right-click on an already inserted row in the list below ("Concentration input") and select "Duplicate row". A new row will be added to the list, identical to the selected row.

#### TO COPY AND PASTE VALUES:

It is possible to right-click on an already inserted line in the list below ("Concentration input") and select "Copy"; it is possible to copy contaminant names, soil gas concentration values, sampling points and sampling periods. The values will be copied to the Windows clipboard, and can normally be pasted into other applications. In addition, the user can right-click on a line already entered in the list below ("Concentration input") and select "Paste" to paste the text from the Windows clipboard onto the selected field; it is possible to paste text on the fields of soil gas concentration values, sampling points and sampling periods.

#### TO REPLICATE VALUES ON OTHER LINES:

It is possible to right-click on an already inserted line in the list below ("Concentration input") and select one of these items:

- Copy above: the value of the selected field will be copied into the corresponding field of all the lines above the selected one.
- Copy below: the value of the selected field will be copied into the corresponding field of all the lines below the selected one.
- Copy all: the value of the selected field will be copied into the corresponding field of all the lines.

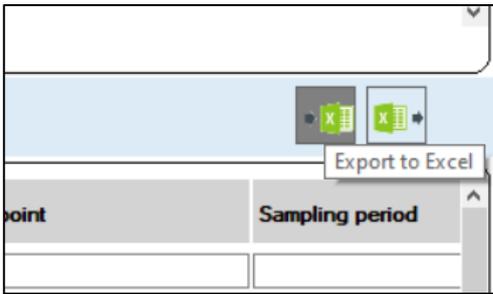
#### AT THE END OF THE CHANGES:

If the user needs to make any changes, at the end of the changes it is necessary to confirm the operations carried out, using the "OK" button.

By clicking OK, the selected units of measure will be set as current.

Unconfirmed changes will be ignored and discarded.

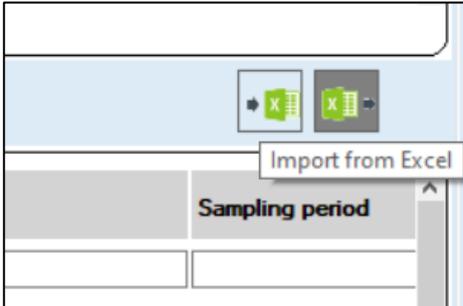
In addition, if the user has made unconfirmed changes and inadvertently changes the screen, the application warns him that such unconfirmed changes may be lost. The user can then decide whether to cancel his choice to change the screen or continue and lose the changes.

**EXPORTING CONTAMINANTS AND CONCENTRATIONS:**

This command allows to create an Excel file containing all the selected contaminants, with the concentration values entered, the depths and types of soil selected, and all other information in the "Concentration Input" list.

Before being able to execute the "Export to Excel" command, it is necessary to have clicked on the Confirm button to verify the data entered. If the user has entered data that has not yet been confirmed, the application will invite the user to click on Confirm before proceeding with "Export to Excel".

If the user exports to Excel with the screen not yet filled in, the application generates an empty Excel template file, that can be used and modified to enter the input of contaminants and soil gas concentrations.

**IMPORTING CONTAMINANTS AND CONCENTRATIONS:**

This command allows to read an Excel file containing the "Concentration Input" list that the user may want to load on the application. With this operation, any selections already made on the application will be canceled, and a list contained in the Excel file will be loaded.

The Excel file must have a well-defined structure. It is possible to use an Excel file generated with the "Export to Excel" operation (described above). The Excel file can be modified at will, adding rows, removing rows, and modifying the values where required, if the entered values are valid.

After executing an "Import from Excel" command, if the data contained in the Excel file is correct, the application will warn the user that the data in the Excel file have been loaded on the screen, and it is therefore possible to proceed with the validation and confirmation of such data, using the Confirm button.

## COMPARISON WITH THRESHOLD VALUES

INDOOR				OUTDOOR			
Chemical	Soil gas conc. [mg/m <sup>3</sup> ]	Threshold [mg/m <sup>3</sup> ]	Threshold exceeded?	Chemical	Soil gas conc. [mg/m <sup>3</sup> ]	Threshold [mg/m <sup>3</sup> ]	Threshold exceeded?
Benzene	1.00E-1	3.31E-3	YES	Ethylbenzene	2.00E-1	2.24E-1	NO
Ethylbenzene	2.00E-1	1.03E-2	YES	Toluene	7.01E+2	6.59E+2	YES
o-Xylene	4.00E-1	1.12E+0	NO				

In this screen, a comparison is made between the concentrations entered in input and the threshold values defined for each selected contaminant.

Two distinct panels are displayed, for the two different selected pathways (indoor and/or outdoor), and each panel contains the contaminants, the entered soil gas concentrations and the threshold values for that pathway together with the indications on sampling point and sampling period, if present.

If the information relating to the sampling points and/or the sampling periods has been entered, two drop-down menus are displayed on the right, which respectively allow to filter the data with respect to the sampling installation and/or the monitoring campaign.

If only one pathway (indoor or outdoor) has been selected, only the corresponding panel will be shown.

For each contaminant, it is also indicated whether the threshold value has been exceeded or not: if the value has not been exceeded, the line is highlighted in green.

However, the software carries out the site-specific risk assessment even for substances that do not have exceeded the threshold values.

## EXPOSURE PARAMETERS

Name	Unit	Residential				Recreational		
		Child (0-6 years)	Adolescent (7-16 years)	Adult (17-65 years)	Senior (>65)	Child (0-6 years)	Adolescent (7-16 years)	Adult (17 years)
Outdoor daily exposure frequency	h/d	19.8	19.6	18	22.4	0.4	0.6	1.4
Indoor daily exposure frequency	h/d	0.7	0.5	0.9	1.9	0.6	0.9	0.8
Exposure frequency	d/yr	350	350	350	350	350	350	350
Exposure duration	yr	6	10	14	5	6	10	14
Averaging time non carcinogens	yr	6	10	14	5	6	10	14
Averaging time carcinogens	yr	70	70	70	70	70	70	70
ADAF carcinogens/mutagens	adm.	5	3	1	1	5	3	1
ADAF carcinogens/mutagens (Vinyl Chloride)	adm.	2	1	1	1	2	1	1

This screen allows to consult the exposure parameters, for each scenario and for each type of receptor associated with the scenario.

It is possible to change these values, if necessary for the current analysis. The screen highlights in gray the values that cannot be changed (because they are based on the values of other rows), and highlights in red any invalid value present.

In addition, the newly changed values can be set as default for all the future analyses. The “Set as default” button allows to save the current values in an Excel sheet, in a folder that can be selected on user’s PC. The file thus saved will be automatically set as the input file for the Exposure Parameters; then, by accessing the input file screen, the user will see the file just saved for this input. In this way, for all future analyses and even if closing the application and restarting it, the exposure parameters will be those modified and set as default.

#### TO MODIFY ONE OR MORE EXPOSURE PARAMETERS:

Click on the cell in the row of the parameter that the user wants to modify, and in the column of the scenario and the appropriate receptor. Enter a valid value in that cell.

The values highlighted in red are incorrect, and therefore the user is required to modify them and replace them with correct values.

#### AT THE END OF THE CHANGES:

If the user needs to make any changes, at the end of the changes it is necessary to confirm the operations carried out, using the "OK" button.

By clicking OK, the selected units of measure will be set as current.

Unconfirmed changes will be ignored and discarded.

In addition, if the user has made unconfirmed changes and inadvertently changes the screen, the application warns him that such unconfirmed changes may be lost. The user can then decide whether to cancel his choice to change the screen or continue and lose the changes.

**Attention:** the confirmed changes are valid only for the analysis currently in progress. By restarting the application or starting a new analysis, the default values will be reset. If, on the other hand, the user wants that the newly modified values to become the definitive values for all future analyses, then the user can click on the “Set as default” button and select the folder where he wants to save the new excel file with the exposure parameters just modified. By saving this file, the modified values will be used for all future analyses, and for all the applications of the suite (therefore, also for Fori).

## TOXICOLOGICAL PARAMETERS

Toxicological parameters				
Name	RfC [mg/m3]	IUR [ $\mu\text{g}/\text{m}^3$ ]-1	Carcinogen	Carcinogen/Mutagen
Benzene	3.00E-2	7.80E-6	Yes	No
Ethylbenzene	1.00E+0	2.50E-6	Yes	No
Styrene	1.00E+0	5.00E-7	Yes	No
m-Xylene	1.00E-1		No	No

This screen allows to consult the toxicological parameters of all contaminants selected for the analysis in progress.

The toxicological parameters are those included in the ISS INAIL database of March 2018. The values of these parameters cannot be changed by the user. Any updates to the same database will be included in the new release of the suite.

## SITE CHARACTERISTICS

Site characteristics			
Off-site outdoor			
Off-site outdoor site characteristics	Symbol	Unit	Value
Source length transversal to wind direction	L'wind	m	<input type="text" value="25"/>
Mixing height	d air	m	<input type="text" value="2"/>
Off-site distance	x	m	<input type="text" value="100"/>
Stability class (Pasquill)	-	-	<input type="text" value="D"/>
Dispersion environment	-	-	<input type="text" value="Urban"/>

This screen allows to consult the parameters of the site characteristics being analyzed. The input of these parameters is only necessary for the Outdoor Off-site route.

If this scenario has not been set, this screen will be blank.

The parameters can be modified, if necessary, for the analysis in progress.

### TO MODIFY ONE OR MORE CHARACTERISTIC PARAMETERS OF THE SITE:

If an Outdoor Off-site scenario has been set, the screen will show the relative parameters (otherwise it will be blank).

Click on the cell in the row of the parameter to be changed, and in the "Value" column, enter a valid value in the selected cell.

#### AT THE END OF THE CHANGES:

If the user has made any changes, at the end of the changes it is necessary to confirm the operations carried out, using the "Confirm" button.

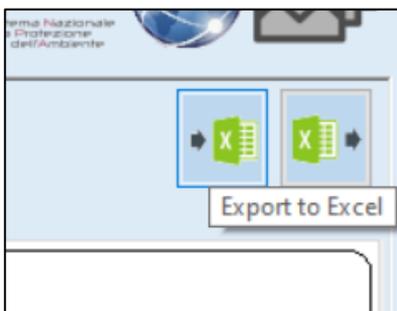
By clicking on Confirm, the entered values will be set as current.

Unconfirmed changes will be ignored and discarded.

In addition, if the user has made unconfirmed changes and inadvertently changes the screen, the application warns him that such unconfirmed changes may be lost. The user can then decide whether to cancel his choice to change the screen or continue and lose the changes.

**Attention:** the confirmed changes are valid only for the analysis currently in progress. By restarting the application or starting a new analysis, the default values will be reset.

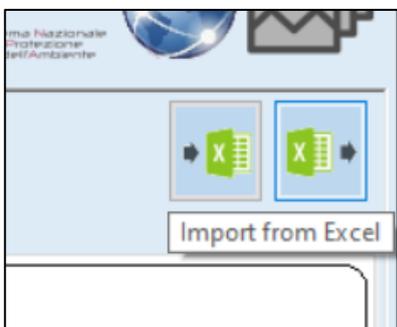
#### EXPORT OF SITE CHARACTERISTICS:



This command allows to create an Excel file containing all the features of the site displayed by the application and eventually modified by the user.

Before being able to execute the "Export to Excel" command, it is necessary to have clicked on the Confirm button to verify the data entered. If the user has entered data that has not yet been confirmed, the application will invite the user to click on Confirm before proceeding with "Export to Excel".

#### IMPORT OF SITE CHARACTERISTICS:



This command allows to read an Excel file containing all the features of the site the user wants to upload to the application. With this operation, any changes already made on the application will be canceled, and the values contained in the Excel file will be loaded.

The Excel file must have a well-defined structure. It is possible to use an Excel file generated with the "Export to Excel" operation (described above). The Excel file can be modified at will, modifying the values where required, if the entered values are valid.

After executing an "Import from Excel" command, if the data contained in the Excel file is correct, the application will warn the user that the data in the Excel file have been loaded on the screen, and it is therefore possible to proceed with the validation and confirmation of such data, using the Confirm button.

## ATTENUATION FACTORS - ALFA

**Attenuation factors - Alpha**

Depth | Soil type | Biodegradation

Depth	Soil type alpha
<2,5 m b.g.s.	5,93E-2
2,5-4 m b.g.s.	3,11E-3
4-9 m b.g.s.	1,97E-3
> 9 m b.g.s.	1,89E-3

**Attenuation factors - Alpha**

Depth | Soil type | Biodegradation

Soil type	Subslab alfa (indoor)	Soil type alpha
Coarse	1,25E-2	1,23E-2
Very coarse	1,53E-2	5,31E-2
Fine	1,02E-2	2,86E-3

**Attenuation factors - Alpha**

Depth | Soil type | Biodegradation

Depth	Subslab alfa (indoor)	Soil type alpha
<2,5 m b.g.s.	3,17E-3	1,68E-2
2,5-4 m b.g.s.		3,56E-5
4-9 m b.g.s.		2,25E-5
> 9 m b.g.s.		2,16E-5

This screen allows to consult the attenuation factors (alpha), depending on the type of sampling, depth, type of soil and applicability of biodegradation.

Regarding the correlation of the alpha factor with depth, it should be noted that the values reported in the SNPA Guidelines refer to the depth of the contamination source. Therefore, for the application of the alpha factors, the sampling depths should be as close as possible to the depths of the contamination sources in the vapor phase.

The parameters are shown in three tables according to the specific correlation, accessible through the labels "Depth", "Soil type" and "Biodegradation" at the top of the screen.

The parameters can be modified, if necessary for the analysis in progress.

#### TO MODIFY ONE OR MORE ATTENUATION FACTORS (ALPHA):

Click on the label of the table that contains the factor to be changed ("Depth", "Soil type" or "Biodegradation").

Click on the cell containing the value to be modified and enter a valid value in the selected cell.

#### AT THE END OF THE CHANGES:

If the user has made any changes, at the end of the changes it is necessary to confirm the operations carried out, using the "Confirm" button.

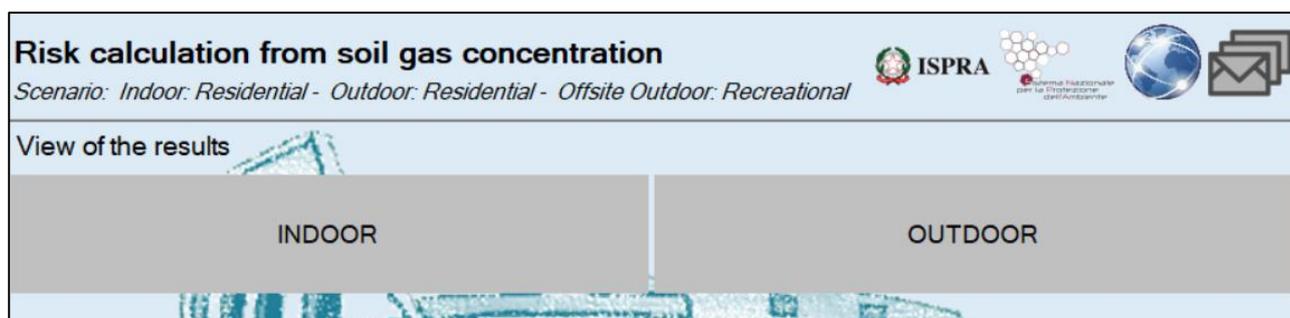
By clicking on Confirm, the entered values will be set as current.

Unconfirmed changes will be ignored and discarded.

In addition, if the user has made unconfirmed changes and inadvertently changes the screen, the application warns him that such unconfirmed changes may be lost. The user can then decide whether to cancel his choice to change the screen or continue and lose the changes.

**Attention:** the confirmed changes are valid only for the analysis currently in progress. By restarting the application or starting a new analysis, the default values will be reset.

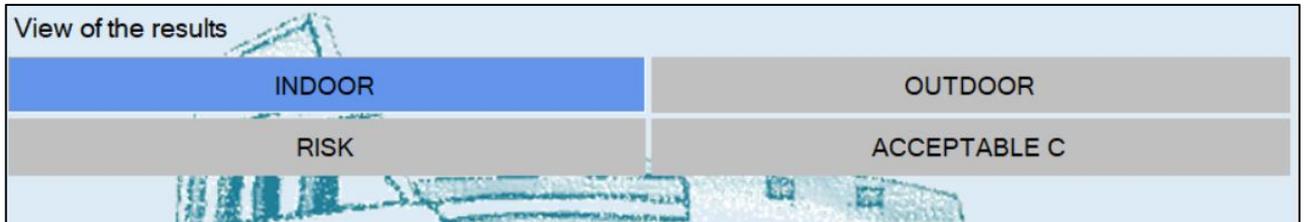
## VIEWING THE RESULTS



This screen allows to consult the results of the performed analysis.

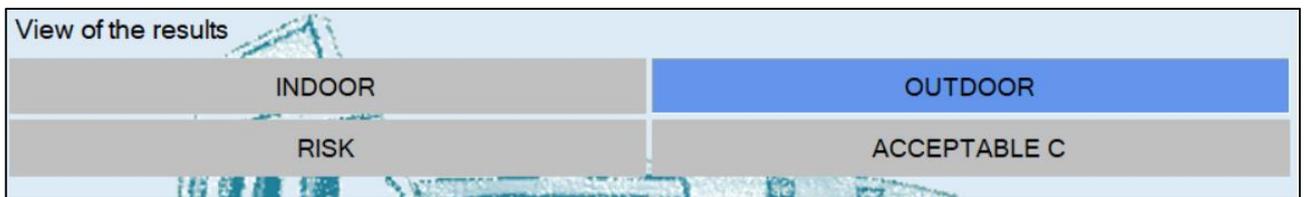
If both Indoor and Outdoor pathways have been selected, the user must choose the pathway for which he wants to view the results. Otherwise, if only one pathway (Indoor or Outdoor) has been chosen, it is automatically selected.

- In the results screen for the Indoor pathway:

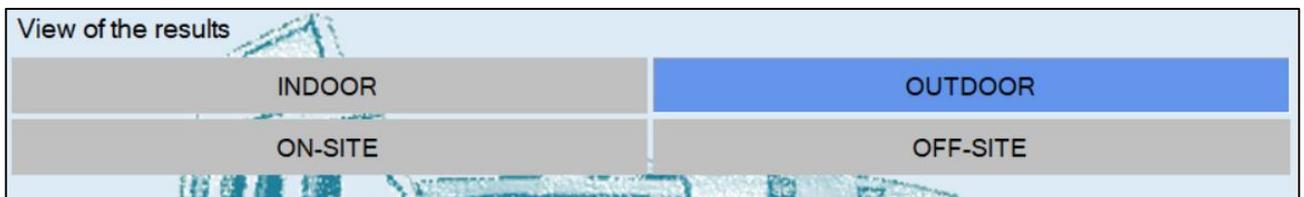


The user can view the results in terms of Risk (forward mode) or acceptable C (backward mode).

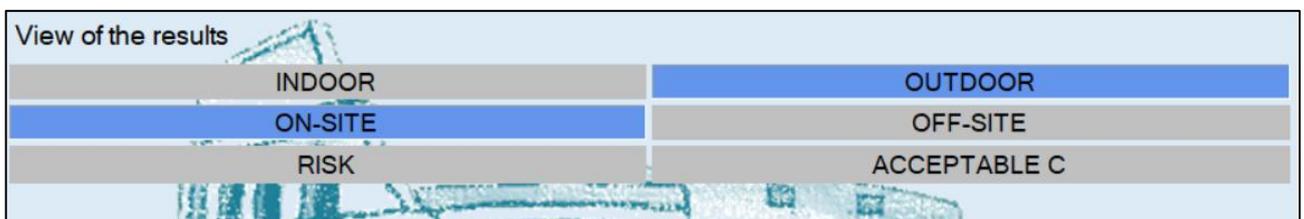
- In the results screen for the Outdoor pathway:
  - If an Outdoor Off-Site scenario has not been selected, the user can view the results in terms of Risk (forward mode) or Acceptable C (backward mode):



- Otherwise, if an Outdoor Off-Site pathway has also been selected, first of all the user can choose the display of the results for On-Site or Off-Site pathway:



and then, the user can view the results in terms of Risk (forward mode) or of Acceptable C (backward mode):



When the selection of the type of result has finished, the corresponding results table is shown.

The table can contain various sections, indicated with respective labels placed above it. Sections can be:

- Alpha Depth: indicates the use of the attenuation factors (alpha) correlated to the depth.
- Alpha Soil type: indicates the use of attenuation factors (alpha) correlated to the type of soil horizon investigated.
- Biodegradation: indicates the use of attenuation factors (alpha) that account for the effects of aerobic biodegradation, for the contaminants to which they are applicable.

- Subslab - Alpha Soil type: indicates the use of the attenuation factors (alpha) applicable to samples taken under the slab.

The lines highlighted in green indicate the input concentrations of contaminants that do not exceed the threshold value.

The cells in red, on the other hand, highlight the unacceptable risk/hazard index values, and/or the exceeding of acceptable concentrations.

View of the results

INDOOR		OUTDOOR	
ON-SITE		OFF-SITE	
RISK		ACCEPTABLE C	

Depth Alpha Soil Type Alpha

Current result: Outdoor on-site - Risk - Depth Alpha

Chemical	Soil gas conc. [mg/m <sup>3</sup> ]	Alpha	HI Child	HI Adolescent	HI Adult	HI Senior	HI Final	Acceptability	R	Acceptability
Styrene	2.00E+0	5.93E-2	3.32E-3	2.37E-3	4.26E-3	9.00E-3	9.00E-3	Acceptable	1.06E-6	Not acceptable
o-Xylene	1.30E-5	5.93E-2	2.15E-7	1.54E-7	2.77E-7	5.85E-7	5.85E-7	Acceptable		

Legend

- Threshold value not exceeded
- Unacceptable result

View of the results

INDOOR		OUTDOOR	
ON-SITE		OFF-SITE	
RISK		ACCEPTABLE C	

Depth Alpha Soil Type Alpha

Current result: Outdoor on-site - Acceptable C - Depth Alpha

Chemical	Soil gas conc. [mg/m <sup>3</sup> ]	Acceptable C [mg/m <sup>3</sup> ]	Acceptable value exceeded
Styrene	2.00E+0	1.89E+0	YES
o-Xylene	1.30E-5	2.22E+1	NO

Legend

- Threshold value not exceeded
- Unacceptable result

If the sampling points or sampling periods for one or more substances have been indicated, the displayed results can be filtered to show only those relating to the sampling point or sampling period. This operation is carried out using two curtains on the right side of the screen, under the legend:

Legend

- Threshold value not exceeded
- Unacceptable result

Filter by sampling point

Filter by sampling period

Oct 2020  
Sept 2020

The "Export" button at the bottom of the screen allows to export the calculated results in Excel or PDF format. By clicking on this button, this panel opens:

Export results

Which results to export? Current results

Format

Excel

PDF

File name:

...

EXPORT

In the selection of "Which results to export", it is possible to indicate whether to export only the results currently displayed (for example, "Indoor-Risk"), or all those available.

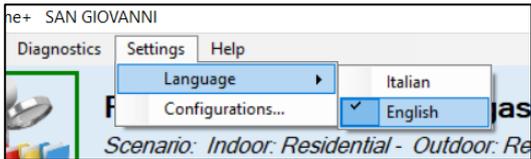
As "Format" it is possible to indicate whether to export to Excel or PDF.

As the file name, select the path and file name to be generated.

After having filled the fields on this panel, by clicking on Export, the results are exported, and the corresponding file is created.

## OTHER OPERATIONS AND FEATURES

### Language selection



From the menu bar at the top, the language to be used for the application can be selected.

By selecting a language, the application will translate all texts, messages and notifications into the related language. Furthermore, all the files generated, the exports made and the saves will be created in the selected language.

### Configuration and connectivity

The applications of the Rome Plus suite use the internet connection to access a remote server that provides several features (eg, updating configurations, online documentation, registration service, etc.).

From the main application window, some icons are shown that show information about it:



The system is connected to the internet, and the application can contact the Rome Plus remote server.



The system is not connected to the internet, or the application is unable to contact the remote Rome Plus server. Note that, in this condition, only the Rome Plus features described in this are not active.



There are no notifications to be shown to the user.

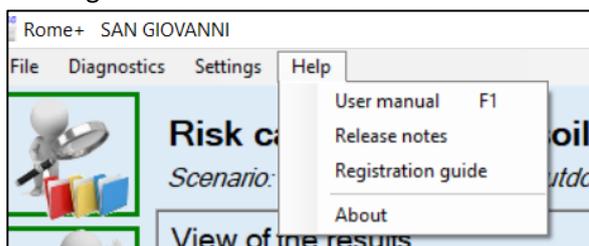


There are notifications to be shown to the user. Notifications can be viewed by hovering the mouse cursor on this icon.

If the icon appears indicating the lack of internet connectivity, this could be due to a temporary situation (for example, a router that has shut down). It is possible to click on the icon to update the connectivity status: in this way, if in the meantime internet connectivity has been re-established, the icon should now display a working connectivity.

For completeness, the other Rome Plus features that require working internet connectivity are listed:

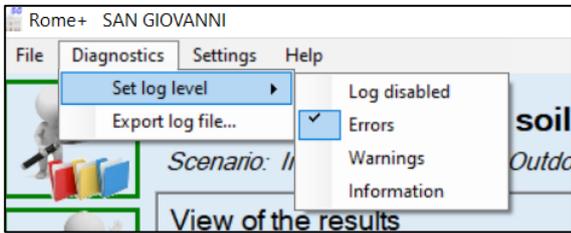
- Viewing the user manual and other documentation



- Rome Plus registration

- Rome Plus configuration update (see "Application Configuration" chapter)

### *Troubleshooting and diagnostics*



In case of technical or application problems, it may be helpful to provide assistance with information on the context of the problem and the details of the operations carried out that caused the problem.

The application keeps track of all useful information in log files. From the menu bar it is possible to export the log files, so that they can be consulted or sent by e-mail. In addition, the user can configure which messages and information to write to the logs by setting the log level.

These features should only be used upon guidance from technical support. In the absence of detailed information, we recommend leaving these settings unchanged.

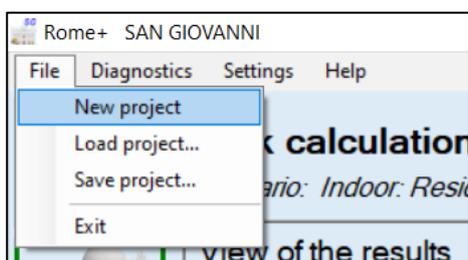
## USER GUIDE AND EXAMPLES

Here are some practical examples on how to perform analyses, in different contexts.

The examples are made up of steps, in order to be easy for the user, who can follow the instructions step by step.

### EXAMPLE 1 - INDOOR RESIDENTIAL SCENARIO WITH CHLORINATED SOLVENTS: SOIL SUB SLAB GAS SAMPLING AT THE SOURCE

**Step 1:** start a new project via the top menu. Select the command: File -> New project.



n.b. when the application is started, a new project is automatically opened, so it is not necessary to select this command. This operation is instead necessary if some actions have already been carried out and therefore the user wants to start from scratch, with a clean project.

**Step 2:** check, from the function buttons area, that the "Input file setting" function (first button) is highlighted in green, indicating that the input files are correctly set:



**Step 3:** using the function buttons area, display the "Scenario and pathway selection" screen (second button, initially highlighted in yellow, indicating that this information has not yet been entered):



Indicate "Exposure pathway": Indoor.

Subsequently, in the "Indoor" area, select Scenario: Residential.

**Scenario and pathway selection**

Exposure pathway: Indoor

Indoor

Scenario: Residential



Click the Confirm button at the bottom of the screen.

In the function buttons area, the "Scenario and pathway selection" button (second button) will now be highlighted in green, indicating that the information has been correctly entered.



**Step 4:** using the function buttons area, display the "Chemicals selection and configuration" screen (third button, initially highlighted in yellow, indicating that this information has not yet been entered):



In the upper list ("Chemicals list"), search the following contaminants and click the  button to add them to the selected contaminants. The lower list ("Input of concentrations") will be updated accordingly.

- 1,2 Dichloroethane: add two samples
- Tetrachlorethylene: add one sample
- Trichlorethylene: add two samples

Selezione dei contaminanti e input delle concentrazioni

Elenco delle sostanze

Sostanza	Categoria
+ Diclorometano	Alifatici clorurati
+ Tetracloroetilene (PCE)	Alifatici clorurati
+ Tricloroetilene	Alifatici clorurati
+ Triclorometano	Alifatici clorurati
+ 1,1,2,2-Tetracloroetano	Alifatici clorurati
+ 1,1,1-Tricloroetano	Alifatici clorurati

Input delle concentrazioni

Sostanza	Concentrazione Soil Gas [mg/m <sup>3</sup> ]	Campione subslab	Profondità	Tipo di suolo	Utilizzo Indoor	Utilizzo Outdoor	Biodegradazione	Punto di campionamento
- 1,2-Dicloroetano	0	<input type="checkbox"/>	<2,5 m da p.c.	Grossolano	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
- 1,2-Dicloroetano	0	<input type="checkbox"/>	<2,5 m da p.c.	Grossolano	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
- Tetracloroetilene (PCE)	0	<input type="checkbox"/>	<2,5 m da p.c.	Grossolano	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
- Tricloroetilene	0	<input type="checkbox"/>	<2,5 m da p.c.	Grossolano	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
- Tricloroetilene	0	<input type="checkbox"/>	<2,5 m da p.c.	Grossolano	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

In the lower list ("Concentration input") make the following settings (for items not indicated, leave the default value):

- 1,2 Dichloroethane (first sample):
  - Soil Gas Concentration (mg/m<sup>3</sup>): 5.6
  - Subslab Sample: Yes
  - Soil type: Very Coarse
  - Sampling point: SS1
- 1,2 Dichloroethane (second sample):
  - Soil Gas Concentration (mg/m<sup>3</sup>): 163.2
  - Depth: 4-9 m b.g.s.
  - Soil type: Fine
  - Sampling point: SG1
- Tetrachlorethylene:
  - Soil Gas Concentration (mg/m<sup>3</sup>): 0.07
  - Depth: 4-9 m b.g.s.
  - Soil type: Fine
  - Sampling point: SG1
- Trichlorethylene (first sample):
  - Soil Gas Concentration (mg/m<sup>3</sup>): 0.02
  - Subslab Sample: Yes
  - Soil type: Very Coarse
  - Sampling point: SS1
- Trichlorethylene (second sample):
  - Soil Gas Concentration (mg/m<sup>3</sup>): 25.4
  - Depth: 4-9 m b.g.s.
  - Soil type: Fine
  - Sampling point: SG1

Chemical	Soil gas concentration [mg/m <sup>3</sup> ]	Subslab sample	Sampling depth	Soil type	Indoor	Outdoor	Biodegradation	Sampling point	Sampling period
1,2-Dichloroethane	5.6	<input checked="" type="checkbox"/>	<2.5 m b.g.s.	Very coarse	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SS1	
1,2-Dichloroethane	163.2	<input type="checkbox"/>	4-9 m b.g.s.	Fine	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SG1	
Tetrachloroethylene (PCE)	0.07	<input type="checkbox"/>	4-9 m b.g.s.	Fine	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SG1	
Trichloroethylene	0.02	<input checked="" type="checkbox"/>	<2.5 m b.g.s.	Very coarse	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SS1	
Trichloroethylene	25.4	<input type="checkbox"/>	4-9 m b.g.s.	Fine	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SG1	

Click the Confirm button at the bottom of the screen.

In the function buttons area, the "Chemicals selection and configuration" button (third button) will now be highlighted in green, indicating that the information has been correctly entered.



**Step 5:** using the function buttons area, display the "Compare with threshold values" screen.



Check which substances and samples exceed the threshold values.

Thresholds comparison				
INDOOR				
Chemical	Soil gas conc. [mg/m <sup>3</sup> ]	Sampling point	Threshold [mg/m <sup>3</sup> ]	Threshold exceeded?
1,2-Dichloroethane	5.60E+0	SS1	9.93E-4	YES
1,2-Dichloroethane	1.63E+2	SG1	9.93E-4	YES
Tetrachloroethylene (PCE)	7.00E-2	SG1	9.93E-2	NO
Trichloroethylene	2.00E-2	SS1	2.76E-3	YES
Trichloroethylene	2.54E+1	SG1	2.76E-3	YES

As there is no need to modify other parameters with respect to the software defaults, the display of the results screen can be directly opened, with the next step (Step 6).

**Step 6:** using the function buttons area, display the "Results calculation" screen (last button at the bottom).



After the screen appears, click on "RISK" to view the results of the soil gas risk assessment. Results for subslab samples will be shown initially.

Scenario: Indoor: Residential

View of the results

INDOOR RISK      OUTDOOR ACCEPTABLE C

Subslab - Soil Type Alpha    Sampling Depth Alpha    Soil Type Alpha

**i** Current result: Indoor - Risk - Subslab - Soil Type Alpha

Chemical	Soil gas conc. [mg/m <sup>3</sup> ]	Sample point	Alpha	HI Child	HI Adolescent	HI Adult	HI Senior	HI Final	Acceptability
1,2-Dichloroethane	5,60E+0	SS1	1,53E-2	9,68E+0	9,58E+0	8,80E+0	1,10E+1	1,10E+1	Not acceptable
Trichloroethylene	2,00E-2	SS1	1,53E-2	1,21E-1	1,20E-1	1,10E-1	1,37E-1	1,37E-1	Acceptable

Legend: Threshold value not exceeded (green), Unacceptable result (red)

Filter by sampling point

By clicking on the "Depth Alpha" label, it is possible to view the results of the analysis based on the selected correlation. The samples and contaminants displayed are those that do not refer to sub-slab samples.

Subslab - Soil Type Alpha    Sampling Depth Alpha    Soil Type Alpha

**i** Current result: Indoor - Risk - Sampling Depth Alpha

Chemical	Soil gas conc. [mg/m <sup>3</sup> ]	Sample point	Alpha	HI Child	HI Adolescent	HI Adult	HI Senior	HI Final	Acceptability
1,2-Dichloroethane	1,63E+2	SG1	1,97E-3	3,64E+1	3,60E+1	3,31E+1	4,12E+1	4,12E+1	Not acceptable
Tetrachloroethylene (PCE)	7,00E-2	SG1	1,97E-3	2,73E-3	2,70E-3	2,48E-3	3,09E-3	3,09E-3	Acceptable
Trichloroethylene	2,54E+1	SG1	1,97E-3	1,98E+1	1,96E+1	1,80E+1	2,24E+1	2,24E+1	Not acceptable

In the case of the display of the acceptable concentrations, the results are shown for example using the correlation of the attenuation factors with the type of soil. By clicking on the "ACCEPTABLE C" button, and then on the "Soil Type Alpha" label, the corresponding results will be displayed. The samples and contaminants displayed are those that do not refer to sub-slab samples.

INDOOR RISK      OUTDOOR ACCEPTABLE C

Subslab - Soil Type Alpha    Sampling Depth Alpha    Soil Type Alpha

**i** Current result: Indoor - Acceptable C - Soil Type Alpha

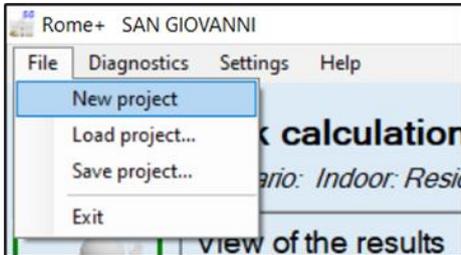
Chemical	Soil gas conc. [mg/m <sup>3</sup> ]	Sample point	Acceptable C [mg/m <sup>3</sup> ]	Acceptable value exceeded
1,2-Dichloroethane	1,63E+2	SG1	3,47E-2	YES
Tetrachloroethylene (PCE)	7,00E-2	SG1	3,47E-0	NO
Trichloroethylene	2,54E+1	SG1	9,66E-2	YES

Legend: Threshold value not exceeded (green), Unacceptable result (red)

Filter by sampling point

## EXAMPLE 2 - INDOOR / OUTDOOR ON-SITE INDUSTRIAL SCENARIO AND EVALUATION OF THE OFF-SITE RECREATIONAL SCENARIO

**Step 1:** start a new project via the top menu. Select the command: File -> New project.



n.b. when the application is started, a new project is automatically opened, so it is not necessary to select this command. This operation is instead necessary if some actions have already been carried out and therefore the user wants to start from scratch, with a clean project.

**Step 2:** check, from the function buttons area, that the "Input file setting" function (first button) is highlighted in green, indicating that the input files are correctly set:



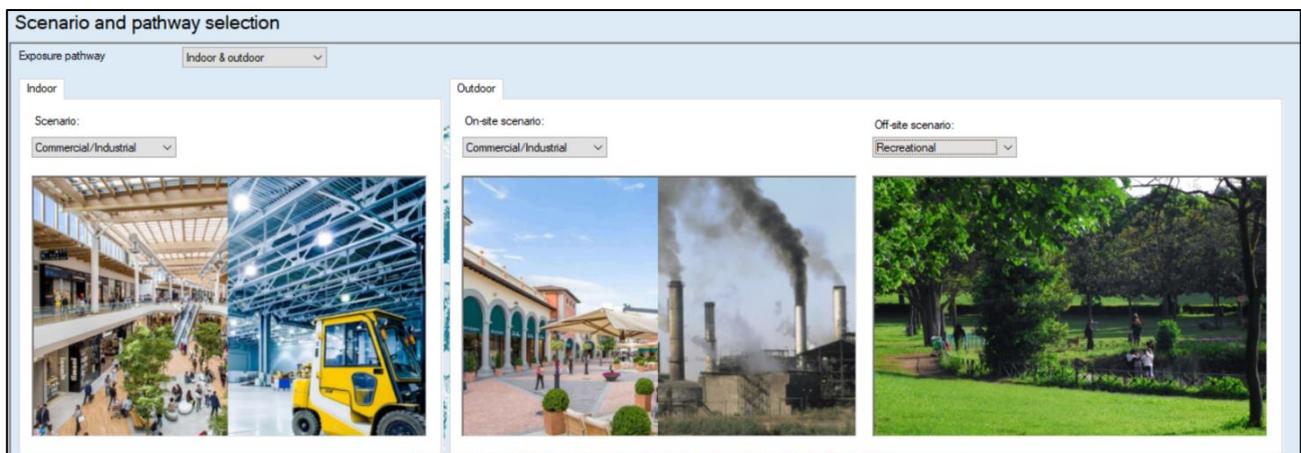
**Step 3:** using the function buttons area, display the "Scenario and pathway selection" screen (second button, initially highlighted in yellow, indicating that this information has not yet been entered):



Indicate "Exposure pathway": Indoor & Outdoor.

Subsequently, in the "Indoor" area, select Scenario: Commercial/Industrial.

In the "Outdoor" area, select On-site scenario: Commercial/Industrial, and off-site scenario: Recreational.



Click the Confirm button at the bottom of the screen.

In the function buttons area, the "Scenario and pathway selection" button (second button) will now be highlighted in green, indicating that the information has been correctly entered.



**Step 4:** using the function buttons area, display the "Chemicals selection and configuration" screen (third button, initially highlighted in yellow, indicating that this information has not yet been entered):



In the upper list ("Chemicals list"), search the following contaminants and click the  button to add them to the selected contaminants. The lower list ("Input of concentrations") will be updated accordingly.

- Benzene: add two samples
- Toluene: add two samples
- C5-C8 Aliphatics: add one sample
- C9-C12 Aliphatics: add one sample
- C9-C10 Aromatics: add one sample
- C11-C12 Aromatics: add one sample

**Risk calculation from soil gas concentration**

Scenario: Indoor: Commercial/Industrial - Outdoor: Commercial/Industrial - Offsite Outdoor: Recreational

ISPR

Chemicals selection and input of soil gas concentration measurements

Chemicals list

Chemical	Category
+ C >10-12 Aliphatics	Hydrocarbons (TPHCWG Classification)
+ C > 7-8 Aromatics	Hydrocarbons (TPHCWG Classification)
+ C >8-10 Aromatics	Hydrocarbons (TPHCWG Classification)
+ C >10-12 Aromatics	Hydrocarbons (TPHCWG Classification)
+ C5-C8 Aliphatics	Hydrocarbons (MADEP Classification)
+ C9-C12 Aliphatics	Hydrocarbons (MADEP Classification)
+ C9-C10 Aromatics	Hydrocarbons (MADEP Classification)
+ C11-C12 Aromatics	Hydrocarbons (MADEP Classification)

Concentrations input

Chemical	Soil gas concentration [mg/m <sup>3</sup> ]	Subslab sample	Sampling depth	Soil type	Indoor	Outdoor	Biodegradation	Sampling point	Sampling period
- Benzene	0	<input type="checkbox"/>	<2.5 m b.g.s.	Coarse	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
- Benzene	0	<input type="checkbox"/>	<2.5 m b.g.s.	Coarse	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
- Toluene	0	<input type="checkbox"/>	<2.5 m b.g.s.	Coarse	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
- Toluene	0	<input type="checkbox"/>	<2.5 m b.g.s.	Coarse	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
- C5-C8 Aliphatics	0	<input type="checkbox"/>	<2.5 m b.g.s.	Coarse	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
- C9-C12 Aliphatics	0	<input type="checkbox"/>	<2.5 m b.g.s.	Coarse	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
- C9-C10 Aromatics	0	<input type="checkbox"/>	<2.5 m b.g.s.	Coarse	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		

In the lower list ("Concentration input") make the following settings (for items not indicated, leave the default value):

- Benzene (first sample):
  - Soil Gas Concentration (mg/m<sup>3</sup>): 0.3
  - Depth: <2.5 m b.g.s.
  - Soil type: Very coarse
  - Indoor use: Yes

- Outdoor use: No
  - Biodegrad .: Yes
  - Sampling point: S1
  - Sampling period: March 2018
- Benzene (second sample):
  - Soil Gas Concentration (mg/m<sup>3</sup>): 1.4
  - Depth: 2.5-4 m b.g.s.
  - Soil type: Coarse
  - Indoor use: Yes
  - Outdoor use: Yes
  - Biodegrad .: No
  - Sampling point: S2
  - Sampling period: June 2018
- • Toluene (first sample):
  - Soil Gas Concentration (mg/m<sup>3</sup>): 1.2
  - Depth: < 2.5 m b.g.s.
  - Soil type: Very coarse
  - Indoor use: Yes
  - Outdoor use: No
  - Biodegrad .: Yes
  - Sampling point: S1
  - Sampling period: March 2018
- • Toluene (second sample):
  - Soil Gas Concentration (mg/m<sup>3</sup>): 0.7
  - Depth: 2.5-4 m b.g.s.
  - Soil type: Coarse
  - Indoor use: Yes
  - Outdoor use: Yes
  - Biodegrad .: No
  - Sampling point: S2
  - Sampling period: June 2018
- • C5-C8 Aliphatics:
  - Soil Gas Concentration (mg/m<sup>3</sup>): 123.2
  - Depth: 2.5-4 m b.g.s.
  - Soil type: Coarse
  - Indoor use: Yes
  - Outdoor use: Yes
  - Biodegrad .: No
  - Sampling point: S2
  - Sampling period: June 2018
- • C9-C12 Aliphatics:
  - Soil Gas Concentration (mg/m<sup>3</sup>): 93.8
  - Depth: 2.5-4 m b.g.s.
  - Soil type: Coarse
  - Indoor use: Yes
  - Outdoor use: Yes
  - Biodegrad .: No
  - Sampling point: S2
  - Sampling period: June 2018

- • C9-C10 Aromatics:
  - Soil Gas Concentration (mg/m<sup>3</sup>): 1.53
  - Depth: 2.5-4 m b.g.s.
  - Soil type: Coarse
  - Indoor use: Yes
  - Outdoor use: Yes
  - Biodegrad .: No
  - Sampling point: S2
  - Sampling period: June 2018
- • C11-C12 Aromatics:
  - Soil Gas Concentration (mg/m<sup>3</sup>): 0.85
  - Depth: 2.5-4 m b.g.s.
  - Soil type: Coarse
  - Indoor use: Yes
  - Outdoor use: Yes
  - Biodegrad .: No
  - Sampling point: S2
  - Sampling period: June 2018

Chemical	Soil gas concentration [mg/m <sup>3</sup> ]	Subslab sample	Sampling depth	Soil type	Indoor	Outdoor	Biodegradation	Sampling point	Sampling period
- Benzene	0.3	<input type="checkbox"/>	<2.5 m b.g.s.	Very coarse	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	S1	March 2018
- Benzene	1.4	<input type="checkbox"/>	2.54 m b.g.s.	Coarse	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	S2	June 2018
- Toluene	1.2	<input type="checkbox"/>	<2.5 m b.g.s.	Very coarse	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	S1	March 2018
- Toluene	0.7	<input type="checkbox"/>	2.54 m b.g.s.	Coarse	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	S2	June 2018
- C5-C8 Alifatics	123.2	<input type="checkbox"/>	2.54 m b.g.s.	Coarse	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	S2	June 2018
- C9-C12 Alifatics	93.8	<input type="checkbox"/>	2.54 m b.g.s.	Coarse	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	S2	June 2018
- C9-C10 Aromatics	1.53	<input type="checkbox"/>	2.54 m b.g.s.	Coarse	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	S2	June 2018

Click the Confirm button at the bottom of the screen.

In the function buttons area, the "Chemicals selection and configuration" button (third button) will now be highlighted in green, indicating that the information has been correctly entered.



**Step 5:** using the function buttons area, display the "Compare with threshold values" screen.



Check which substances and samples exceed the threshold values.

Thresholds comparison

INDOOR						OUTDOOR					
Chemical	Soil gas conc. [mg/m <sup>3</sup> ]	Sampling point	Sampling period	Threshold [mg/m <sup>3</sup> ]	Tr ex	Chemical	Soil gas conc. [mg/m <sup>3</sup> ]	Sampling point	Sampling period	Threshold [mg/m <sup>3</sup> ]	Tr ex
Benzene	3.00E-1	S1	March 2018	1.57E-2	YE	Benzene	1.40E+0	S2	June 2018	1.57E-2	YE
Benzene	1.40E+0	S2	June 2018	1.57E-2	YE	Toluene	7.00E-1	S2	June 2018	2.19E+2	NO
Toluene	1.20E+0	S1	March 2018	2.19E+2	NO	C5-C8 Alifatics	1.23E+2	S2	June 2018	8.74E+0	YE
Toluene	7.00E-1	S2	June 2018	2.19E+2	NO	C9-C12 Alifatics	9.38E+1	S2	June 2018	8.74E+0	YE
C5-C8 Alifatics	1.23E+2	S2	June 2018	8.74E+0	YE	C9-C10 Aromatics	1.53E+0	S2	June 2018	1.10E+0	YE
C9-C12 Alifatics	9.38E+1	S2	June 2018	8.74E+0	YE	C11-C12 Aromatics	8.50E-1	S2	June 2018	1.10E+0	NO
C9-C10 Aromatics	1.53E+0	S2	June 2018	1.10E+0	YE						
C11-C12 Aromatics	8.50E-1	S2	June 2018	1.10E+0	NO						

As there is no need to modify other parameters with respect to the software defaults, the display of the results screen can be directly opened, with the next step (Step 6).

**Step 6:** using the function buttons area, display the "Results calculation" screen (last button at the bottom).



After the screen appears, click on "INDOOR" and then "RISK" to view the results of the soil gas risk assessment for the indoor environment. The results associated to the use of the attenuation factor correlated with depth (Depth Alpha) will be shown initially.

View of the results

INDOOR				OUTDOOR																																																																											
RISK				ACCEPTABLE C																																																																											
Sampling Depth Alpha	Soil Type Alpha	Biodegradation Alpha																																																																													
<p>Legend</p> <ul style="list-style-type: none"> <li>Threshold value not exceeded</li> <li>Unacceptable result</li> </ul>																																																																															
<p>Current result: Indoor - Risk - Sampling Depth Alpha</p> <table border="1"> <thead> <tr> <th>Chemical</th> <th>Soil gas conc. [mg/m<sup>3</sup>]</th> <th>Sample point</th> <th>Sample period</th> <th>HI mainly indoor</th> <th>HI indoor/outdoor</th> <th>HI mainly outdoor</th> <th>Acceptability</th> </tr> </thead> <tbody> <tr> <td>Benzene</td> <td>3.00E-1</td> <td>S1</td> <td>March 2018</td> <td>1.35E-1</td> <td>1.35E-1</td> <td>2.54E-2</td> <td>Acceptable</td> </tr> <tr> <td>Benzene</td> <td>1.40E+0</td> <td>S2</td> <td>June 2018</td> <td>3.31E-2</td> <td>3.31E-2</td> <td>6.21E-3</td> <td>Acceptable</td> </tr> <tr> <td>Toluene</td> <td>1.20E+0</td> <td>S1</td> <td>March 2018</td> <td>3.25E-3</td> <td>3.25E-3</td> <td>6.09E-4</td> <td>Acceptable</td> </tr> <tr> <td>Toluene</td> <td>7.00E-1</td> <td>S2</td> <td>June 2018</td> <td>9.94E-5</td> <td>9.94E-5</td> <td>1.86E-5</td> <td>Acceptable</td> </tr> <tr> <td>C5-C8 Alifatics</td> <td>1.23E+2</td> <td>S2</td> <td>June 2018</td> <td>4.39E-1</td> <td>4.39E-1</td> <td>8.22E-2</td> <td>Acceptable</td> </tr> <tr> <td>C9-C12 Alifatics</td> <td>9.38E+1</td> <td>S2</td> <td>June 2018</td> <td>3.34E-1</td> <td>3.34E-1</td> <td>6.26E-2</td> <td>Acceptable</td> </tr> <tr> <td>C9-C10 Aromatics</td> <td>1.53E+0</td> <td>S2</td> <td>June 2018</td> <td>4.35E-2</td> <td>4.35E-2</td> <td>8.15E-3</td> <td>Acceptable</td> </tr> <tr> <td>C11-C12 Aromatics</td> <td>8.50E-1</td> <td>S2</td> <td>June 2018</td> <td>2.41E-2</td> <td>2.41E-2</td> <td>4.53E-3</td> <td>Acceptable</td> </tr> </tbody> </table>								Chemical	Soil gas conc. [mg/m <sup>3</sup> ]	Sample point	Sample period	HI mainly indoor	HI indoor/outdoor	HI mainly outdoor	Acceptability	Benzene	3.00E-1	S1	March 2018	1.35E-1	1.35E-1	2.54E-2	Acceptable	Benzene	1.40E+0	S2	June 2018	3.31E-2	3.31E-2	6.21E-3	Acceptable	Toluene	1.20E+0	S1	March 2018	3.25E-3	3.25E-3	6.09E-4	Acceptable	Toluene	7.00E-1	S2	June 2018	9.94E-5	9.94E-5	1.86E-5	Acceptable	C5-C8 Alifatics	1.23E+2	S2	June 2018	4.39E-1	4.39E-1	8.22E-2	Acceptable	C9-C12 Alifatics	9.38E+1	S2	June 2018	3.34E-1	3.34E-1	6.26E-2	Acceptable	C9-C10 Aromatics	1.53E+0	S2	June 2018	4.35E-2	4.35E-2	8.15E-3	Acceptable	C11-C12 Aromatics	8.50E-1	S2	June 2018	2.41E-2	2.41E-2	4.53E-3	Acceptable
Chemical	Soil gas conc. [mg/m <sup>3</sup> ]	Sample point	Sample period	HI mainly indoor	HI indoor/outdoor	HI mainly outdoor	Acceptability																																																																								
Benzene	3.00E-1	S1	March 2018	1.35E-1	1.35E-1	2.54E-2	Acceptable																																																																								
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C9-C12 Alifatics	9.38E+1	S2	June 2018	3.34E-1	3.34E-1	6.26E-2	Acceptable																																																																								
C9-C10 Aromatics	1.53E+0	S2	June 2018	4.35E-2	4.35E-2	8.15E-3	Acceptable																																																																								
C11-C12 Aromatics	8.50E-1	S2	June 2018	2.41E-2	2.41E-2	4.53E-3	Acceptable																																																																								

By clicking on the "Biodegradation Alpha" label, it will be possible to view results for the contaminants and samples to which the effects of aerobic biodegradation is applicable.

Sampling Depth Alpha | Soil Type Alpha | Biodegradation Alpha

Current result: Indoor - Risk - Biodegradation Alpha

Chemical	Soil gas conc. [mg/m <sup>3</sup> ]	Sample point	Sample period	HI mainly indoor	HI indoor/outdoor	HI mainly outdoor	Acceptability
Benzene	3.00E-1	S1	March 2018	3.83E-2	3.83E-2	7.19E-3	Acceptable
Toluene	1.20E+0	S1	March 2018	9.20E-4	9.20E-4	1.73E-4	Acceptable

In the case of the acceptable concentrations, the results are shown for example using the attenuation factors correlated with the soil type investigated. By clicking on the "ACCEPTABLE C" button, and then on the "Soil Type Alpha" label, the corresponding results will be displayed.

View of the results

INDOOR	OUTDOOR
RISK	ACCEPTABLE C

Sampling Depth Alpha | Soil Type Alpha | Biodegradation Alpha

**i** Current result: Indoor - Acceptable C - Soil Type Alpha

Chemical	Soil gas conc. [mg/m <sup>3</sup> ]	Sample point	Sample period	Acceptable C mnl indoor [mg/m <sup>3</sup> ]	Acceptable C indoor/outdoor [mg/m <sup>3</sup> ]
Benzene	3.00E-1	S1	March 2018	2.96E-2	2.96E-2
Benzene	1.40E+0	S2	June 2018	1.27E-1	1.27E-1
Toluene	1.20E+0	S1	March 2018	4.12E+2	4.12E+2
Toluene	7.00E-1	S2	June 2018	1.78E+3	1.78E+3
C5-C8 Alifatics	1.23E+2	S2	June 2018	7.09E+1	7.09E+1
C9-C12 Alifatics	9.38E+1	S2	June 2018	7.09E+1	7.09E+1
C9-C10 Aromatics	1.53E+0	S2	June 2018	8.88E+0	8.88E+0
C11-C12 Aromatics	8.50E-1	S2	June 2018	8.88E+0	8.88E+0

Legend

Threshold value not exceeded

Unacceptable result

Filter by sampling point

Filter by sampling period

To view the results, for example, in terms of risk associated with the outdoor off-site pathway, click on the "OUTDOOR" button, then on "OFF-SITE" and finally on "RISK"; the results related to the use of the attenuation factor correlated with depth (Depth Alpha) will initially be displayed.

View of the results

INDOOR	OUTDOOR
ON-SITE	OFF-SITE
RISK	ACCEPTABLE C

Sampling Depth Alpha | Soil Type Alpha

**i** Current result: Outdoor off-site - Risk - Sampling Depth Alpha

Chemical	Soil gas conc. [mg/m <sup>3</sup> ]	Sample point	Sample period	Alpha	HI Child	HI Adolescent	HI Adult	HI Senior	HI F
Benzene	1.40E+0	S2	June 2018	3.11E-3	2.53E-4	3.80E-4	3.38E-4	2.53E-4	3.80E-4
Toluene	7.00E-1	S2	June 2018	3.11E-3	7.60E-7	1.14E-6	1.01E-6	7.60E-7	1.14E-6
C5-C8 Alifatics	1.23E+2	S2	June 2018	3.11E-3	3.35E-3	5.03E-3	4.47E-3	3.35E-3	5.03E-3
C9-C12 Alifatics	9.38E+1	S2	June 2018	3.11E-3	2.55E-3	3.83E-3	3.40E-3	2.55E-3	3.83E-3
C9-C10 Aromatics	1.53E+0	S2	June 2018	3.11E-3	3.32E-4	4.98E-4	4.43E-4	3.32E-4	4.98E-4
C11-C12 Aromatics	8.50E-1	S2	June 2018	3.11E-3	1.84E-4	2.77E-4	2.46E-4	1.84E-4	2.77E-4

Legend

Threshold value not exceeded

Unacceptable result

Filter by sampling point

Filter by sampling period

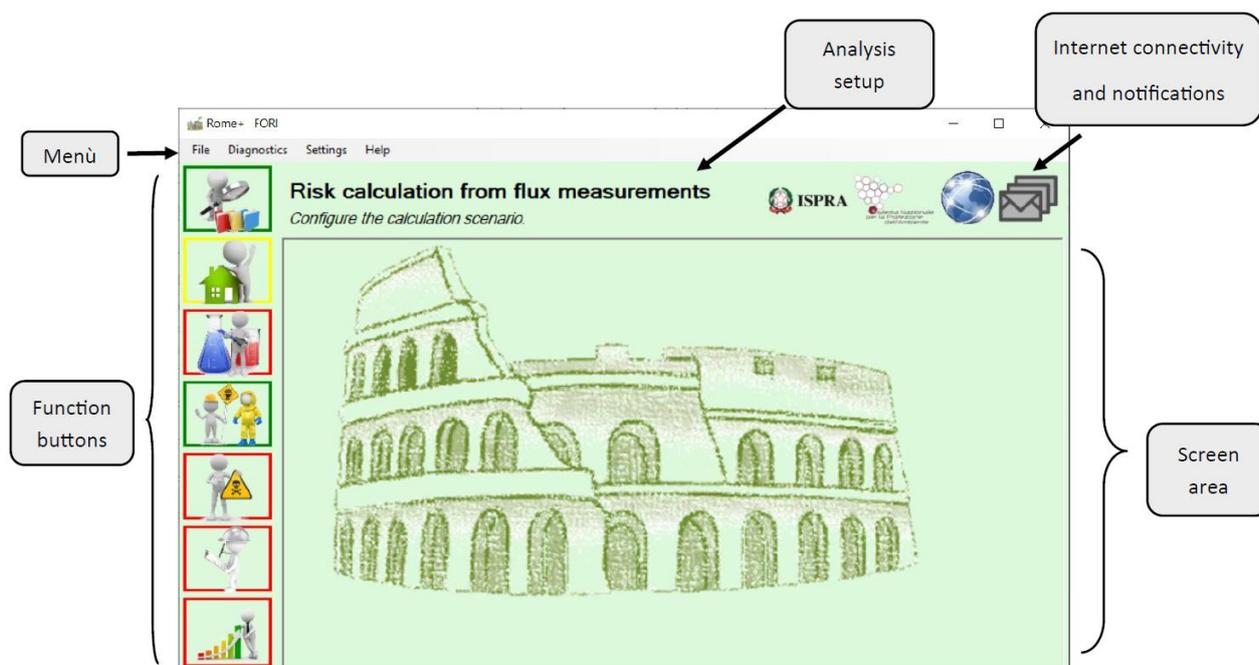


# FORI

## RISK CALCULATION FROM FLUX MEASUREMENTS

### USE OF THE APPLICATION AND FUNCTIONS

#### MAIN SCREEN



The main screen of Fori is made up of various sections.

At the top, as in most Windows applications, there is a menu that allows to save and load a project or to start a new project, and to access to other settings and screens.

Immediately below, there is the description of the project setting including the pathway and the exposure scenario selection. This description is shown in all the screens to always have a clear reference context in all the phases of the evaluation.

The screen is mainly occupied by the so-called "Screen Area", in which the various panels progressively used during the project will be displayed..

At the top right, two icons show the current connectivity to Rome Plus web services, and the presence of any messages notified to users (e.g. if a more recent version of the application has been released). For more details, see the "Configuration and connectivity" chapter.

On the left, a series of buttons allow to access the various subsections of the project; each one is characterized by a specific screen within the Screen Area. Each button can be highlighted with different colors:

- A **red** highlight indicates that that feature is currently disabled, as it is necessary to complete other previous preparatory subsections.
- A **yellow** highlight indicates that it is necessary to enter inputs or select settings within the specific subsection.
- A **green** highlight indicates that the information or settings in the specific subsection are complete.

Below a brief description of the menu, the buttons, and the related subsections is reported. For details, refer to the corresponding chapter of this manual.

#### "File" menu

- **New project:** start a new project with all default settings.
- **Load project:** allows to load a previously saved project, keeping all the selections and settings made, and all the values used in the calculations: pathway and scenarios, contaminants and related inputs, site characteristics, exposure parameters, etc.
- **Save project:** allows to save a project so that it can be reused in the future, keeping all the selections and settings made, and all the values used in the calculations: pathway and scenarios, contaminants and related inputs, site characteristics, exposure parameters, etc.



#### Input files settings

In this screen, the software default input files are set. Most of the times, this box is highlighted in green to indicate that all input files are set correctly. In case there is something that needs to be corrected, this box is highlighted in yellow and all other features are disabled until the necessary corrections are made.

Usually, once the input files are set up correctly, they should be kept in all subsequent sessions.



#### Scenario and pathway selection

When creating a new project, the first thing to do is to select the scenario (residential, commercial/industrial or recreational) and the pathway (indoor inhalation, outdoor on-site and/or outdoor off-site inhalation). If this box is highlighted in yellow, it means that the selection has not yet been made, and in this case, many other features are disabled until this operation is completed. If it is green, it means that the selection has been made correctly.



#### Contaminants selection and input of flux measurements

This screen allows the user to select the contaminants to be assessed and, for each of them, to indicate the contaminant mass flux emitted from soil and other information necessary for carrying out the calculations.



#### Exposure parameters

Here the default values of the exposure parameters for each available scenario can be viewed and changed if necessary.



### **Toxicological parameters**

Here it is possible to view the toxicological parameters of each contaminant previously entered.



### **Site characteristics**

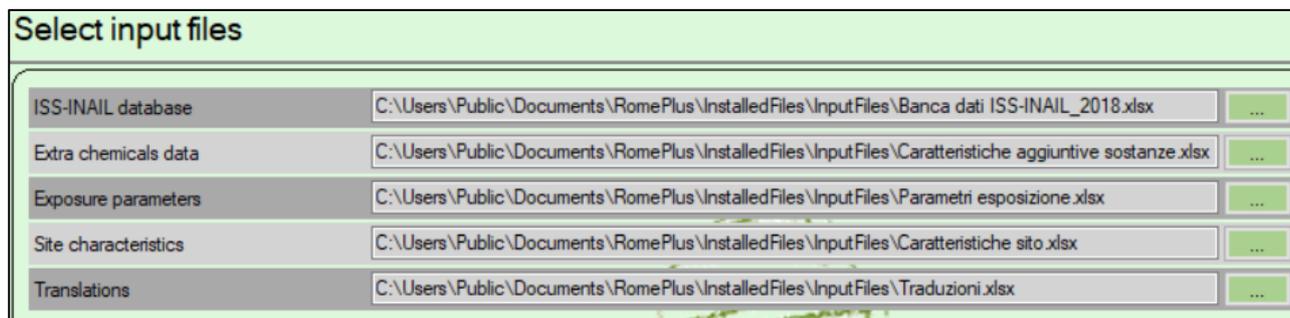
Here it is possible to view the default values of the site characteristics parameters, which, in some cases, may be necessary for the calculations, and to modify them if necessary.



### **Viewing the results**

Here it is possible to view the results of the analysis, in terms of the risks associated with the flux measurements, based on all the settings made in the previous screens.

## INPUT FILES SETTINGS



Category	File Path	Action
ISS-INAIL database	C:\Users\Public\Documents\RomePlus\InstalledFiles\InputFiles\Banca dati ISS-INAIL_2018.xlsx	...
Extra chemicals data	C:\Users\Public\Documents\RomePlus\InstalledFiles\InputFiles\Caratteristiche aggiuntive sostanze.xlsx	...
Exposure parameters	C:\Users\Public\Documents\RomePlus\InstalledFiles\InputFiles\Parametri esposizione.xlsx	...
Site characteristics	C:\Users\Public\Documents\RomePlus\InstalledFiles\InputFiles\Caratteristiche sito.xlsx	...
Translations	C:\Users\Public\Documents\RomePlus\InstalledFiles\InputFiles\Traduzioni.xlsx	...

In order to function, the application requires some excel files containing:

- the ISS-INAIL database of March 2018 containing the chemical-physical and toxicological characteristics of the compounds defined as "of interest" for the volatilization process
- the characteristics of mutagenicity and biodegradability of the substances
- the default exposure parameters for all exposure scenarios included in the software
- the site characteristics needed for risk assessment in case the outdoor off-site scenario has been selected
- English/Italian translations of the names and terms contained in the various excel files

These excel files are installed with the application and set as default files. Consequently, once the application is started, this screen should be already filled in and there should be no need to take any action.

However, in particular cases, a user may need to set different or modified excel files. In these situations, this screen allows the user to specify a different pathway or file name for each of the expected input files.

It should be highlighted that, by specifying a different file, it is necessary that this file has the same structure and template as the original file, otherwise the application will not be able to read its content.

### TO SET UP A NEW EXCEL FILE:

For each of the seven types of the input files in this screen, the name of the currently selected file is indicated together with a button. By pressing the button, it is possible to choose the new file to use.

### AT THE END OF THE CHANGES:

If the user needs to make any changes, at the end of the changes it is necessary to confirm the performed operations, using the "Confirm" button at the bottom of the screen.

Unconfirmed changes will be ignored and discarded.

In addition, if the user has made unconfirmed changes and inadvertently changes the screen, the application warns him that such unconfirmed changes may be lost. The user can then decide whether to cancel his choice to change the screen or continue and thus lose the changes.

## SCENARIO AND PATHWAY SELECTION

The screenshot shows a web interface titled "Scenario and pathway selection". At the top, there is a dropdown menu for "Exposure pathway" currently set to "Indoor". Below this, there are two main panels: "Indoor" and "Outdoor". The "Indoor" panel is active and contains a "Scenario:" dropdown menu set to "Residential" and a photograph of a woman sitting on a sofa with a laptop, and a young boy sitting next to her with a teddy bear. The "Outdoor" panel is inactive and contains two dropdown menus: "On-site scenario:" set to "Residential" and "Off-site scenario:" set to "None". At the bottom left of the interface is a button labeled "Units...".

In this screen it is possible to select the exposure pathway, choosing between Indoor, Outdoor, or both (Indoor-Outdoor).

For each of the selected pathways, it is necessary to indicate the scenario: Residential, Recreational or Industrial/Commercial.

In addition, in the case of the Outdoor pathway, it is also possible to evaluate an off-site scenario (outside the source area) different from the on-site one (inside the source area), if necessary.

Using the "Units" button, the screen for setting the measurement units can be accessed (see page 12).

Once the pathways and related scenarios have been selected, and this selection confirmed, the application will show these settings in all subsequent phases, at the top of the screen:

*Scenario: Indoor: Residential - Outdoor: Commercial/Industrial*

### SETTING PATHWAY AND SCENARIO:

"Indoor", "Outdoor" or "Indoor-Outdoor" can be selected as the "Exposure pathway". Based on the selected item, the corresponding panels below will be activated.

If "Indoor" or "Indoor-Outdoor" have been selected, the Indoor panel will be active, and the selection of the relevant scenario is needed, choosing between "Residential", "Recreational" or "Industrial / Commercial".

If "Outdoor" or "Indoor-Outdoor" have been selected, the Outdoor panel will be active, and the selection of the related on-site scenario is needed, choosing between "Residential", "Recreational" or "Industrial / Commercial". Furthermore, at the user's discretion, it will also be possible to indicate a different off-site scenario, with the same choices.

### AT THE END OF THE CHANGES:

If the user needs to make any changes, at the end of the changes it is necessary to confirm the operations carried out, using the "Confirm" button at the bottom of the screen.

Unconfirmed changes will be ignored and discarded.

In addition, if the user has made unconfirmed changes and inadvertently changes the screen, the application warns him that such unconfirmed changes may be lost. The user can then decide whether to cancel his choice to change the screen or continue and lose the changes.

## UNITS

Select the units:

FLUX	LENGTH	AREA	VOLUME	SPEED	TIME
Current units					
<b>mg/m<sup>2</sup> s</b>	<b>m</b>	<b>m<sup>2</sup></b>	<b>m<sup>3</sup></b>	<b>m/s</b>	<b>s</b>
Select the new units to be used:					
<input type="checkbox"/> mg/cm <sup>2</sup> s <input type="checkbox"/> mg/cm <sup>2</sup> min <input type="checkbox"/> mg/cm <sup>2</sup> h <input checked="" type="checkbox"/> mg/m <sup>2</sup> s <input type="checkbox"/> mg/m <sup>2</sup> min <input type="checkbox"/> mg/m <sup>2</sup> h <input type="checkbox"/> µg/cm <sup>2</sup> s	<input type="checkbox"/> cm <input checked="" type="checkbox"/> m	<input type="checkbox"/> cm <sup>2</sup> <input checked="" type="checkbox"/> m <sup>2</sup>	<input type="checkbox"/> cm <sup>3</sup> <input checked="" type="checkbox"/> m <sup>3</sup>	<input type="checkbox"/> cm/s <input type="checkbox"/> cm/min <input type="checkbox"/> cm/h <input checked="" type="checkbox"/> m/s <input type="checkbox"/> m/min <input type="checkbox"/> m/h	<input checked="" type="checkbox"/> s <input type="checkbox"/> min <input type="checkbox"/> h
Cancel	Default				OK

This screen allows to specify the measurement units to use.

The application uses default units, but if the user prefers to use different units, he can change them in this screen. In addition, once the units have been changed, the user can return to this screen and click on "Default" to set the initial units again.

The application shows the main quantities used in the various stages of analysis and, if possible, provides choices for each of them.

In addition, in the upper part, the screen shows the current set of units, thus allowing the user to compare the current ones with those that he is eventually modifying.

### SETTING THE UNITS:

Click on " Units" to open the relevant screen.

The user can select the units for the six displayed entities: flux, length, area, volume, speed, time.

SPEED	TIME
m/s	s
<input checked="" type="checkbox"/> cm/s <input type="checkbox"/> cm/min <input type="checkbox"/> cm/h <input type="checkbox"/> m/s <input type="checkbox"/> m/min <input type="checkbox"/> m/h	<input checked="" type="checkbox"/> s <input type="checkbox"/> min <input type="checkbox"/> h

By selecting a specific unit, in the other columns all the non-compatible units will be disabled; for instance, by selecting "seconds" (s) as time unit, in the "Speed" column all the units not using "seconds" will be disabled, thus leaving "cm/s" and "m/s" as valid choices for selection.

Unit selection must be consistent for all the entities.

Alternatively, the user could set the predefined units again by clicking on the "Default" button.

### AT THE END OF THE CHANGES:

If the user needs to make any changes, at the end of the changes it is necessary to confirm the operations carried out, using the "OK" button.

By clicking OK, the selected units of measure will be set as current.

Unconfirmed changes will be ignored and discarded.

In addition, if the user has made unconfirmed changes and inadvertently changes the screen, the application warns him that such unconfirmed changes may be lost. The user can then decide whether to cancel his choice to change the screen or continue and lose the changes.

## SELECTION AND SETTING OF CONTAMINANTS

Chemicals selection and input of mass flux measurements

Chemicals list

Chemical	Category
+ Cyanides	Inorganics
+ Elemental Mercury	Inorganics
+ Benzene	Aromatics
+ Ethylbenzene	Aromatics
+ Styrene	Aromatics
+ Toluene	Aromatics

Flux measures input

Chemical	Mass flux [mg/m <sup>2</sup> s]	Indoor	Outdoor	Sampling point	Sampling period
- Elemental Mercury	0	<input type="checkbox"/>	<input type="checkbox"/>		
- Benzene	0	<input type="checkbox"/>	<input type="checkbox"/>		

Cancel Confirm

This screen allows to select the contaminants to be assessed. For each contaminant it is necessary to enter the measured mass flux, the relevant pathway (indoor and/or outdoor) for which the data are used and, if necessary, the identification of the sampling point and the sampling period, in order to carry out the subsequent calculations.

The chemicals list shows all the substances "of interest" for volatilization pathway included in the ISS INAIL database of March 2018, grouped according to the Category defined in the same database.

By selecting the substances from the upper list (using the  button), they will be added to the lower list ("Flux measures input"), where they can be integrated with all the necessary information.

Conversely, it is possible to remove unnecessary substances from the lower list (using the  button).

If the analysis should be carried out for different sampling points or sampling periods, it is possible to enter several times the list (complete or partial) of the analytes that have been subjected to monitoring, specifying each time the sampling point or period to which the reported soil gas concentrations refer.

#### ADDING A NEW CONTAMINANT:

Search for the contaminant in the upper list ("List of substances"), and once found, click on the corresponding button  to add it to the list below ("Flux measures input").

#### REMOVING AN ALREADY ADDED CONTAMINANT:

Search for the contaminant to be eliminated in the list below ("Flux measures input"), and once found, click on the corresponding button .

**HOW TO INSERT INFORMATION ABOUT AN ALREADY ADDED CONTAMINANT:**

Find the contaminant in the list below ("Flux measures input").

Once found, the following pieces of information can be set or modified:

- **Mass flux:** the contaminant concentration measured in the soil gases must be inserted, using the shown unit. This value is mandatory for every selected contaminant.  
*note. If needed, the user may change the current unit for concentration values. To do this, go to the "Scenario and pathway selection" screen and click the "Units" button (see pg. 12).*
- **Indoor use:** it is necessary to indicate if the sample will be used for the evaluation of the indoor scenario. This can only be indicated if the exposure pathway selected in the previous screens is "Indoor" or "Indoor-Outdoor".
- **Outdoor use:** it is necessary to indicate whether the sample will be used for the evaluation of the outdoor scenario. This can only be indicated if the exposure pathway selected in the previous screens is "Outdoor" or "Indoor-Outdoor".
- **Sampling point, Sampling period:** it is possible to enter details about each sample, to facilitate the reading of the input data and the results of the analysis. These fields are usually optional. However, they become mandatory if the same contaminant has been selected several times.

**TO DUPLICATE AN ALREADY INSERTED LINE:**

It is possible to right-click on an already inserted row in the list below ("Flux measures input") and select "Duplicate row". A new row will be added to the list, identical to the selected row.

**TO COPY AND PASTE VALUES:**

It is possible to right-click on an already inserted line in the list below ("Flux measures input") and select "Copy"; it is possible to copy contaminant names, mass flux values, sampling points and sampling periods. The values will be copied to the Windows clipboard, and can normally be pasted into other applications. In addition, the user can right-click on a line already entered in the list below ("Flux measures input") and select "Paste" to paste the text from the Windows clipboard onto the selected field; it is possible to paste text on the fields of mass flux values, sampling points and sampling periods.

**TO REPLICATE VALUES ON OTHER LINES:**

It is possible to right-click on an already inserted line in the list below ("Flux measures input") and select one of these items:

- **Copy above:** the value of the selected field will be copied into the corresponding field of all the lines above the selected one.
- **Copy below:** the value of the selected field will be copied into the corresponding field of all the lines below the selected one.
- **Copy all:** the value of the selected field will be copied into the corresponding field of all the lines.

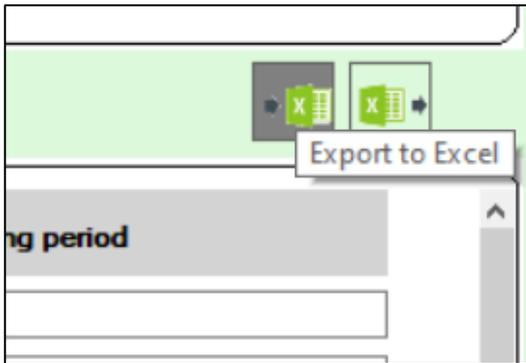
**AT THE END OF THE CHANGES:**

If the user needs to make any changes, at the end of the changes it is necessary to confirm the operations carried out, using the "OK" button.

By clicking OK, the selected units of measure will be set as current.

Unconfirmed changes will be ignored and discarded.

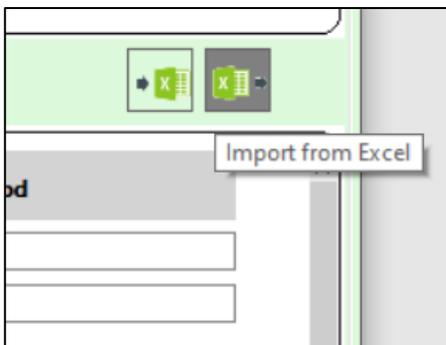
In addition, if the user has made unconfirmed changes and inadvertently changes the screen, the application warns him that such unconfirmed changes may be lost. The user can then decide whether to cancel his choice to change the screen or continue and lose the changes.

**EXPORTING CONTAMINANTS AND CONCENTRATIONS:**

This command allows to create an Excel file containing all the selected contaminants, with the flux values entered, and all other information in the "Flux measures input" list.

Before being able to execute the "Export to Excel" command, it is necessary to have clicked on the Confirm button to verify the data entered. If the user has entered data that has not yet been confirmed, the application will invite the user to click on Confirm before proceeding with "Export to Excel".

If the user exports to Excel with the screen not yet filled in, the application generates an empty Excel template file, that can be used and modified to enter the input of contaminants and soil gas concentrations.

**IMPORTING CONTAMINANTS AND CONCENTRATIONS:**

This command allows to read an Excel file containing the "Flux measures input" list that the user may want to load on the application. With this operation, any selections already made on the application will be canceled, and a list contained in the Excel file will be loaded.

The Excel file must have a well-defined structure. It is possible to use an Excel file generated with the "Export to Excel" operation (described above). The Excel file can be modified at will, adding rows, removing rows, and modifying the values where required, if the entered values are valid.

After executing an "Import from Excel" command, if the data contained in the Excel file is correct, the application will warn the user that the data in the Excel file have been loaded on the screen, and it is therefore possible to proceed with the validation and confirmation of such data, using the Confirm button.

**EXPOSURE PARAMETERS**

Exposure parameters

Name	Unit	Residential				Recreational		
		Child (0-6 years)	Adolescent (7-16 years)	Adult (17-65 years)	Senior (>65)	Child (0-6 years)	Adolescent (7-16 years)	Adult (17-65 years)
Outdoor daily exposure frequency	h/d	19.8	19.6	18	22.4	0.4	0.6	1.4
Indoor daily exposure frequency	h/d	0.7	0.5	0.9	1.9	0.6	0.9	0.8
Exposure frequency	d/yr	350	350	350	350	350	350	350
Exposure duration	yr	6	10	14	5	6	10	14
Averaging time non carcinogens	yr	6	10	14	5	6	10	14
Averaging time carcinogens	yr	70	70	70	70	70	70	70
ADAF carcinogens/mutagens	adm.	5	3	1	1	5	3	1
ADAF carcinogens/mutagens (Vinyl Chloride)	adm.	2	1	1	1	2	1	1

Cannot be changed

Invalid value, to be corrected

Cancel Confirm Set as default

This screen allows to consult the exposure parameters, for each scenario and for each type of receptor associated with the scenario.

It is possible to change these values, if necessary for the current analysis. The screen highlights in gray the values that cannot be changed (because they are based on the values of other rows), and highlights in red any invalid value present.

In addition, the newly changed values can be set as default for all the future analyses. The "Set as default" button allows to save the current values in an Excel sheet, in a folder that can be selected on user's PC. The file thus saved will be automatically set as the input file for the Exposure Parameters; then, by accessing the input file screen, the user will see the file just saved for this input. In this way, for all future analyses and even if closing the application and restarting it, the exposure parameters will be those modified and set as default.

#### TO MODIFY ONE OR MORE EXPOSURE PARAMETERS:

Click on the cell in the row of the parameter that the user wants to modify, and in the column of the scenario and the appropriate receptor. Enter a valid value in that cell.

The values highlighted in red are incorrect, and therefore the user is required to modify them and replace them with correct values.

#### AT THE END OF THE CHANGES:

If the user needs to make any changes, at the end of the changes it is necessary to confirm the operations carried out, using the "OK" button.

By clicking OK, the selected units of measure will be set as current.

Unconfirmed changes will be ignored and discarded.

In addition, if the user has made unconfirmed changes and inadvertently changes the screen, the application warns him that such unconfirmed changes may be lost. The user can then decide whether to cancel his choice to change the screen or continue and lose the changes.

**Attention:** the confirmed changes are valid only for the analysis currently in progress. By restarting the application or starting a new analysis, the default values will be reset. If, on the other hand, the user wants that the newly modified values to become the definitive values for all future analyses, then the user can click

on the “Set as default” button and select the folder where he wants to save the new excel file with the exposure parameters just modified. By saving this file, the modified values will be used for all future analyses, and for all the applications of the suite (therefore, also for San Giovanni).

## TOXICOLOGICAL PARAMETERS

Toxicological parameters				
Name	RfC [mg/m3]	IUR [µg/m3]-1	Carcinogen	Carcinogen/Mutagen
Elemental Mercury	3,00E-4		No	No
Benzene	3,00E-2	7,80E-6	Yes	No

This screen allows to consult the toxicological parameters of all contaminants selected for the analysis in progress.

The toxicological parameters are those included in the ISS INAIL database of March 2018. The values of these parameters cannot be changed by the user. Any updates to the same database will be included in the new release of the suite.

## SITE CHARACTERISTICS

Site characteristics					
Indoor <input type="radio"/> On-site outdoor <input type="radio"/> Off-site outdoor <input type="radio"/>					
Indoor site characteristics	Symbol	Unit	Residential usage	Commercial/ Industrial usage	Recreational usage
Indoor emission area	Ae	m <sup>2</sup>	150	400	200
Indoor volume considered for mixing	Ve	m <sup>3</sup>	300	1200	600
Air exchange rate	ERa	1/s	1,39E-4	2,31E-4	2,31E-4

Site characteristics			
Indoor <input type="radio"/> On-site outdoor <input type="radio"/> Off-site outdoor <input type="radio"/>			
On-site outdoor site characteristics	Symbol	Unit	Value
Source length in the wind direction	Lwind	m	25
Mean annual wind velocity	Uwind	m/s	2,25
Mixing height	d air	m	2

Site characteristics			
Indoor <input type="radio"/> On-site outdoor <input type="radio"/> Off-site outdoor <input type="radio"/>			
Off-site outdoor site characteristics	Symbol	Unit	Value
Source length transversal to wind direction	L'wind	m	25
Mixing height	d air	m	2
Off-site distance	x	m	100
Stability class (Pasquill)	-	-	D
Dispersion environment	-	-	Urban

This screen allows to consult the parameters of the site characteristics being analyzed.

To evaluate the risk associated to contaminant mass flux data, it is necessary that parameters of site characteristics associated to selected pathway/pathways are set. It is possible to view default values of indoor, outdoor and off-site outdoor site characteristics needed to calculations. Only the screens related to the selected pathways in the initial configuration of the exposure pathway and scenario are displayed.

The parameters can be modified, if necessary, for the analysis in progress.

#### TO MODIFY ONE OR MORE CHARACTERISTIC PARAMETERS OF THE SITE:

Select the "Indoor", "On-site Outdoor" or "Off-site Outdoor" label, in order to display the screen with the corresponding parameters.

Click on the cell in the row of the parameter to be changed, and in the "Value" column, enter a valid value in the selected cell.

#### AT THE END OF THE CHANGES:

If the user has made any changes, at the end of the changes it is necessary to confirm the operations carried out, using the "Confirm" button.

By clicking on Confirm, the entered values will be set as current.

Unconfirmed changes will be ignored and discarded.

In addition, if the user has made unconfirmed changes and inadvertently changes the screen, the application warns him that such unconfirmed changes may be lost. The user can then decide whether to cancel his choice to change the screen or continue and lose the changes.

**Attention:** the confirmed changes are valid only for the analysis currently in progress. By restarting the application or starting a new analysis, the default values will be reset.

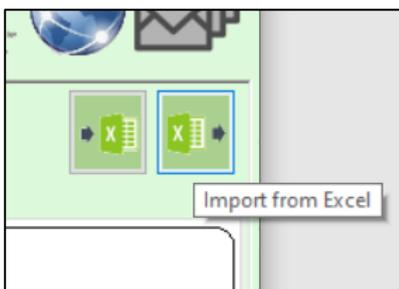
## EXPORT OF SITE CHARACTERISTICS:



This command allows to create an Excel file containing all the features of the site displayed by the application and eventually modified by the user.

Before being able to execute the "Export to Excel" command, it is necessary to have clicked on the Confirm button to verify the data entered. If the user has entered data that has not yet been confirmed, the application will invite the user to click on Confirm before proceeding with "Export to Excel".

## IMPORT OF SITE CHARACTERISTICS:



This command allows to read an Excel file containing all the features of the site the user wants to upload to the application. With this operation, any changes already made on the application will be canceled, and the values contained in the Excel file will be loaded.

The Excel file must have a well-defined structure. It is possible to use an Excel file generated with the "Export to Excel" operation (described above). The Excel file can be modified at will, modifying the values where required, if the entered values are valid.

After executing an "Import from Excel" command, if the data contained in the Excel file is correct, the application will warn the user that the data in the Excel file have been loaded on the screen, and it is therefore possible to proceed with the validation and confirmation of such data, using the Confirm button.

## VIEWING THE RESULTS



This screen allows to consult the results of the performed analysis.

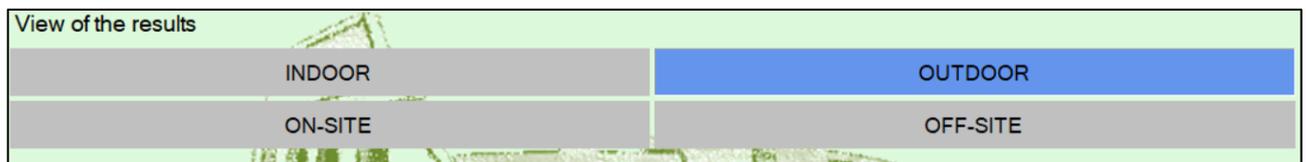
If both Indoor and Outdoor pathways have been selected, the user must choose the pathway for which he wants to view the results. Otherwise, if only one pathway (Indoor or Outdoor) has been chosen, it is automatically selected.

- In the results screen for the Indoor pathway, the risk associated to the input flux measurements is shown.

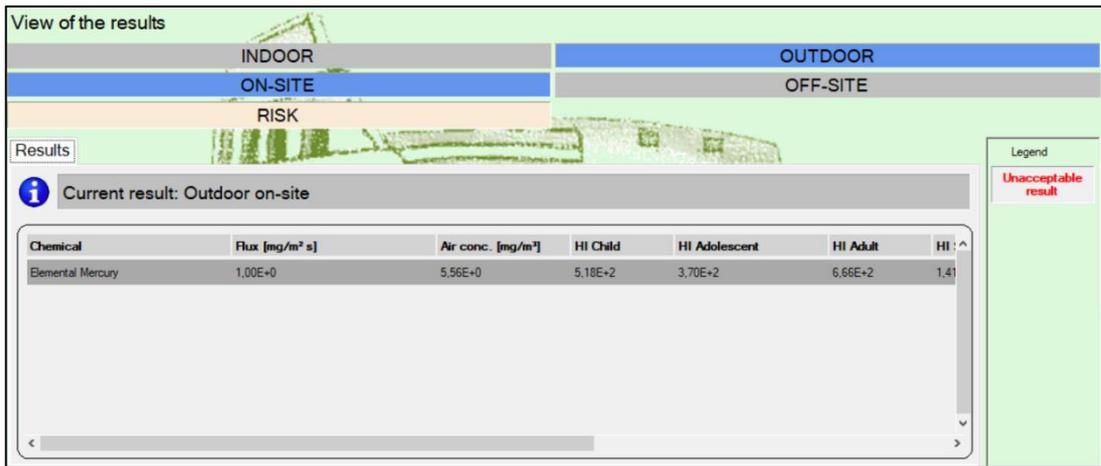
The screenshot shows the 'View of the results' section with 'INDOOR' selected. Below it, a 'RISK' table is displayed. The table has columns for Chemical, Flux [mg/m<sup>2</sup> s], Air conc. [mg/m<sup>3</sup>], HI Child, HI Adolescent, HI Adult, and HI. The data rows are for Elemental Mercury and Benzene. A legend on the right indicates 'Unacceptable result' in red. An 'Export...' button is at the bottom left.

Chemical	Flux [mg/m <sup>2</sup> s]	Air conc. [mg/m <sup>3</sup> ]	HI Child	HI Adolescent	HI Adult	HI
Elemental Mercury	1.00E+0	3.60E+3	9.49E+6	9.40E+6	8.63E+6	1.07E+7
Benzene	2.00E+0	7.20E+3	1.90E+5	1.88E+5	1.73E+5	2.15E+5

- In the results screen for the Outdoor pathway:
  - If an Outdoor Off-Site scenario has been selected, the user can choose the display of the results for On-Site or Off-Site pathway:



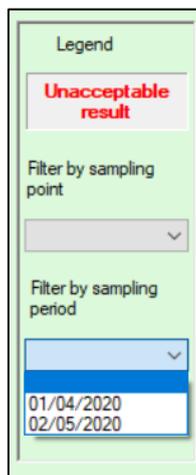
- Then, the risk associated to the input flux measurements is shown.



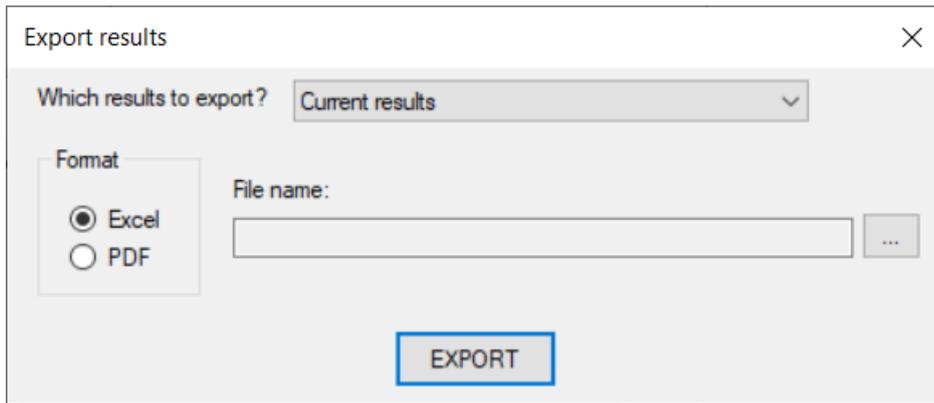
When the selection of the type of result has finished, the corresponding results table is shown. The cells in red highlight the unacceptable risk/hazard index values.

Chemical	Flux [mg/m <sup>2</sup> s]	Air conc. [mg/m <sup>3</sup> ]	HI Child	HI Adolescent	HI Adult	HI Senior	HI Final	Acceptable
Elemental Mercury	1,00E+0	5,56E+0	5,18E+2	3,70E+2	6,66E+2	1,41E+3	1,41E+3	Not acceptable

Se sono stati indicati i punti di campionamento o i periodi di campionamento di una o più sostanze, è possibile filtrare i risultati visualizzati in modo da mostrare solo quelli relativi al punto di campionamento o al periodo di campionamento indicato. Questa operazione viene effettuata tramite due tendine presenti nella parte destra della schermata, sotto alla legenda:



The "Export" button at the bottom of the screen allows to export the calculated results in Excel or PDF format. By clicking on this button, this panel opens:



Export results

Which results to export? Current results

Format

Excel

PDF

File name:

...

EXPORT

In the selection of “Which results to export”, it is possible to indicate whether to export only the results currently displayed (for example, “Indoor-Risk”), or all those available.

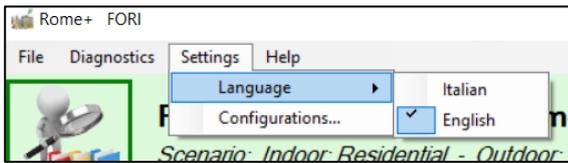
As "Format" it is possible to indicate whether to export to Excel or PDF.

As the file name, select the path and file name to be generated.

After having filled the fields on this panel, by clicking on Export, the results are exported, and the corresponding file is created.

## OTHER OPERATIONS AND FEATURES

### Language selection



From the menu bar at the top, the language to be used for the application can be selected.

By selecting a language, the application will translate all texts, messages and notifications into the related language. Furthermore, all the files generated, the exports made and the saves will be created in the selected language.

### Configuration and connectivity

The applications of the Rome Plus suite use the internet connection to access a remote server that provides several features (eg, updating configurations, online documentation, registration service, etc.).

From the main application window, some icons are shown that show information about it:



The system is connected to the internet, and the application can contact the Rome Plus remote server.



The system is not connected to the internet, or the application is unable to contact the remote Rome Plus server. Note that, in this condition, only the Rome Plus features described in this are not active.



There are no notifications to be shown to the user.

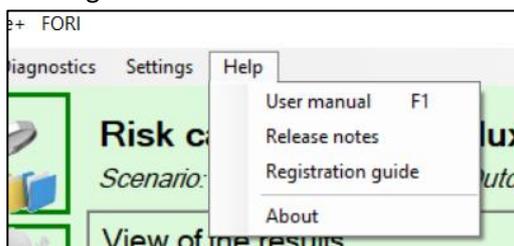


There are notifications to be shown to the user. Notifications can be viewed by hovering the mouse cursor on this icon.

If the icon appears indicating the lack of internet connectivity, this could be due to a temporary situation (for example, a router that has shut down). It is possible to click on the icon to update the connectivity status: in this way, if in the meantime internet connectivity has been re-established, the icon should now display a working connectivity.

For completeness, the other Rome Plus features that require working internet connectivity are listed:

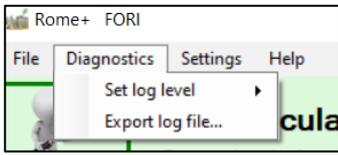
- Viewing the user manual and other documentation



- Rome Plus registration

- Rome Plus configuration update (see "Application Configuration" chapter)

### *Troubleshooting and diagnostics*



In case of technical or application problems, it may be helpful to provide assistance with information on the context of the problem and the details of the operations carried out that caused the problem.

The application keeps track of all useful information in log files. From the menu bar it is possible to export the log files, so that they can be consulted or sent by e-mail. In addition, the user can configure which messages and information to write to the logs by setting the log level.

These features should only be used upon guidance from technical support. In the absence of detailed information, we recommend leaving these settings unchanged.

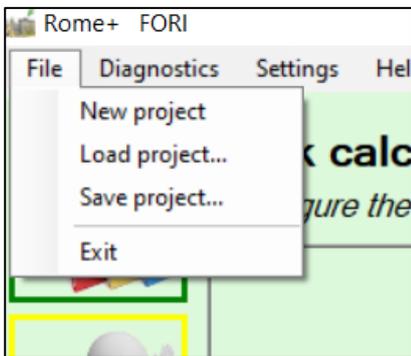
## USER GUIDE AND EXAMPLES

Here are some practical examples on how to perform analyses, in different contexts.

The examples are made up of steps, in order to be easy for the user, who can follow the instructions step by step.

### EXAMPLE 1 – INDOOR RESIDENTIAL SCENARIO

**Step 1:** start a new project via the top menu. Select the command: File -> New project.



n.b. when the application is started, a new project is automatically opened, so it is not necessary to select this command. This operation is instead necessary if some actions have already been carried out and therefore the user wants to start from scratch, with a clean project.

**Step 2:** check, from the function buttons area, that the "Input file setting" function (first button) is highlighted in green, indicating that the input files are correctly set:



**Step 3:** using the function buttons area, display the "Scenario and pathway selection" screen (second button, initially highlighted in yellow, indicating that this information has not yet been entered):



Indicate "Exposure pathway": Indoor.

Subsequently, in the "Indoor" area, select Scenario: Residential.

**Scenario and pathway selection**

Exposure pathway: Indoor

Indoor

Scenario: Residential



Outdoor

On-site scenario: Residential

Off-site scenario: None

Click the Confirm button at the bottom of the screen.

In the function buttons area, the "Scenario and pathway selection" button (second button) will now be highlighted in green, indicating that the information has been correctly entered.



**Step 4:** using the function buttons area, display the "Chemicals selection and configuration" screen (third button, initially highlighted in yellow, indicating that this information has not yet been entered):



In the upper list ("Chemicals list"), search the following contaminants and click the  button to add them to the selected contaminants. The lower list ("Flux measures input") will be updated accordingly.

- Elemental Mercury: add two samples
- Trichloromethane: add two samples

**Chemicals selection and input of mass flux measurements**

**Chemicals list**

Chemical	Category
Dichloromethane	Alifatic Chlorinated Compounds
Tetrachloroethylene (PCE)	Alifatic Chlorinated Compounds
Trichloroethylene	Alifatic Chlorinated Compounds
Trichloromethane	Alifatic Chlorinated Compounds
1,1,2,2-Tetrachloroethane	Alifatic Chlorinated Compounds
1,1,1-Trichloromethane	Alifatic Chlorinated Compounds

**Flux measures input**

Chemical	Mass flux [mg/m <sup>2</sup> s]	Indoor	Outdoor	Sampling point	Sampling period
Elemental Mercury	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
Elemental Mercury	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
Trichloromethane	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
Trichloromethane	0	<input checked="" type="checkbox"/>	<input type="checkbox"/>		

In the lower list ("Flux measures input") make the following settings (for items not indicated, leave the default value):

- Elemental Mercury (first sample):
  - Mass flux: 1.7
  - Sampling point: S1
  - Sampling period: march 2018
- Elemental Mercury (second sample):
  - Mass flux: 0.1
  - Sampling point: S2
  - Sampling period: june 2018
- Trichloromethane (first sample):
  - Mass flux: 0.01
  - Sampling point: S1
  - Sampling period: march 2018
- Trichloromethane (second sample):
  - Mass flux: 2.53
  - Sampling point: S2
  - Sampling period: june 2018

Chemical	Mass flux [mg/m <sup>2</sup> s]	Indoor	Outdoor	Sampling point	Sampling period
Elemental Mercury	1.7	<input checked="" type="checkbox"/>	<input type="checkbox"/>	S1	march 2018
Elemental Mercury	0.1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	S2	june 2018
Trichloromethane	0.01	<input checked="" type="checkbox"/>	<input type="checkbox"/>	S1	march 2018
Trichloromethane	2.53	<input checked="" type="checkbox"/>	<input type="checkbox"/>	S2	june 2018

Click the Confirm button at the bottom of the screen.

In the function buttons area, the "Chemicals selection and configuration" button (third button) will now be highlighted in green, indicating that the information has been correctly entered.



As there is no need to modify other parameters with respect to the software defaults, the display of the results screen can be directly opened, with the next step (Step 5).

**Step 5:** using the function buttons area, display the "Results calculation" screen (last button at the bottom).



The Indoor results will be automatically displayed, since they are the only ones set.

Results are displayed in terms of carcinogenic risk/hazard index associated to the set mass flux data.

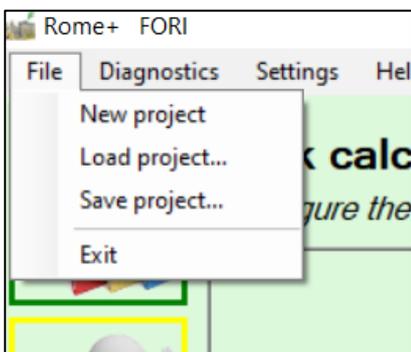
View of the results

INDOOR				OUTDOOR		
RISK						
Results						
Current result: Indoor						
HI Adolescent	HI Adult	HI Senior	HI Final	Acceptable	R	Acceptable
1,60E+7	1,47E+7	1,83E+7	1,83E+7	Not acceptable		
9,40E+5	8,63E+5	1,07E+6	1,07E+6	Not acceptable		
2,88E+2	2,64E+2	3,29E+2	3,29E+2	Not acceptable	3,21E-1	Not acceptable
7,28E+4	6,68E+4	8,32E+4	8,32E+4	Not acceptable	8,12E+1	Not acceptable

Legend  
Unacceptable result  
Filter by sampling point  
Filter by sampling period

## EXAMPLE 2 – OUTDOOR COMMERCIAL SCENARIO AND RECREATONAL OFF-SITE SCENARIO EVALUATION

**Step 1:** start a new project via the top menu. Select the command: File -> New project.



n.b. when the application is started, a new project is automatically opened, so it is not necessary to select this command. This operation is instead necessary if some actions have already been carried out and therefore the user wants to start from scratch, with a clean project.

**Step 2:** check, from the function buttons area, that the "Input file setting" function (first button) is highlighted in green, indicating that the input files are correctly set:



**Step 3:** using the function buttons area, display the "Scenario and pathway selection" screen (second button, initially highlighted in yellow, indicating that this information has not yet been entered):



Indicate "Exposure pathway": Outdoor.

Subsequently, in the "Outdoor" area, select On-site scenario: Commercial/Industrial, and Off-site scenario: Recreational.

Click the Confirm button at the bottom of the screen.

In the function buttons area, the "Scenario and pathway selection" button (second button) will now be highlighted in green, indicating that the information has been correctly entered.



**Step 4:** using the function buttons area, display the "Chemicals selection and configuration" screen (third button, initially highlighted in yellow, indicating that this information has not yet been entered):



In the upper list ("Chemicals list"), search the following contaminants and click the  button to add them to the selected contaminants. The lower list ("Flux measures input") will be updated accordingly.

- Acenaphthene: aggiungere due misure
- Naphthalene: aggiungere due misure
- Phenanthrene: aggiungere due misure

**Chemicals selection and input of mass flux measurements**

**Chemicals list**

Chemical	Category
<input type="checkbox"/> Anthracene	Polycyclic Aromatic Hydrocarbons
<input type="checkbox"/> Phenanthrene	Polycyclic Aromatic Hydrocarbons
<input type="checkbox"/> Fluorene	Polycyclic Aromatic Hydrocarbons
<input type="checkbox"/> Naphthalene	Polycyclic Aromatic Hydrocarbons
<input type="checkbox"/> MTBE	Other Compounds
<input type="checkbox"/> ETBE	Other Compounds
<input type="checkbox"/> Tetraethyl lead	Other Compounds

**Flux measures input**

Chemical	Mass flux [mg/m <sup>2</sup> s]	Indoor	Outdoor	Sampling point	Sampling period
<input type="checkbox"/> Acenaphthene	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
<input type="checkbox"/> Acenaphthene	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
<input type="checkbox"/> Naphthalene	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
<input type="checkbox"/> Naphthalene	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
<input type="checkbox"/> Phenanthrene	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		
<input type="checkbox"/> Phenanthrene	0	<input type="checkbox"/>	<input checked="" type="checkbox"/>		

In the lower list ("Flux measures input") make the following settings (for items not indicated, leave the default value):

- Acenaphthene (first sample):
  - Mass flux: 25,3
  - Sampling point: F1
- Acenaphthene (second sample):
  - Mass flux: 0.02
  - Sampling point: F2
- Naphthalene (first sample):
  - Mass flux: 185
  - Sampling point: F1
- Naphthalene (second sample):
  - Mass flux: 0.001
  - Sampling point: F2
- Phenanthrene (first sample):
  - Mass flux: 0.03
  - Sampling point: F1
- Phenanthrene (second sample):
  - Mass flux: 0.25
  - Sampling point: F2

Chemical	Mass flux [mg/m <sup>2</sup> s]	Indoor	Outdoor	Sampling point	Sampling period
<input type="checkbox"/> Acenaphthene	25.3	<input type="checkbox"/>	<input checked="" type="checkbox"/>	F1	
<input type="checkbox"/> Acenaphthene	0.02	<input type="checkbox"/>	<input checked="" type="checkbox"/>	F2	
<input type="checkbox"/> Naphthalene	185	<input type="checkbox"/>	<input checked="" type="checkbox"/>	F1	
<input type="checkbox"/> Naphthalene	0.001	<input type="checkbox"/>	<input checked="" type="checkbox"/>	F2	
<input type="checkbox"/> Phenanthrene	0.03	<input type="checkbox"/>	<input checked="" type="checkbox"/>	F1	
<input type="checkbox"/> Phenanthrene	0.25	<input type="checkbox"/>	<input checked="" type="checkbox"/>	F2	

Click the Confirm button at the bottom of the screen.

In the function buttons area, the "Chemicals selection and configuration" button (third button) will now be highlighted in green, indicating that the information has been correctly entered.



As there is no need to modify other parameters with respect to the software defaults, the display of the results screen can be directly opened, with the next step (Step 5).

**Step 5:** using the function buttons area, display the "Results calculation" screen (last button at the bottom).



As the screen is displayed, "OUTDOOR" is automatically selected, since it's the only pathway set. By clicking on "ON-SITE", results in terms of carcinogenic risk/hazard index associated to the set mass flux data for the on site scenario are displayed.

View of the results

INDOOR	OUTDOOR
ON-SITE	OFF-SITE
RISK	

Results

Current result: Outdoor on-site

Chemical	Flux [mg/m² s]	Sampling point	Air conc. [mg/m³]	HI mainly indoor	HI indoor/outdoor	HI mainly outdoor	Acceptable
Acenaphthene	2.53E+1	F1	1.41E+2	2.01E+3	1.07E+4	1.07E+4	Not acceptable
Acenaphthene	2.00E-2	F2	1.11E-1	1.59E+0	8.46E+0	8.46E+0	Not acceptable
Naphthalene	1.85E+2	F1	1.03E+3	1.47E+4	7.82E+4	7.82E+4	Not acceptable
Naphthalene	1.00E-3	F2	5.56E-3	7.93E-2	4.23E-1	4.23E-1	Acceptable
Phenanthrene	3.00E-2	F1	1.67E-1	2.38E+0	1.27E+1	1.27E+1	Not acceptable
Phenanthrene	2.50E-1	F2	1.39E+0	1.98E+1	1.06E+2	1.06E+2	Not acceptable

Legend: Unacceptable result

Filter by sampling point

By clicking on "OFF-SITE", results in terms of carcinogenic risk/hazard index associated to the set mass flux data for the off site scenario are displayed.

View of the results

INDOOR	OUTDOOR
ON-SITE	OFF-SITE
RISK	

Results

Current result: Outdoor off-site

Chemical	Flux [mg/m² s]	Sampling point	Air conc. [mg/m³]	HI mainly indoor	HI indoor/outdoor	HI mainly outdoor	Acceptable
Acenaphthene	2.53E+1	F1	1.02E+1	1.46E+2	7.78E+2	7.78E+2	Not acceptable
Acenaphthene	2.00E-2	F2	8.09E-3	1.15E-1	6.15E-1	6.15E-1	Acceptable
Naphthalene	1.85E+2	F1	7.48E+1	1.07E+3	5.69E+3	5.69E+3	Not acceptable
Naphthalene	1.00E-3	F2	4.04E-4	5.77E-3	3.08E-2	3.08E-2	Acceptable
Phenanthrene	3.00E-2	F1	1.21E-2	1.73E-1	9.23E-1	9.23E-1	Acceptable
Phenanthrene	2.50E-1	F2	1.01E-1	1.44E+0	7.69E+0	7.69E+0	Not acceptable

Legend: Unacceptable result

Filter by sampling point

## DATA MODIFICATION

When installing Rome Plus, some Excel files including all the required data are copied to the application folder.

These files are listed in the “Input files settings” screen, in every application of the suite. In this screen, the user can read the currently used excel files, with their full path. In addition, he can specify different files, if the use of different data than the originals is needed.

If the user need to modify some data, he must open the proper Excel file, and apply the required changes. This can be done in two ways:

1. Modify directly the default files: it’s possible to open the default Exel files and modify them. However, this way is discouraged. It is better to NOT modify the default files, EVER, so that the original data base is always available, with the possibility to restore them if any issue arises.
2. Copy the Excel files in another folder, modify the copied files, and then select the modified files in the “Input file settings” screen, in the application. This is the suggested way, since it allows to keep a backup copy of the default files, in case any issue arises.

When an Excel file is modified, the user must be **very** careful: if anything wrong is done, the Rome Plus applications might not work properly. Follow the guidelines described here.

Furthermore, remember that the changes to the Excel files will be applied when Rome Plus starts: all the running applications will continue to use the previously read data; in this case, the application must be restarted to use the newly modified data.

## EXCEL FILES COMPATIBLE FORMATS

The installed Rome Pluls Excel files have the Excel 2007 format, thus have the **xlsx** extension. This is the mainly used format for all the Rome Plus functionalities.

In addition, Rome Plus also supports reading and writing files using the Microsoft Excel 97/2000/XP format, thus with the **xls** extension. This may be useful if Microsoft Office is not available in a particular pc and a different software (like Open Office) is instead available to work ith xls files. In such situation, if a modification of the Excel file is needed, the user can use his own software and save the file with this format.

## GENERAL GUIDELINES

Before proceeding with modifying the input data for Rome Plus, some thoughts are first needed about which parameters may, and should, be changed, and which parameters **should not** be changed (with very rare exceptions).

About adding new chemicals, or modifying chemical-physical parameters, toxicological attributes or threshold values, please note that any change **must be first validated** by Control Authorities and Central Institutes for the technical aspects of concern.

As a general rule, risk assessments **are not considered acceptable**, if some chemical characteristics have been changed from the default values. Such changes must be considered in very rare and specific cases only, and must be properly authorized.

About the threshold values, these may be changed only if authorized by ISPRA.

About the attenuation factors, the modification of these values is **discouraged**. In very rare cases, such modifications may be authorized, in case of availability of data validated by the Control Authorities sufficient to guarantee the representativeness (in terms of numerosness and reliability) for the site to be evaluated.

## ADDING A NEW CHEMICAL

If the user wants to add a new chemical, he needs to run through a number of steps, modifying several Excel files. Please follow these instructions carefully, since any mistake might cause the application to malfunction.

- a. Modify the “Banca dati ISS-INAIL” Excel file
  - Modify the “Tab. 2a - Propr. Chim-fis” sheet
    - I. Select an existing row, by clicking on the number at the start of the row (in the case of this screenshot, click on the “10”):

	A	B	E	F	G	H
	SPECIE CHIMICA	Numero CAS	Rif.	Volatilità	Punto Ebolliz. [°C]	Rif.
1	<b>Aromatici policiclici</b>					
2	Acenafte	83-32-9	00 1	V	279	6
3	Acenaftilene	208-96-8	00 2	V	265	6
4	Antracene	120-12-7	2 1	V	342	6
5	Fenantrene	85-01-8	1 2	V	340	6
6	Fluorantene	206-44-0	1 1		384	6
7	Fluorene	86-73-7	00 1	V	295	6
8	Naftalene	91-20-3	01 1	V	217,9	6
9	Perilene	198-55-0	4 2		400	6
10	<b>Altre sostanze</b>					
11	MTBE	109-10-4	00 15	V	55	6

- II. Right click, and select Copy.
- III. Right click, and select Insert Copied Cells.

A	B	F	G	H
SPECIE CHIMICA	Numero CAS	Applicabilità	Punto Ebolliz. [°C]	Rif.
<b>Aromatici policiclici</b>				
Acenaftene	83-32-9	V	279	6
Acenaftilene	208-96-8	V	265	6
Antracene	120-12-7	V	342	6
Fenantrene	85-01-8	V	340	6
Fluorantene	206-44-0		384	6
Fluorene	86-73-7	V	295	6
Naftalene	91-20-3	V	217,9	6
Perilene	198-55-0		400	6
<b>Altre sostanze</b>				
MTBF	1634-04-4	V	55	6

IV. A duplicated row will be created.

10	Perilene	198-55-0	252,31	1,31E-04	2		400	6	3,3€
11	Perilene	198-55-0	252,31	1,31E-04	2		400	6	3,3€

V. Edit one of these two rows, inserting the name of the chemical. Please be **very** careful for any special character (upper cases, spaces, punctuation,...) since the same name, written in the very same way, will be used in the following steps.

VI. Apply any needed change to the row of the new chemical.

- Modify the “Tab. 2b - Propr. Toss” sheet
  - I. Follow similar instructions, as done for the “Tab. 2a - Propr. Chim-fis” sheet.
  - II. Create a new row, and write the chemical name, written in the very same way as the previous step.
  - III. Apply any needed change to the row of the new chemical.

b. Modify the “Caratteristiche aggiuntive sostanze.xlsx” Excel file

Add a new row at the end of the document, using the chemical name (written in the very same way as the previous step), and setting the other columns “Numero CAS”, “Cancerogene Mutagene” (Sì or No) and “Applicabilità biodegradazione” (Sì or No).

c. Modify the “Concentrazioni soglia soil gas.xlsx” Excel file

Add a new row at the end of the document, using the chemical name (written in the very same way as the previous step), and setting the other columns: “Numero CAS” and the threshold values for any scenario and path. Write values using the scientific notation, as with all the other existing values.

d. Modify the “Traduzioni.xlsx” Excel file

Add a new row at the end of the document, using the chemical name (written in the very same way as the previous step), and setting the other column with the corresponding English translation.

## MODIFYING A CHEMICAL

Here is the list of all the values that may be modified for the existing chemicals. For all the other values, and for anything not specified in the following steps, any modification is **discouraged**, since it may cause the application to malfunction.

- **Volatility:** indicates if the contaminant can be evaluated for volatilization pathway. It may be set in the “**Banca dati ISS-INAIL**” excel file, in the column “Volatilità” of the “Tab. 1a - Propr. Chim-fis” and “Tab. 2a - Propr. Chim-fis” sheets. A cell with **V** value indicates that the chemical is volatile, while an empty cell indicates that the chemical is non volatile. Non volatile chemicals do not appear in the contaminants list that can be selected in input.  
If the value is changed to **V** for a chemical that initially was classified as non volatile/volatizable (according to ISS-INAIL database of march 2018), the same chemical must be added also in the “Caratteristiche aggiuntive sostanze” and “Concentrazioni soglia soil gas” excel files; for additional information refer to the instructions for adding a new chemical.
- **IUR:** is the inhalation toxicity parameter for carcinogens. It may be set in the the “**Banca dati ISS-INAIL**” excel file, in the column “IUR” of the “Tab. 1b - Propr. Toss” and “Tab. 2b - Propr. Toss” sheets. The value must be set in the scientific notation.
- **RfC:** is the inhalation toxicity parameter for non carcinogenic substances. It may be set in the the “**Banca dati ISS-INAIL**” excel file, in the column “RfC” of the “Tab. 1b - Propr. Toss” and “Tab. 2b - Propr. Toss” sheets. The value must be set in the scientific notation.
- **Carcinogenic Mutagenic:** indicates if the chemical is classified as carcinogenic-mutagenic in the ISS-INAIL database of march 2018. It may be set in the “**Caratteristiche aggiuntive sostanze.xlsx**” excel file, “Sostanze” sheet, column “Cancerogene Mutagene”. Allowed value are “Sì” and “No”.
- **Biodegradation applicability:** indicates if the biodegradation factor can be applied to the specific contaminant, according to the reference documents. It may be set in the “**Caratteristiche aggiuntive sostanze.xlsx**” excel file, “Sostanze” sheet, column “Applicabilità biodegradazione”. Allowed value are “Sì” and “No”.
- **Threshold Value:** indicates the reference threshold value in soil gases for the specific contaminant. It may be set in the “**Concentrazioni soglia soil gas.xlsx**” excel file, “Concentrazioni soglia” sheet. It is mandatory to set the threshold value for each of the specified pathway and scenario, based on the values provided by ISPRA. The values must be set in the scientific notation.

## MODIFYING THE EXPOSURE PARAMETERS

The exposure parameters can be modified directly through the Rome Plus applications. The specific functionalities may be used to change these values within the scope of a single project. Also, it can be specified new default values to be used for every project. There might be no reason to manually modify this specific Excel file (“**Parametri esposizione.xlsx**”).

## MODIFYING THE ATTENUATION FACTORS

The attenuation factors can be modified directly in San Giovanni. The specific functionality may be used to change these values within the scope of a single project.

Please remember that setting Alpha factors differently to what specified in the referenced documentation might be done only in very rare cases, having a correlation analysis for the evaluated site between soil gas

concentrations and values measured in indoor/outdoor air. This analysis must be supported by a significant amount of data (equivalent to the reference USEPA Vapour Intrusion database from which alfa values have been derived) validated by the Control Authorities and with sufficient robustness.

The user shouldn't have any reason to manually modify this specific Excel file ("**Fattori attenuazione.xlsx**").

## **MODIFYING THE SITE CHARACTERISTICS**

The site characteristics can be modified directly through the Rome Plus applications. The user can use a specific functionality to change these values within the scope of a single project.

If the user wants to change the default values of any of these parameters, he can open the "**Caratteristiche sito.xlsx**" Excel file and change what is needed, using the same notation as the existing values.

Please be careful not to modify the structure of the Excel file, do not change the first row of each sheet (the column names), the first column (the parameter name), the "Simbolo" and "Unità di misura" columns, and do not enter values in the empty cells.

# APPLICATION CONFIGURATION

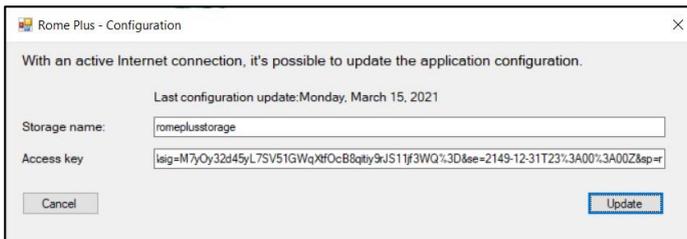
The application is installed with some predefined configuration settings, about the internet address of some internet-available resources (for example, the Rome Plus registration service URL, and the user manuals, and so on).

Some of these settings may change over the time. Rome Plus applications may update their configuration settings, retrieving the latest updates over the internet and saving them on the local PC.

If the configuration update is not run, the affected Rome Plus functions may not work properly. In this case, anyway, a specific message will inform the user that an update may solve the malfunctionings.

## HOW TO RUN THE UPDATE

The various Rome Plus applications include a menu item (“Settings”->“Configurations”) that, if selected, shows the configuration update panel. This panel is also available in the Rome Plus registration panel.



The panel is automatically displayed with some values, that should not need to be changed by the user.

Clicking “Update”, the application executes the configuration settings update by retrieving the new values over the internet. Please note that this operation requires an active internet connection.

In case the operation reports an error, it is possible to contact the technical support, in order to receive instructions on how to modify the values on this panel. By typing the correct values and trying the update again, the operation should run correctly.

# INSTALLATION

Rome Plus is distributed as an installation package, that is a file to run in order to configure the PC for the application.

By double-clicking the installation package, a guided procedure starts, allowing the user to select the application folder. The predefined values are recommended.

During the installation procedure, it's also possible to specify if the application will be used only by the user who is running the install (single user), or by all the users that connect to the PC (multi-user).

- By choosing "single user", the application will be usable by the current user only. If it's needed to extend this possibility to other users, the application must be uninstalled, and the installed again and selecting "multi-user" during the new installation.
- By choosing "multi-user", all the users connecting to the PC could use the application. Each user can configure his own settings. In addition, the registration procedure is required for each user that needs to run the application.

Please note that the Rome Plus installation must be run by a user with the "administrator" privileges. If the procedure is run by a different user, the application will ask the credentials (username and password) of an administrator, in order to complete the installation.

## Rome Plus update

Rome Plus is continuously evolving, so it's possible that an application update is released, with fixes, improvements and new features.

If Rome Plus is already installed on a PC and a newer version of Rome Plus is installed, an automatic update is executed, keeping all existings settings and configurations.

## **ROME PLUS REGISTRATION**

Rome Plus requires the user to be registered, in order to be used.

The first time one of the applications of the Rome Plus suite is run on a given PC, the registration procedure will start.

The registration is free, and consists in the request of a particular code, that will be provided via e-mail. By typing the registration code, the procedure is completed, and the Rome Plus applications will be usable.

There is a single registration procedure for the entire suite: after having registered for one of them, all the Rome Plus applications can be used.

Details about the registration procedure are described on the “Registration guide”, that can be opened from the “Help” menu of any Rome Plus application.

# SYSTEM REQUIREMENTS

**Sistema operativo:** Windows 7 or newer.

*With Windows 7, Windows 8 o Windows 8.1, during the installation procedure, the .NET Framework 4.6.1 installation could be required and run automatically.*

**RAM:** 512 MB.

**Disk space:** 5 GB.

# APPENDIX 1 – REFERENCE EQUATIONS

The reference equations shown below are taken from the reference documents prepared by the SNPA for the assessment of the risk associated to the aeriform matrices measurements:

- "Procedure for the evaluation and use of soil gas data in the risk assessment of contaminated sites" (Linee Guida SNPA 17/2018)
- "Design of vapour monitoring in contaminated sites" – Appendix B "Active Flux Chambers monitoring" (Linee Guida SNPA 15/2018)

## SAN GIOVANNI

### GENERAL EQUATIONS FOR CALCULATING RISK AND ACCEPTABLE C

#### Calculation of the risk associated with soil gas concentrations (RISK)

For the single selected substance:

$$R_{canc} = C_{soil\ gas} \cdot FA \cdot EM_{canc} \cdot IUR \cdot 10^3 \quad \text{carcinogenic substances}$$

$$HI = \frac{C_{soil\ gas} \cdot FA \cdot EM_{non\ canc}}{RfC} \quad \text{non carcinogenic substances}$$

where:

- $R_{canc}$  [adim.] is the carcinogenic risk calculated by the suite for carcinogenic substances;
- $HI$  [adim.] is the Hazard Index calculated by the suite for non carcinogenic substances;
- $C_{soil\ gas}$  [mg/m<sup>3</sup>] is the input concentration measured in the soil gas;
- $FA$  [adim.] is the attenuation factor related to the selected pathway;
- $EM_{canc}$  [adim.] is the inhalation exposure rate for carcinogenic substances related to the selected pathway and scenario;
- $EM_{noncanc}$  [adim.] is the inhalation exposure rate for carcinogenic substances related to the selected pathway and scenario;
- $IUR$  [1/(μg/m<sup>3</sup>)] inhalation toxicological parameter for carcinogenic effects of each selected carcinogenic chemical according to ISS-INAIL Database of march 2018;
- $RfC$  [mg/m<sup>3</sup>] inhalation toxicological parameter for toxic effects of each selected non carcinogenic chemical according to ISS-INAIL Database of march 2018;

#### Calculation of the acceptable concentration in the soil gas (ACCEPTABLE C)

For the single selected substance:

$$C_{acc} = \frac{TR_{canc}}{FA \cdot EM_{canc} \cdot IUR \cdot 10^3} \quad \text{carcinogenic substances}$$

$$C_{acc} = \frac{THI \cdot RfC}{FA \cdot EM_{noncanc}} \quad \text{carcinogenic substances}$$

where:

- $C_{acc}$  [ $\text{mg}/\text{m}^3$ ] is the maximum acceptable concentration in the soil gas calculated by the suite for carcinogenic substances;
- $TR_{canc}$  [adim.] is the target carcinogenic risk ( $TR_{canc} = 1\text{E-}06$ );
- $THI$  [adim.] is the target Hazard Index ( $THI = 1$ );
- $FA$  [adim.] is the attenuation factor related to the selected pathway;
- $EM_{canc}$  [adim.] is the inhalation exposure rate for carcinogenic substances related to the selected pathway and scenario;
- $EM_{noncanc}$  [adim.] is the inhalation exposure rate for carcinogenic substances related to the selected pathway and scenario;
- $IUR$  [ $1/(\mu\text{g}/\text{m}^3)$ ] inhalation toxicological parameter for carcinogenic effects of each selected carcinogenic chemical according to ISS-INAIL Database of march 2018;
- $RfC$  [ $\text{mg}/\text{m}^3$ ] inhalation toxicological parameter for toxic effects of each selected non carcinogenic chemical according to ISS-INAIL Database of march 2018;

## EVALUATION OF THE ATTENUATION FACTOR

### Indoor and outdoor on-site pathway

$$FA = \alpha_s$$

where  $\alpha_s$  is the experimental specific attenuation factor determined according to the correlation with the input parameters (sample under the slab, depth, type of soil investigated, evaluation of the effects of biodegradation) associated with the gas concentration of each contaminant.

### Outdoor off-site pathway

$$FA = \alpha_s \cdot ADF$$

$$ADF = \frac{L'_{wind} \cdot \delta_{air}}{2\pi \cdot \sigma_y \cdot \sigma_z} \cdot \left[ 2 \exp\left(-\frac{\delta_{air}^2}{2\sigma_z^2}\right) \right]$$

where:

- $\alpha_s$  [adim.] is the experimental specific attenuation factor determined according to the correlation with the input parameters (sample under the slab, depth, type of soil investigated, evaluation of the effects of biodegradation) associated with the gas concentration of each contaminant;
- $ADF$  [adim.] is the off-site dispersion factor;
- $L'_{wind}$  [m] [m] is the source length in the direction orthogonal to the wind;
- $\delta_{air}$  [m] is the height of the outdoor mixing area;
- $\sigma_y$  [m] is the transverse dispersion coefficient as a function of the distance from the off-site receptor and the climatic characteristics of the site (atmospheric stability class);
- $\sigma_z$  [m] is the vertical dispersion coefficient as a function of the distance from the off-site receptor and the climatic characteristics of the site (atmospheric stability class);

Remember that the equations adopted by the software for the evaluation of the “off-site dispersion factor” (ADF) are valid for values of the parameter “Distance from the off-site receptor” (x) not less than 100 m.

In the case of distances of less than 100 m, the attenuation factor is cautiously set equal to unity.

## CALCULATION OF THE EXPOSURE RATE

### Residential/Recreational Scenario - indoor pathway

*Carcinogenic and mutagenic substances*

$$EM_{canc} = \frac{(EF \cdot EF_{g\_indoor} \cdot ED)_{0-6} \cdot ADAF_{0-6} + (EF \cdot EF_{g\_indoor} \cdot ED)_{7-16} \cdot ADAF_{7-16}}{AT_{canc} \cdot 365 \cdot 24} + \frac{(EF \cdot EF_{g\_indoor} \cdot ED)_{17-65} \cdot ADAF_{17-65} + (EF \cdot EF_{g\_indoor} \cdot ED)_{>65} \cdot ADAF_{>65}}{AT_{canc} \cdot 365 \cdot 24}$$

*Carcinogenic substances*

$$EM_{canc} = \frac{(EF \cdot EF_{g\_indoor} \cdot ED)_{0-6} + (EF \cdot EF_{g\_indoor} \cdot ED)_{7-16}}{AT_{canc} \cdot 365 \cdot 24} + \frac{(EF \cdot EF_{g\_indoor} \cdot ED)_{17-65} + (EF \cdot EF_{g\_indoor} \cdot ED)_{>65}}{AT_{canc} \cdot 365 \cdot 24}$$

*Non carcinogenic substances*

$$EM_{non\,canc} = \max \left\{ \left( \frac{(EF \cdot EF_{g\_indoor} \cdot ED)_{0-6}}{AT_{noncanc} \cdot 365 \cdot 24}, \frac{(EF \cdot EF_{g\_indoor} \cdot ED)_{7-16}}{AT_{noncanc} \cdot 365 \cdot 24} \right); \left( \frac{(EF \cdot EF_{g\_indoor} \cdot ED)_{17-65}}{AT_{noncanc} \cdot 365 \cdot 24}, \frac{(EF \cdot EF_{g\_indoor} \cdot ED)_{>65}}{AT_{noncanc} \cdot 365 \cdot 24} \right) \right\}$$

where:

- $EF$  [days/year] is the frequency of exposure, or the number of days per year in which it is assumed that the receptor is present on the site;
- $EF_{g\_indoor}$  [hours/day] is the daily frequency of exposure, i.e., the number of hours per day in which the receptor frequents indoor environments on site; this parameter is differentiated according to the age group: 0-6 years (child), 7-16 years (adolescent), 17-65 years (adult), > 65 years (elderly);
- $ED$  [years] is the duration of exposure, ie the number of years in which it is assumed that the receptor is present on the site; this parameter is differentiated according to the age group: 0-6 years (child), 7-16 years (adolescent), 17-65 years (adult), > 65 years (elderly);
- $AT_{canc}$  [years] is the averaging time on which the exposure to carcinogenic substances is mediated;
- $ADAF$  [adim.] is the factor increasing the incidence of carcinogenic effects due to exposure to the substance in childhood for carcinogenic and mutagenic substances;
- $AT_{noncanc}$  [years] is the averaging time on which the exposure to non-carcinogenic substances is mediated;

**Residential/Recreational Scenario - outdoor pathway***Carcinogenic and mutagenic substances*

$$EM_{canc} = \frac{(EF \cdot EF_{g\_outdoor} \cdot ED)_{0-6} \cdot ADAF_{0-6} + (EF \cdot EF_{g\_outdoor} \cdot ED)_{7-16} \cdot ADAF_{7-16}}{AT_{canc} \cdot 365 \cdot 24} + \frac{(EF \cdot EF_{g\_outdoor} \cdot ED)_{17-65} \cdot ADAF_{17-65} + (EF \cdot EF_{g\_outdoor} \cdot ED)_{>65} \cdot ADAF_{>65}}{AT_{canc} \cdot 365 \cdot 24}$$

*Carcinogenic substances*

$$EM_{canc} = \frac{(EF \cdot EF_{g\_outdoor} \cdot ED)_{0-6} + (EF \cdot EF_{g\_outdoor} \cdot ED)_{7-16}}{AT_{canc} \cdot 365 \cdot 24} + \frac{(EF \cdot EF_{g\_outdoor} \cdot ED)_{17-65} + (EF \cdot EF_{g\_outdoor} \cdot ED)_{>65}}{AT_{canc} \cdot 365 \cdot 24}$$

*Non carcinogenic substances*

$$EM_{non\,canc} = \max \left\{ \frac{(EF \cdot EF_{g\_outdoor} \cdot ED)_{0-6}}{AT_{noncanc} \cdot 365 \cdot 24}; \frac{(EF \cdot EF_{g\_outdoor} \cdot ED)_{7-16}}{AT_{noncanc} \cdot 365 \cdot 24}; \frac{(EF \cdot EF_{g\_outdoor} \cdot ED)_{17-65}}{AT_{noncanc} \cdot 365 \cdot 24}; \frac{(EF \cdot EF_{g\_outdoor} \cdot ED)_{>65}}{AT_{noncanc} \cdot 365 \cdot 24} \right\}$$

where:

- $EF$  [days/year] is the frequency of exposure, or the number of days per year in which it is assumed that the receptor is present on the site;
- $EF_{g\_outdoor}$  [hours/day] is the daily frequency of exposure, i.e., the number of hours per day in which the receptor frequents outdoor environments on site; this parameter is differentiated according to the age group: 0-6 years (child), 7-16 years (adolescent), 17-65 years (adult), > 65 years (elderly);
- $ED$  [years] is the duration of exposure, ie the number of years in which it is assumed that the receptor is present on the site; this parameter is differentiated according to the age group: 0-6 years (child), 7-16 years (adolescent), 17-65 years (adult), > 65 years (elderly);
- $AT_{canc}$  [years] is the averaging time on which the exposure to carcinogenic substances is mediated;
- $ADAF$  [adim.] is the factor increasing the incidence of carcinogenic effects due to exposure to the substance in childhood for carcinogenic and mutagenic substances;
- $AT_{noncanc}$  [years] is the averaging time on which the exposure to non-carcinogenic substances is mediated;

### Industrial/Commercial Scenario - indoor pathway

*Carcinogenic substances*

$$EM_{canc} = \frac{EF \cdot EF_{g\_indoor} \cdot ED}{AT_{canc} \cdot 365 \cdot 24}$$

*Non carcinogenic substances*

$$EM_{non\,canc} = \frac{EF \cdot EF_{g\_indoor} \cdot ED}{AT_{noncanc} \cdot 365 \cdot 24}$$

where:

- $EF$  [days/year] is the frequency of exposure, or the number of days per year in which it is assumed that the receptor is present on the site;
- $EF_{g\_indoor}$  [hours/day] is the daily frequency of exposure, i.e., the number of hours per day in which the receptor frequents indoor environments on site; this parameter is differentiated according to the type of work activity: mainly indoor, indoor / outdoor, mainly outdoor;
- $ED$  [years] is the duration of exposure, i.e. the number of years in which it is assumed that the receptor is present on the site;
- $AT_{canc}$  [years] is the averaging time on which the exposure to carcinogenic substances is mediated;

- *ADAF* [adim.] is the factor increasing the incidence of carcinogenic effects due to exposure to the substance in childhood for carcinogenic and mutagenic substances;
- *AT<sub>noncanc</sub>* [years] is the averaging time on which the exposure to non-carcinogenic substances is mediated;

### Industrial/Commercial Scenario - outdoor pathway

#### *Carcinogenic substances*

$$EM_{canc} = \frac{EF \cdot EF_{g\_outdoor} \cdot ED}{AT_{canc} \cdot 365 \cdot 24}$$

#### *Non carcinogenic substances*

$$EM_{non\canc} = \frac{EF \cdot EF_{g\_outdoor} \cdot ED}{AT_{noncanc} \cdot 365 \cdot 24}$$

where:

- *EF* [days/year] is the frequency of exposure, or the number of days per year in which it is assumed that the receptor is present on the site;
- *EF<sub>g\_indoor</sub>* [hours/day] is the daily frequency of exposure, i.e., the number of hours per day in which the receptor frequents outdoor environments on site; this parameter is differentiated according to the type of work activity: mainly indoor, indoor / outdoor, mainly outdoor;
- *ED* [years] is the duration of exposure, i.e. the number of years in which it is assumed that the receptor is present on the site;
- *AT<sub>canc</sub>* [years] is the averaging time on which the exposure to carcinogenic substances is mediated;
- *ADAF* [adim.] is the factor increasing the incidence of carcinogenic effects due to exposure to the substance in childhood for carcinogenic and mutagenic substances;
- *AT<sub>noncanc</sub>* [years] is the averaging time on which the exposure to non-carcinogenic substances is mediated;

## FORI

### CALCULATION OF AMBIENT AIR CONCENTRATIONS

#### Indoor pathway

$$C_{indoor\_air} = \frac{J \cdot A_B}{V_B \cdot ER_B}$$

where:

- $J$  [ $\text{mg}/\text{m}^2 \cdot \text{s}$ ] is the mass flux of the contaminant measured with the flux chamber inserted in input;
- $A_B$  [ $\text{m}^2$ ] is the surface through which the emissive flux enters the building;
- $V_B$  [ $\text{m}^3$ ] is the volume of the enclosed space in which mixing takes place;
- $ER_B$  [1/s] è il tasso di ricambio di aria nello spazio chiuso.

#### Outdoor on-site pathway

$$C_{outdoor\_air} = \frac{J \cdot L_{wind}}{v_{wind} \cdot \delta_{air}}$$

where:

- $J$  [ $\text{mg}/\text{m}^2 \cdot \text{s}$ ] is the mass flux of the contaminant measured with the flux chamber inserted in input;
- $L'_{wind}$  [m] is the source length in the direction of the wind;
- $v_{wind}$  [m] is the mean annual wind velocity;
- $\delta_{air}$  [m] is the height of the outdoor mixing area;

#### Outdoor off-site pathway

##### Percorso Outdoor off site

$$C_{outdoor\_air\_offsite} = \frac{J \cdot L_{wind}}{v_{wind} \cdot \delta_{air}} \cdot \text{ADF}$$

$$\text{ADF} = \frac{L'_{wind} \cdot \delta_{air}}{2\pi \cdot \sigma_y \cdot \sigma_z} \cdot \left[ 2 \exp\left(-\frac{\delta_{air}^2}{2\sigma_z^2}\right) \right]$$

dove:

- $J$  [ $\text{mg}/\text{m}^2 \cdot \text{s}$ ] is the mass flux of the contaminant measured with the flux chamber inserted in input;
- $L'_{wind}$  [m] is the source length in the direction of the wind;
- $v_{wind}$  [m] is the mean annual wind velocity;
- $\delta_{air}$  [m] is the height of the outdoor mixing area;
- ADF [adim.] is the off-site dispersion factor;
- $L'_{wind}$  [m] [m] is the source length in the direction orthogonal to the wind;
- $\delta_{air}$  [m] is the height of the outdoor mixing area;
- $\sigma_y$  [m] is the transverse dispersion coefficient as a function of the distance from the off-site receptor and the climatic characteristics of the site (atmospheric stability class);

- $\sigma_z$  [m] is the vertical dispersion coefficient as a function of the distance from the off-site receptor and the climatic characteristics of the site (atmospheric stability class);

Remember that the equations adopted by the software for the evaluation of the “off-site dispersion factor” (ADF) are valid for values of the parameter “Distance from the off-site receptor” (x) not less than 100 m.

In the case of distances of less than 100 m, the attenuation factor is cautiously set equal to unity.

## GENERAL EQUATIONS FOR CALCULATING RISK

### Calculation of the risk associated with flux measurements (RISK)

For the single selected substance:

$$R_{canc} = C_{air} \cdot EM_{canc} \cdot IUR \cdot 10^3 \quad \text{carcinogenic substances}$$

$$HI = \frac{C_{air} \cdot FA \cdot EM_{non\,canc}}{RfC} \quad \text{non carcinogenic substances}$$

where:

- $R_{canc}$  [adim.] is the carcinogenic risk calculated by the suite for carcinogenic substances;
- $HI$  [adim.] is the Hazard Index calculated by the suite for non carcinogenic substances;
- $C_{air}$  [mg/m<sup>3</sup>] is the concentration in air calculated from the flux measurements based on the selected pathway;
- $EM_{canc}$  [adim.] is the inhalation exposure rate for carcinogenic substances related to the selected pathway and scenario;
- $EM_{noncanc}$  [adim.] is the inhalation exposure rate for carcinogenic substances related to the selected pathway and scenario;
- $IUR$  [1/(μg/m<sup>3</sup>)] inhalation toxicological parameter for carcinogenic effects of each selected carcinogenic chemical according to ISS-INAIL Database of march 2018;
- $RfC$  [mg/m<sup>3</sup>] inhalation toxicological parameter for toxic effects of each selected non carcinogenic chemical according to ISS-INAIL Database of march 2018;

## CALCULATION OF THE EXPOSURE RATE

### Residential/Recreational Scenario - indoor pathway

*Carcinogenic and mutagenic substances*

$$EM_{canc} = \frac{(EF \cdot EF_{g\_indoor} \cdot ED)_{0-6} \cdot ADAF_{0-6} + (EF \cdot EF_{g\_indoor} \cdot ED)_{7-16} \cdot ADAF_{7-16}}{AT_{canc} \cdot 365 \cdot 24} + \frac{(EF \cdot EF_{g\_indoor} \cdot ED)_{17-65} \cdot ADAF_{17-65} + (EF \cdot EF_{g\_indoor} \cdot ED)_{>65} \cdot ADAF_{>65}}{AT_{canc} \cdot 365 \cdot 24}$$

*Carcinogenic substances*

$$EM_{canc} = \frac{(EF \cdot EF_{g\_indoor} \cdot ED)_{0-6} + (EF \cdot EF_{g\_indoor} \cdot ED)_{7-16}}{AT_{canc} \cdot 365 \cdot 24} + \frac{(EF \cdot EF_{g\_indoor} \cdot ED)_{17-65} + (EF \cdot EF_{g\_indoor} \cdot ED)_{>65}}{AT_{canc} \cdot 365 \cdot 24}$$

*Non carcinogenic substances*

$$EM_{non\,canc} = \max \left\{ \frac{(EF \cdot EF_{g\_indoor} \cdot ED)_{0-6}}{AT_{noncanc} \cdot 365 \cdot 24}; \frac{(EF \cdot EF_{g\_indoor} \cdot ED)_{7-16}}{AT_{noncanc} \cdot 365 \cdot 24}; \frac{(EF \cdot EF_{g\_indoor} \cdot ED)_{17-65}}{AT_{noncanc} \cdot 365 \cdot 24}; \frac{(EF \cdot EF_{g\_indoor} \cdot ED)_{>65}}{AT_{noncanc} \cdot 365 \cdot 24} \right\}$$

where:

- $EF$  [days/year] is the frequency of exposure, or the number of days per year in which it is assumed that the receptor is present on the site;
- $EF_{g\_indoor}$  [hours/day] is the daily frequency of exposure, i.e., the number of hours per day in which the receptor frequents indoor environments on site; this parameter is differentiated according to the age group: 0-6 years (child), 7-16 years (adolescent), 17-65 years (adult), > 65 years (elderly);
- $ED$  [years] is the duration of exposure, ie the number of years in which it is assumed that the receptor is present on the site; this parameter is differentiated according to the age group: 0-6 years (child), 7-16 years (adolescent), 17-65 years (adult), > 65 years (elderly);
- $AT_{canc}$  [years] is the averaging time on which the exposure to carcinogenic substances is mediated;
- $ADAF$  [adim.] is the factor increasing the incidence of carcinogenic effects due to exposure to the substance in childhood for carcinogenic and mutagenic substances;
- $AT_{noncanc}$  [years] is the averaging time on which the exposure to non-carcinogenic substances is mediated;

**Residential/Recreational Scenario - outdoor pathway***Carcinogenic and mutagenic substances*

$$EM_{canc} = \frac{(EF \cdot EF_{g\_outdoor} \cdot ED)_{0-6} \cdot ADAF_{0-6} + (EF \cdot EF_{g\_outdoor} \cdot ED)_{7-16} \cdot ADAF_{7-16}}{AT_{canc} \cdot 365 \cdot 24} + \frac{(EF \cdot EF_{g\_outdoor} \cdot ED)_{17-65} \cdot ADAF_{17-65} + (EF \cdot EF_{g\_outdoor} \cdot ED)_{>65} \cdot ADAF_{>65}}{AT_{canc} \cdot 365 \cdot 24}$$

*Carcinogenic substances*

$$EM_{canc} = \frac{(EF \cdot EF_{g\_outdoor} \cdot ED)_{0-6} + (EF \cdot EF_{g\_outdoor} \cdot ED)_{7-16}}{AT_{canc} \cdot 365 \cdot 24} + \frac{(EF \cdot EF_{g\_outdoor} \cdot ED)_{17-65} + (EF \cdot EF_{g\_outdoor} \cdot ED)_{>65}}{AT_{canc} \cdot 365 \cdot 24}$$

*Non carcinogenic substances*

$$EM_{non\,canc} = \max \left\{ \frac{(EF \cdot EF_{g\_outdoor} \cdot ED)_{0-6}}{AT_{noncanc} \cdot 365 \cdot 24}; \frac{(EF \cdot EF_{g\_outdoor} \cdot ED)_{7-16}}{AT_{noncanc} \cdot 365 \cdot 24}; \frac{(EF \cdot EF_{g\_outdoor} \cdot ED)_{17-65}}{AT_{noncanc} \cdot 365 \cdot 24}; \frac{(EF \cdot EF_{g\_outdoor} \cdot ED)_{>65}}{AT_{noncanc} \cdot 365 \cdot 24} \right\}$$

where:

- $EF$  [days/year] is the frequency of exposure, or the number of days per year in which it is assumed that the receptor is present on the site;
- $EF_{g\_outdoor}$  [hours/day] is the daily frequency of exposure, i.e., the number of hours per day in which the receptor frequents outdoor environments on site; this parameter is differentiated according to the age group: 0-6 years (child), 7-16 years (adolescent), 17-65 years (adult), > 65 years (elderly);
- $ED$  [years] is the duration of exposure, ie the number of years in which it is assumed that the receptor is present on the site; this parameter is differentiated according to the age group: 0-6 years (child), 7-16 years (adolescent), 17-65 years (adult), > 65 years (elderly);
- $AT_{canc}$  [years] is the averaging time on which the exposure to carcinogenic substances is mediated;
- $ADAF$  [adim.] is the factor increasing the incidence of carcinogenic effects due to exposure to the substance in childhood for carcinogenic and mutagenic substances;
- $AT_{noncanc}$  [years] is the averaging time on which the exposure to non-carcinogenic substances is mediated;

### Industrial/Commercial Scenario - indoor pathway

#### *Carcinogenic substances*

$$EM_{canc} = \frac{EF \cdot EF_{g\_indoor} \cdot ED}{AT_{canc} \cdot 365 \cdot 24}$$

#### *Non carcinogenic substances*

$$EM_{non\,canc} = \frac{EF \cdot EF_{g\_indoor} \cdot ED}{AT_{noncanc} \cdot 365 \cdot 24}$$

where:

- $EF$  [days/year] is the frequency of exposure, or the number of days per year in which it is assumed that the receptor is present on the site;
- $EF_{g\_indoor}$  [hours/day] is the daily frequency of exposure, i.e., the number of hours per day in which the receptor frequents indoor environments on site; this parameter is differentiated according to the type of work activity: mainly indoor, indoor / outdoor, mainly outdoor;
- $ED$  [years] is the duration of exposure, i.e. the number of years in which it is assumed that the receptor is present on the site;
- $AT_{canc}$  [years] is the averaging time on which the exposure to carcinogenic substances is mediated;
- $ADAF$  [adim.] is the factor increasing the incidence of carcinogenic effects due to exposure to the substance in childhood for carcinogenic and mutagenic substances;
- $AT_{noncanc}$  [years] is the averaging time on which the exposure to non-carcinogenic substances is mediated;

### Industrial/Commercial Scenario - outdoor pathway

#### *Carcinogenic substances*

$$EM_{canc} = \frac{EF \cdot EF_{g\_outdoor} \cdot ED}{AT_{canc} \cdot 365 \cdot 24}$$

#### *Non carcinogenic substances*

$$EM_{non\ conc} = \frac{EF \cdot EF_{g\_outdoor} \cdot ED}{AT_{noncanc} \cdot 365 \cdot 24}$$

where:

- $EF$  [days/year] is the frequency of exposure, or the number of days per year in which it is assumed that the receptor is present on the site;
- $EF_{g\_indoor}$  [hours/day] is the daily frequency of exposure, i.e., the number of hours per day in which the receptor frequents outdoor environments on site; this parameter is differentiated according to the type of work activity: mainly indoor, indoor / outdoor, mainly outdoor;
- $ED$  [years] is the duration of exposure, i.e. the number of years in which it is assumed that the receptor is present on the site;
- $AT_{canc}$  [years] is the averaging time on which the exposure to carcinogenic substances is mediated;
- $ADAF$  [adim.] is the factor increasing the incidence of carcinogenic effects due to exposure to the substance in childhood for carcinogenic and mutagenic substances;
- $AT_{noncanc}$  [years] is the averaging time on which the exposure to non-carcinogenic substances is mediated;