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S-Risk®

A quick user manual

Marie JAILLER (SPAQUE)

13.08.2026

Content

- Implementation of the Human Health Risk Assessment methodology in the S-RISK tool
- How to log to S-RISK - different versions of S-RISK
- Case study in application I : calculation of soil threshold values for a generic land-use
- Case study in application II : calculation of risks
- Case study in application III : calculation of remediation goals (clean-up levels)
- Application II : calculation in the different pathways from a soil (groundwater) concentration - Flowcharts for all chemicals except PFAS
- Application II : calculation in the different pathways from a soil (groundwater) concentration - Flowcharts for PFAS
- Explanations about the standard scenarios

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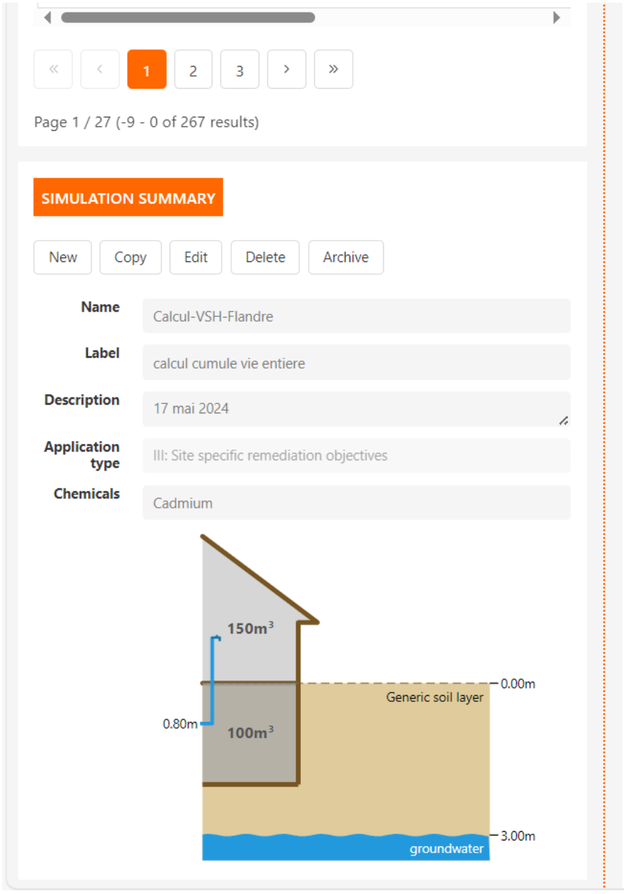
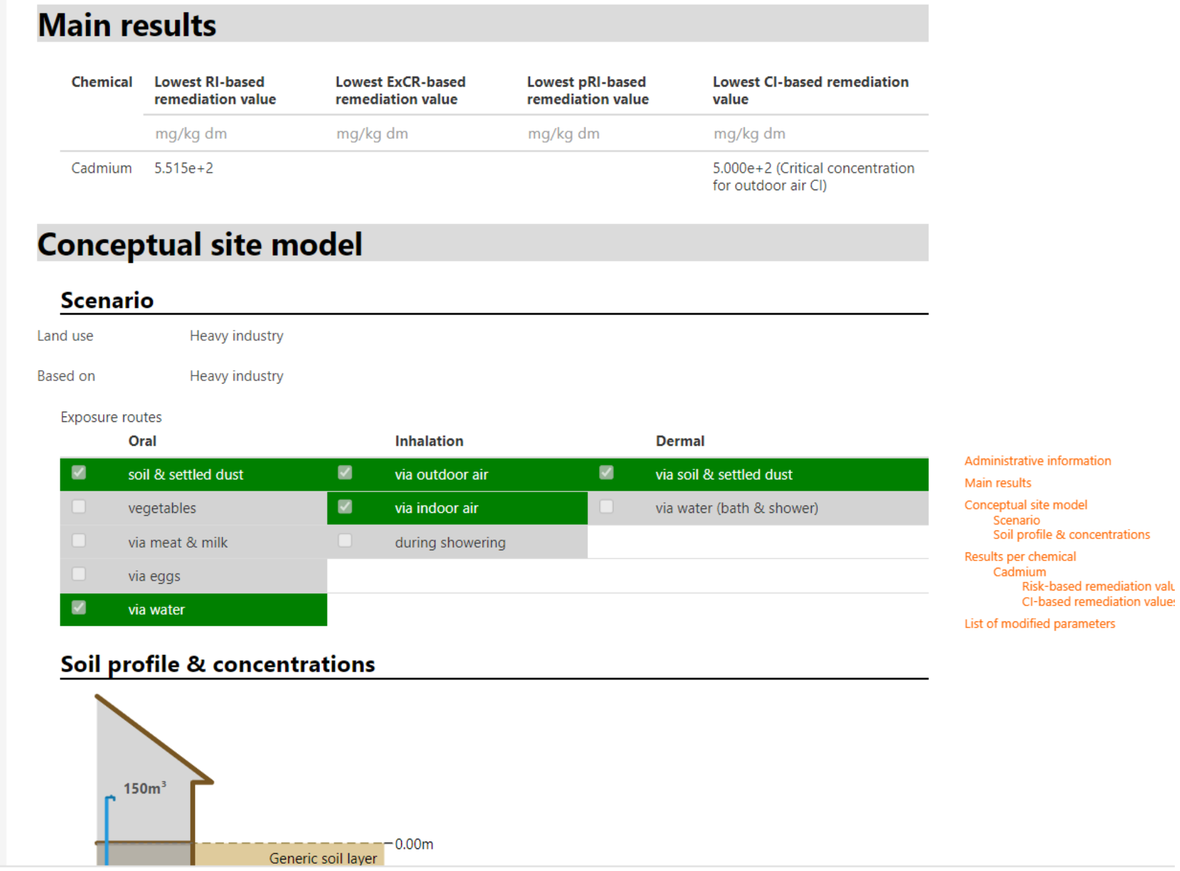
S-Risk : a human health risk assessment tool





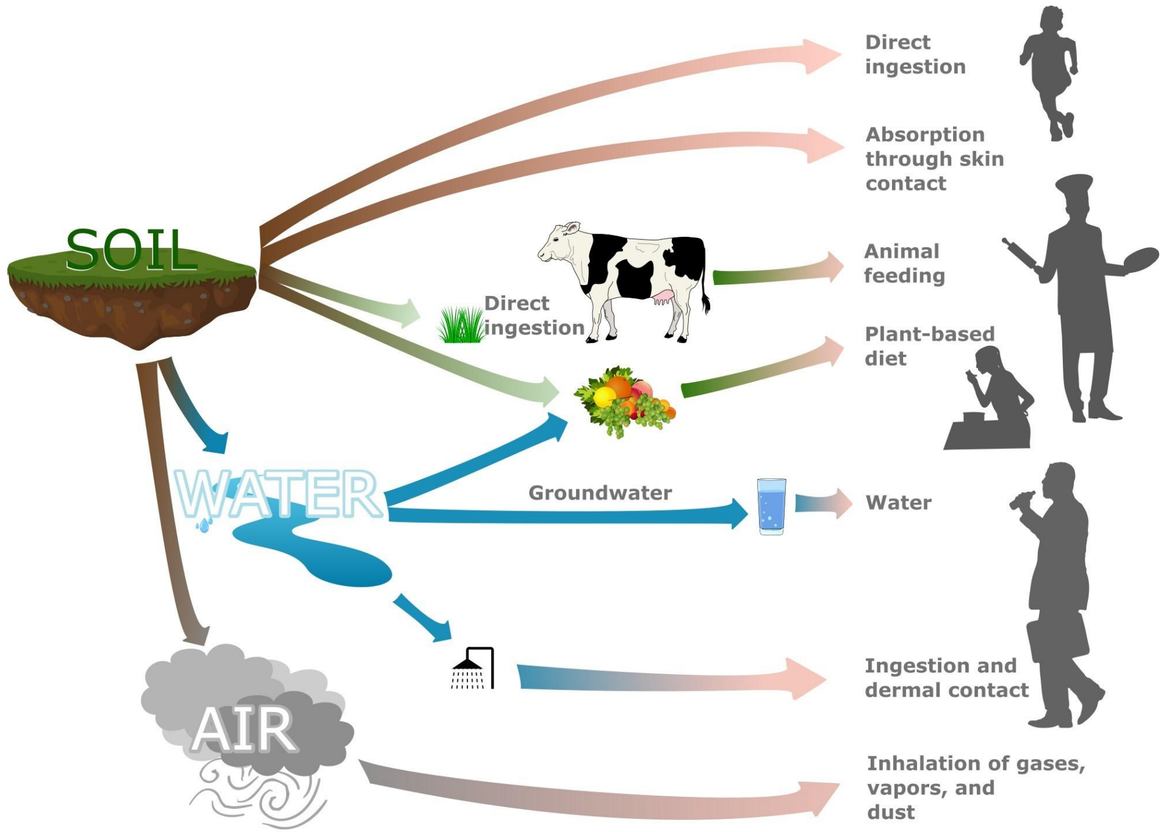
How does S-Risk® work ?

INPUTS

Chemical concentration
Soil, water or air (indoor, outdoor)

Soil layers
Generic, loam, sand,…

Scenarios
Agriculture, residential, industry,…

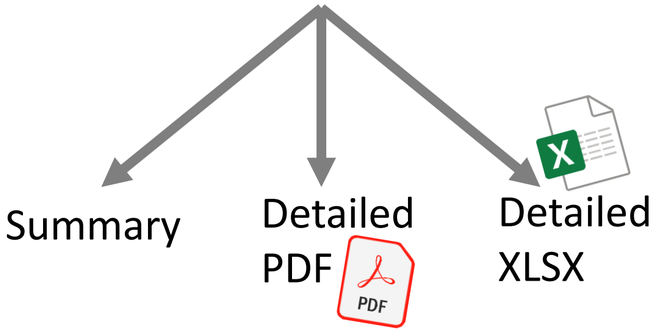


OUTPUTS

Forward mode
Risk Index (for threshold chemicals)
Excess Risk (for non-threshold chemicals)

Backward mode
Remediation objectives

Export results



Calculation of clean-up levels in soil

- Step 1 : Data collection and Conceptual exposure model

→ Backward mode : concentration in soil = Cleanup level

- Step 2 : Toxicity assessment

→ Chemical-specific parameters, Toxicity values or Reference doses

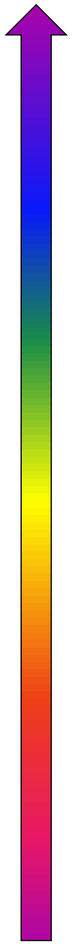
- Step 3 : Exposure assessment

→ S-RISK model, generic soil, 5 generic land-uses

- Step 4 : Risk characterization

→ Acceptable risk : Risk Index = 1 et Excess Cancer Risk = 10^{-5}

Trigger Value or Cleanup level

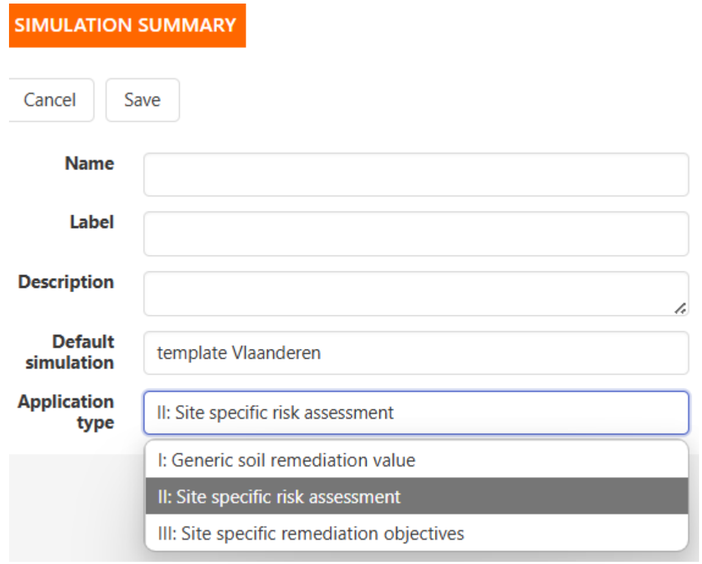


SPAQuE

How does S-Risk® work ?

Three fields of application (= 3 possible Outputs) :

- **Application I** : Calculation of generic human health based soil remediation values (useful if legal values are proposed in the regulation)
- **Application II** : Calculation of site-specific human health risks within a detailed risk assessment (**forward mode = C_environment → calculation of Risk**)
- **Application III** : Calculation of site-specific remediation objectives (**backward mode = what is the soil/groundwater concentration to avoid risk ?**)



CONCLUSION : The definition of the screening values (Application I) are coherent with later on site specific risk assessment (Application II)
→ principle of transparency OK

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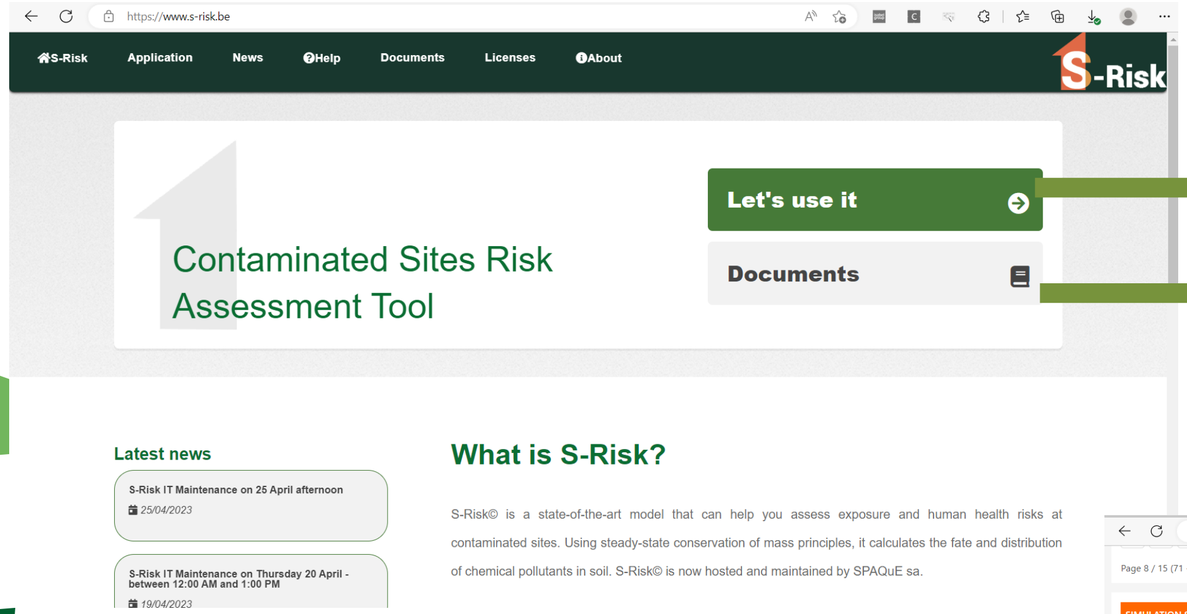
A quick user manual : How to log in to S-Risk®?



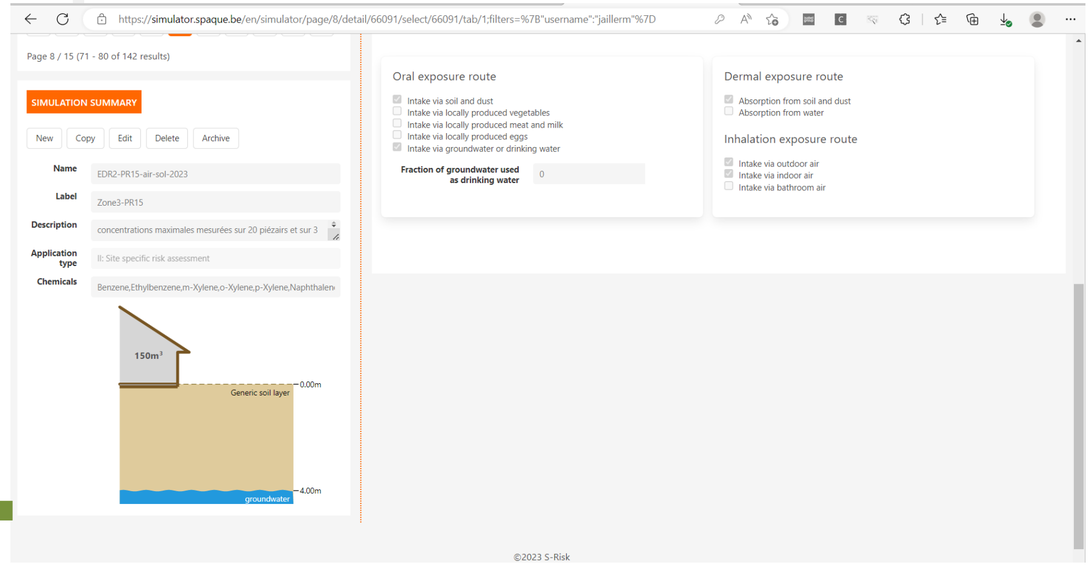
Web platform : https://www.s-risk.be

Documents in English and in Dutch (transparency) *but can be developed in another language easily*

Intuitive and user-friendly interface

Always up to date

Robust backup system (safe!)



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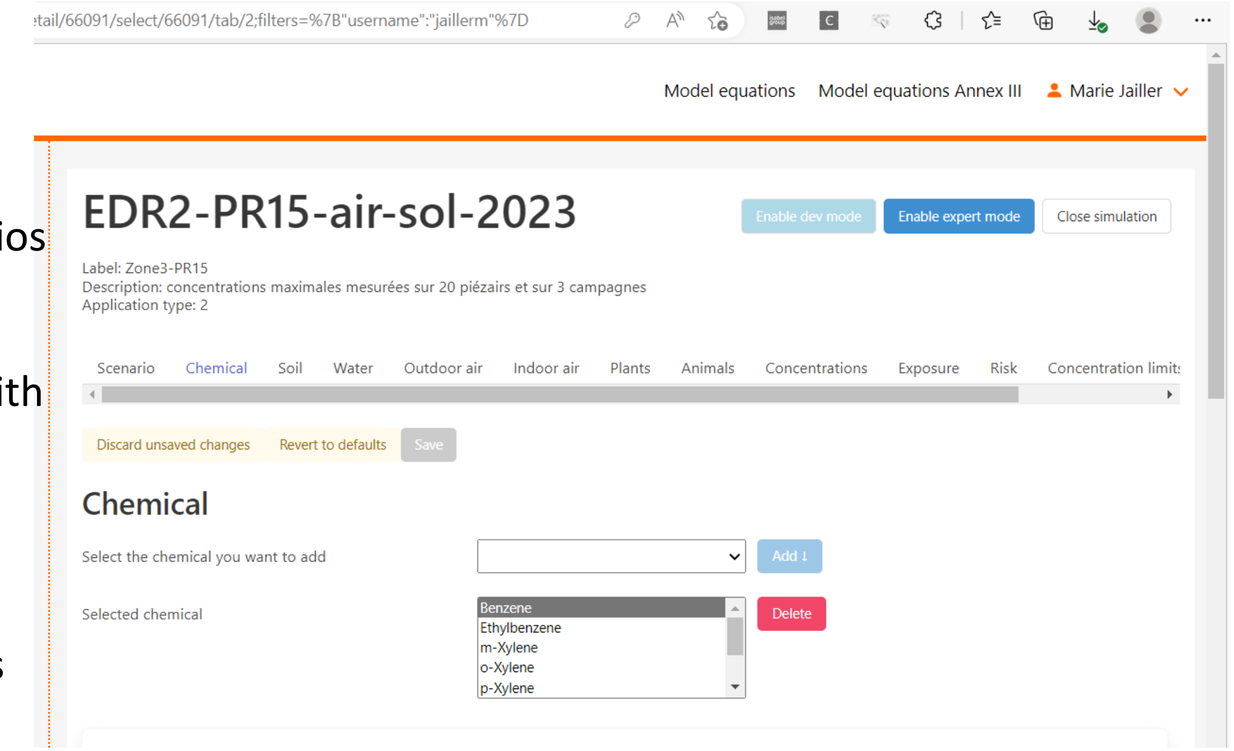
S-Risk® contains specific and flexible database

Exposure scenarios

70-80 chemicals with physico-chemical parameters

Soil properties



Background concentrations (optional)

Toxicity Reference Values

The database contains region/country-specific data (very customizable)

Flanders/Brussels → Tool called « S-Risk VL/BR »
Wallonia → Tool called « S-Risk Wal »
And ... soon Grand-Duchy of Luxembourg

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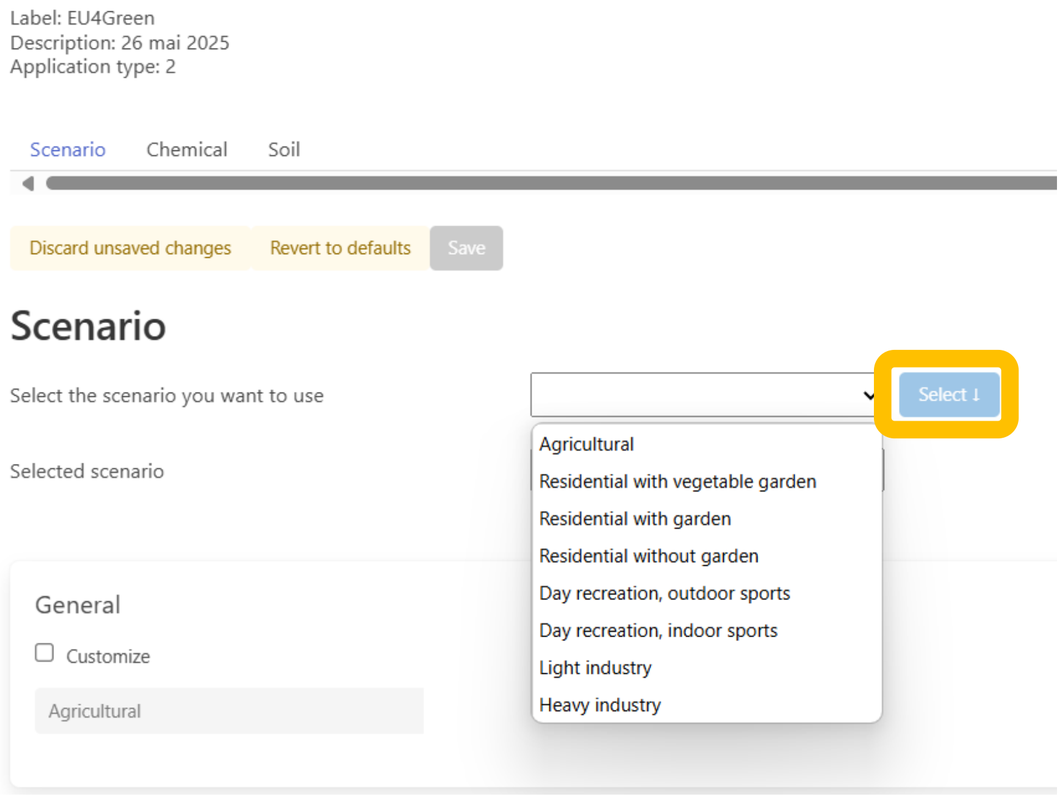
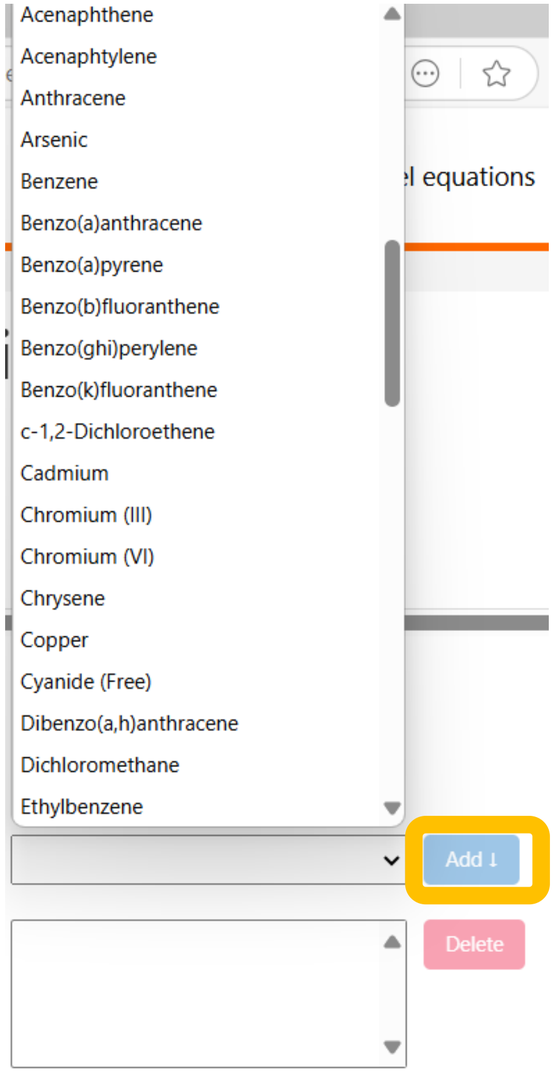
S-Risk® : the advantages of pre-encoded data

70-80 chemicals with physico-chemical parameters

Exposure scenarios





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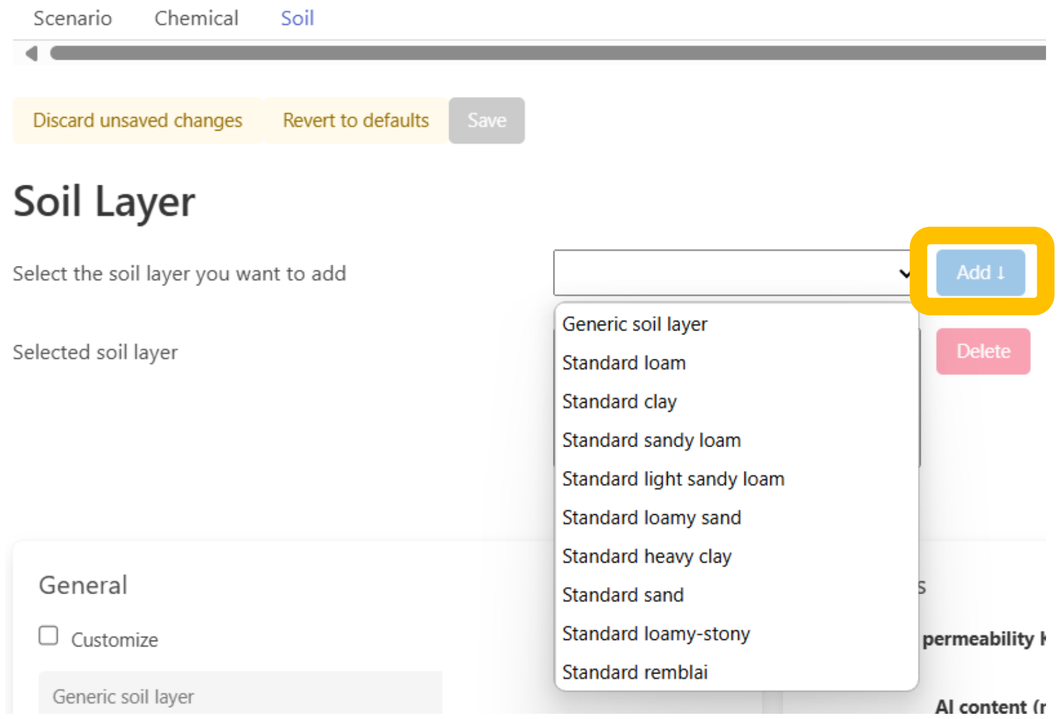
S-Risk® : the advantages of pre-encoded data

Soil properties



No need to enter a lot of data : pre-encoded data are available
→ just to «select »/« add » in the menu

Only soil or/and groundwater concentrations are needed to calculate risks !

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S-Risk® : useful for a specific risk assessment

For example:
In case of discovery of a soil pollution in a residential or agricultural area, you analyse vegetable/milk/meat/egg samples

In case of discovery of a soil pollution due to volatile chemicals, you analyse indoor air samples in houses

You are also able to introduce in S-Risk:

- measured vegetable concentrations
- measured meat/liver/kidney/milk/butter/egg concentrations
- measured indoor air concentrations
- measured soil air concentrations

<u>A helpful tool</u> when assessing individual exposure living on a contaminated site, with the assumption that exposure comes from soil contamination (not from other sources such as actual emissions)

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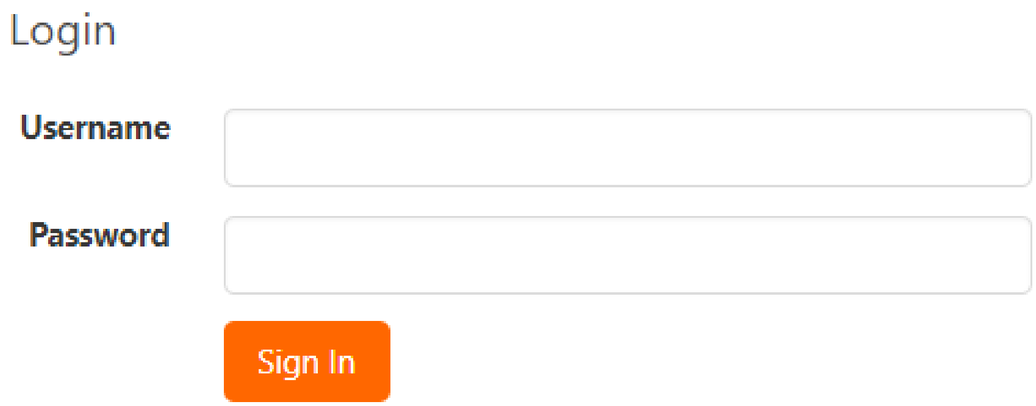
The presentation of S-Risk tool : 3 case studies



Drop-down menu → information to select in the menu

Data to enter in the tab (soil concentration, ...)

Result

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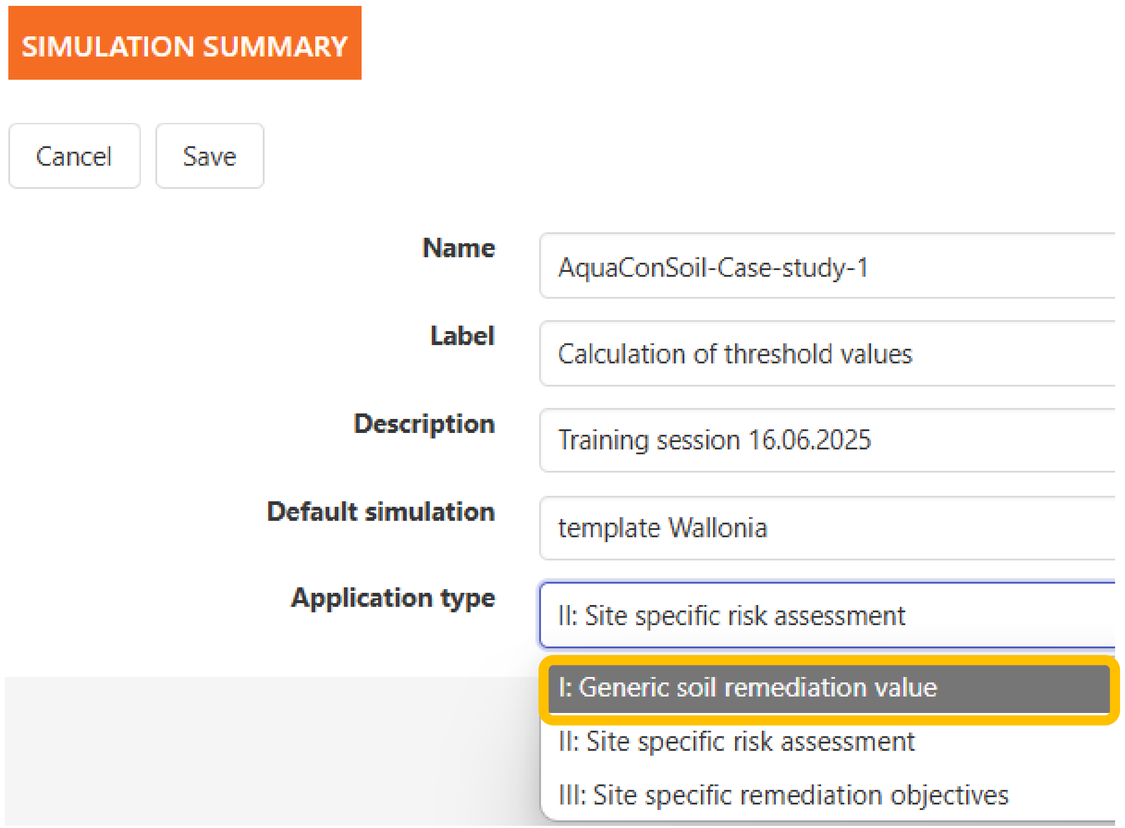
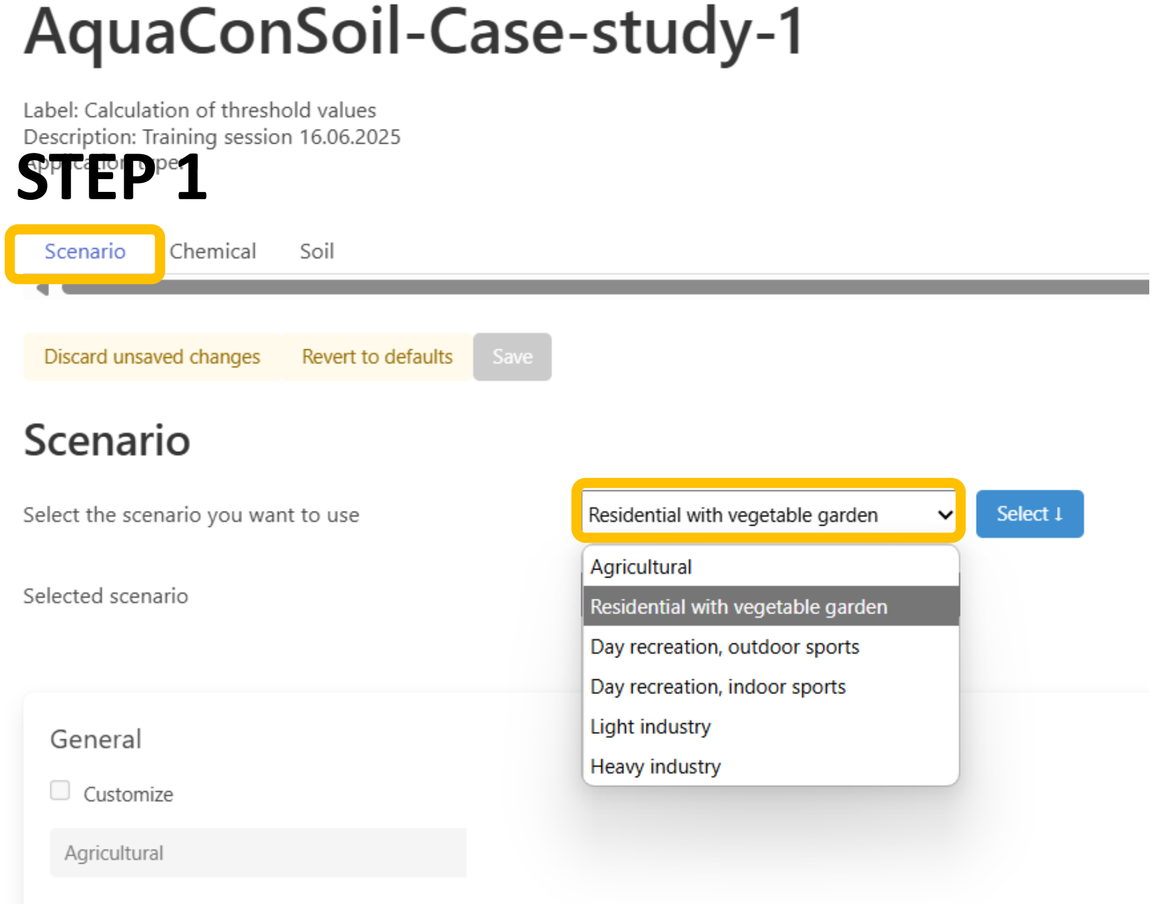
Case study n°1 :
A regulator wants to calculate screening/threshold values in soils

Valeurs limites	VS_H ($mg/kg_{m.s.}$)				
Type d'usage	I Usage naturel	II Usage agricole	III Usage résidentiel	IV Usage récréatif ou commercial	V Usage industriel
Métaux lourds et métalloïdes					
Arsenic	30,00	30,00	40,00	40,00	65,00
Cadmium	2052,00	10,85	32,52	1192,00	1192,00
Chrome	3204,00	178,30	290,70	3204,00	7043,00
Chrome VI	250,20	8,53	25,96	95,04	95,04
Cuivre	87880,0	1516,00	2504,00	87880,00	182000,00
Mercure	37,38	1,1	1,75	37,38	572,43
Nickel	3978,00	264,80	349,50	3803,00	3803,00
Plomb	120,00	200,00	200,00	390,00	1840,00
Zinc	186200	259,00	5222,00	186200	374000
Hydrocarbures aromatiques monocycliques non halogénés					
Benzène	143,60	0,10	0,10	0,7	0,7
Ethylbenzène	**1930,00**	0,32	0,35	3,21	3,21
Toluène	**50050**	9,16	9,75	125,00	126,10
Xylènes	**125600**	6,36	6,45	74,94	76,63
Styrène	**127300**	18,11	18,11	143,70	143,70
Phénol	18970,0	10,79	16,23	9927,00	9927,00
Hydrocarbures aromatiques polycycliques					
Naphtalène	**278100**	3,72	3,72	29,56	29,56
Acénaphtylène	**91700**	1154,00	**4267,00**	**91700**	**176900**
Acénaphtène	**27400,0**	**3323,00**	**4183,00**	**27400,00**	**176800**
Fluorène	**18270,0**	**2272,00**	**2922,00**	**18270,00**	**119400**

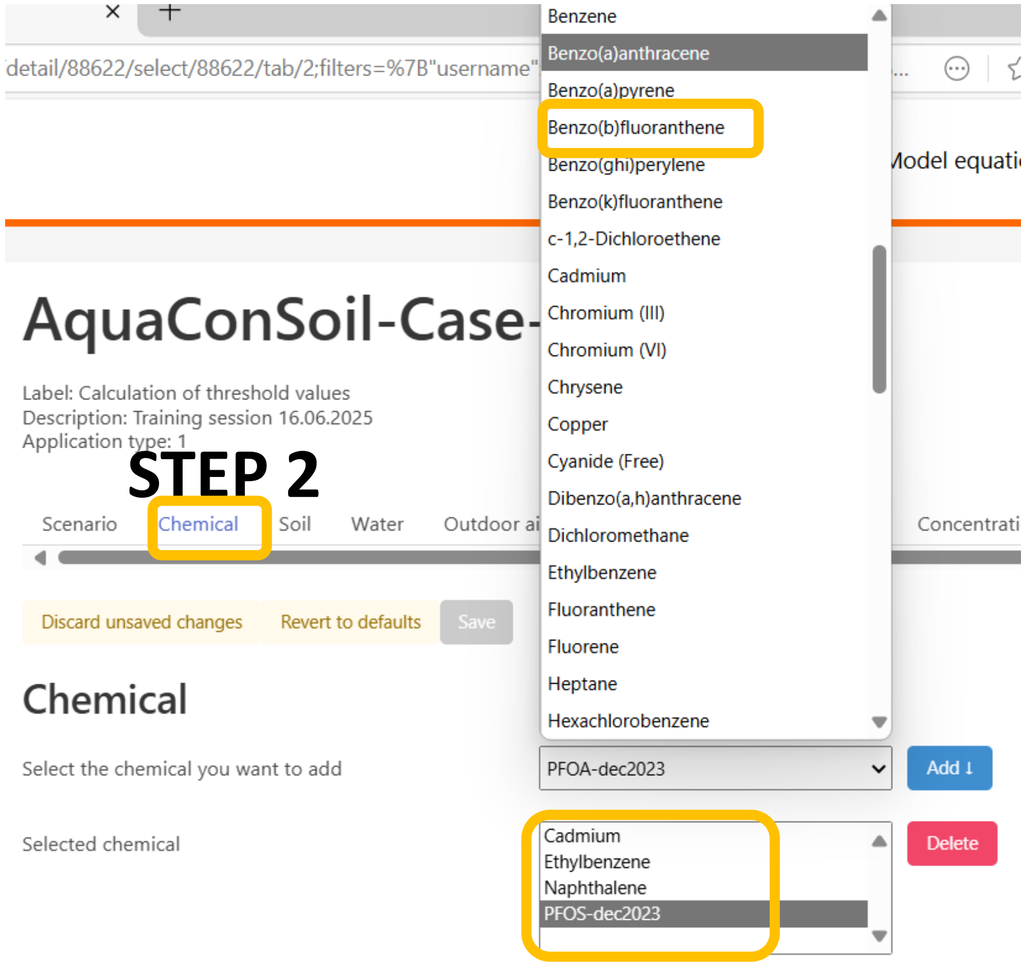


Case study n°1 :
A regulator wants to calculate screening/threshold values in soils



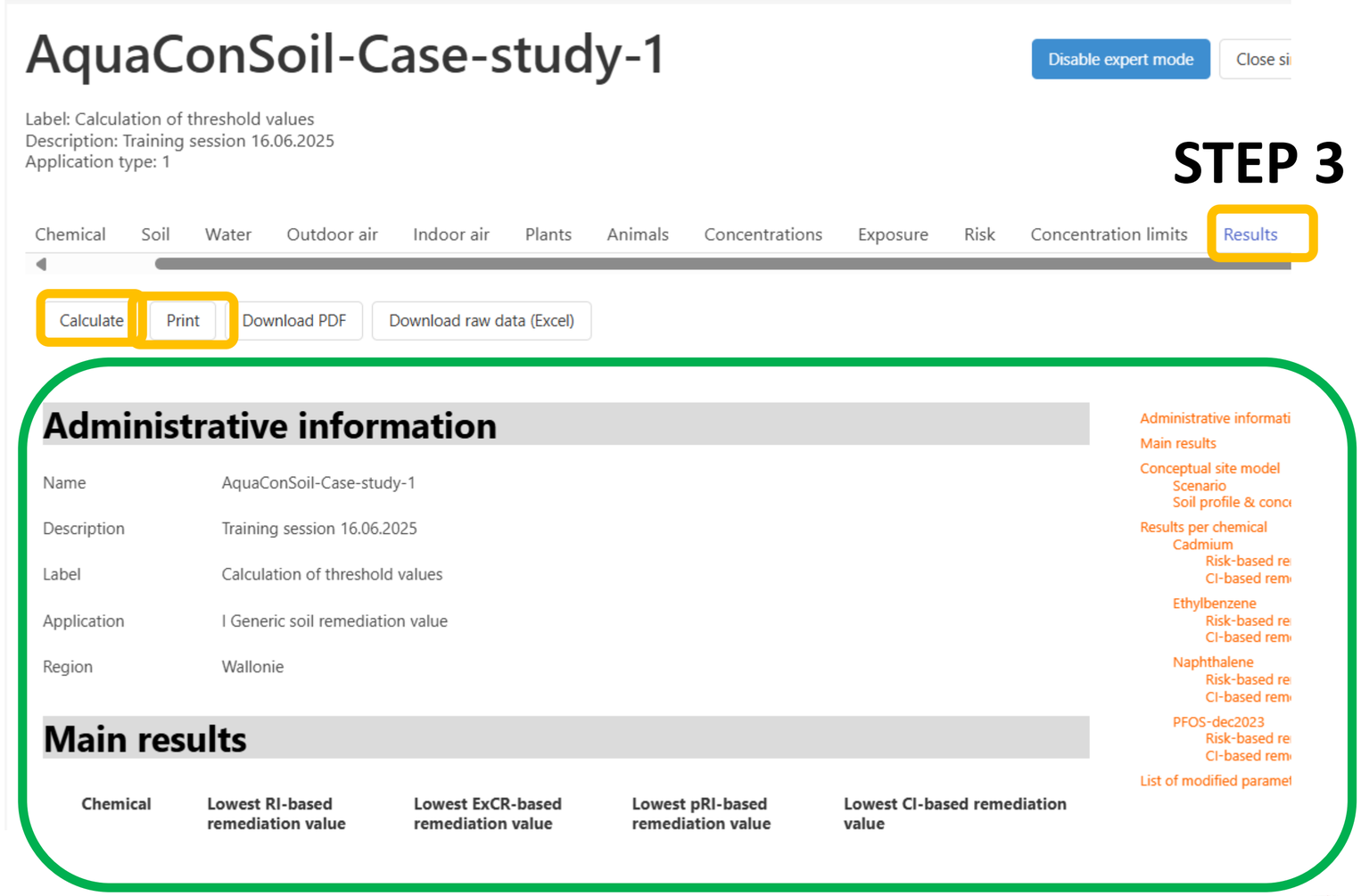
Selected scenario
= residential with vegetable garden

Case study n°1 :
A regulator wants to calculate screening/threshold values in soils



Selected chemicals
= cadmium, ethylbenzene, naphthalene and PFOS

Case study n°1 :
A regulator wants to calculate screening/threshold values in soils



« Print »
→
summary report in pdf

Case study n°1 :
A regulator wants to calculate screening/threshold values in soils

Lowest concentration based on threshold effects

Lowest concentration based on non-threshold effects

Lowest concentration based on limit values in air/water (regulation)

Main results

Chemical	Lowest RI-based remediation value	Lowest ExCR-based remediation value	Lowest pRI-based remediation value	Lowest CI-based remediation value
	mg/kg dm	mg/kg dm	mg/kg dm	mg/kg dm
Cadmium	3.252e+1	5.769e+2		5.000e+2 (Critical concentration for outdoor air CI)
Ethylbenzene	1.493e+1	3.461e-1		(Critical concentration for indoor air CI)
Naphthalene		3.722e+0		(Critical concentration for indoor air CI)
PFOS-dec2023	2.152e-2	3.237e+0		(Critical concentration for indoor air CI)

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Case study n°2 :
A Soil Expert (service provider) wants to assess the risk due to the soil or/and groundwater pollution on a site – Step 1

Usine Cockerill – Seraing (Belgium) - 1955

Cokerie Flémalle (Belgium) - 2006

Soil and groundwater sampling

Case study n°2 :
A Soil Expert (service provider) wants to assess the risk due to the soil or/and groundwater pollution on a site

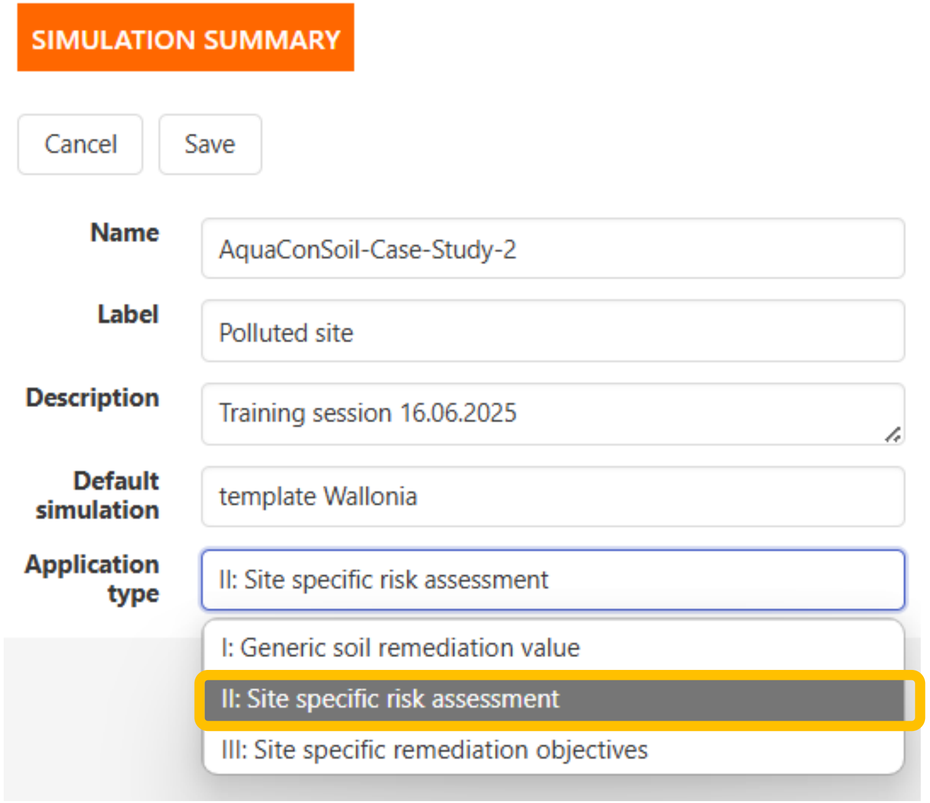
Case study n°2

Future land-use = office/companies

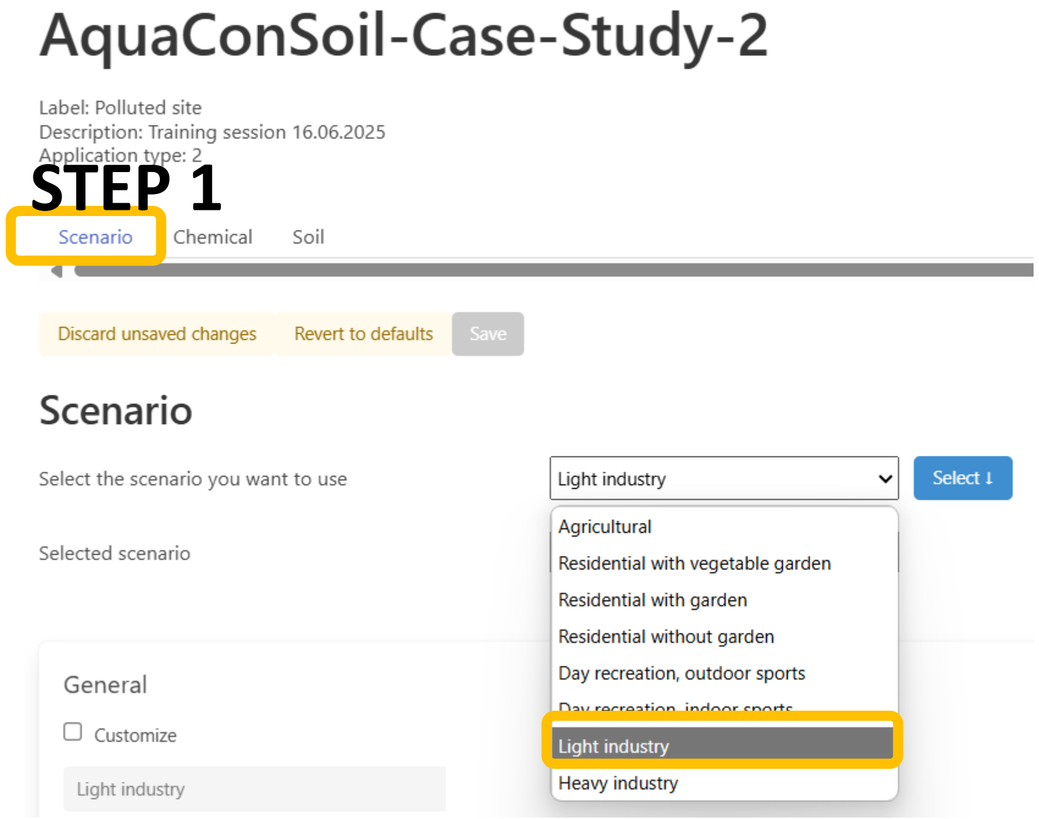
Type of soil : generic soil

Depth of groundwater : 3 m

Chemical	C_soil (mg/kg)	C_groundwater (µg/L)
Benzene	10	100
Naphthalene	15	50
Tetrachloroethene	5	10
Free cyanide	7	50

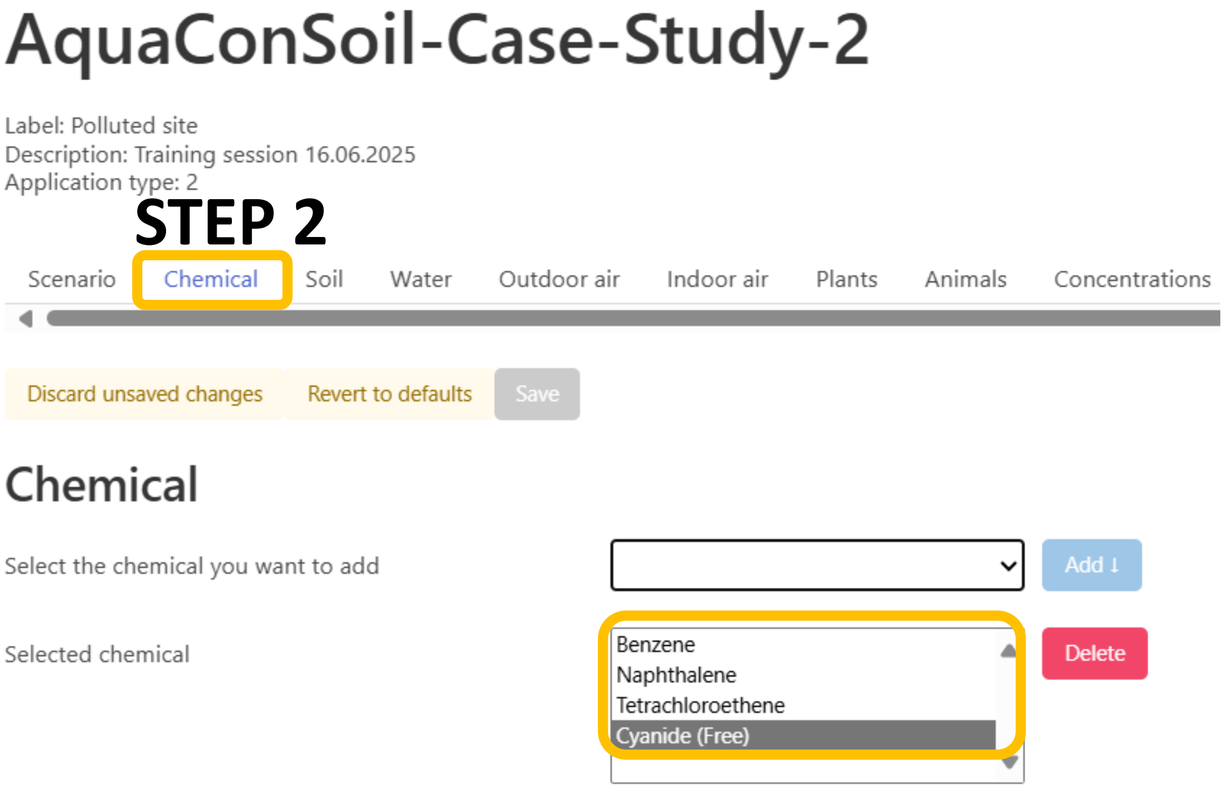


Case study n°2 :
A Soil Expert (service provider) wants to assess the risk due to the soil or/and groundwater pollution on a site



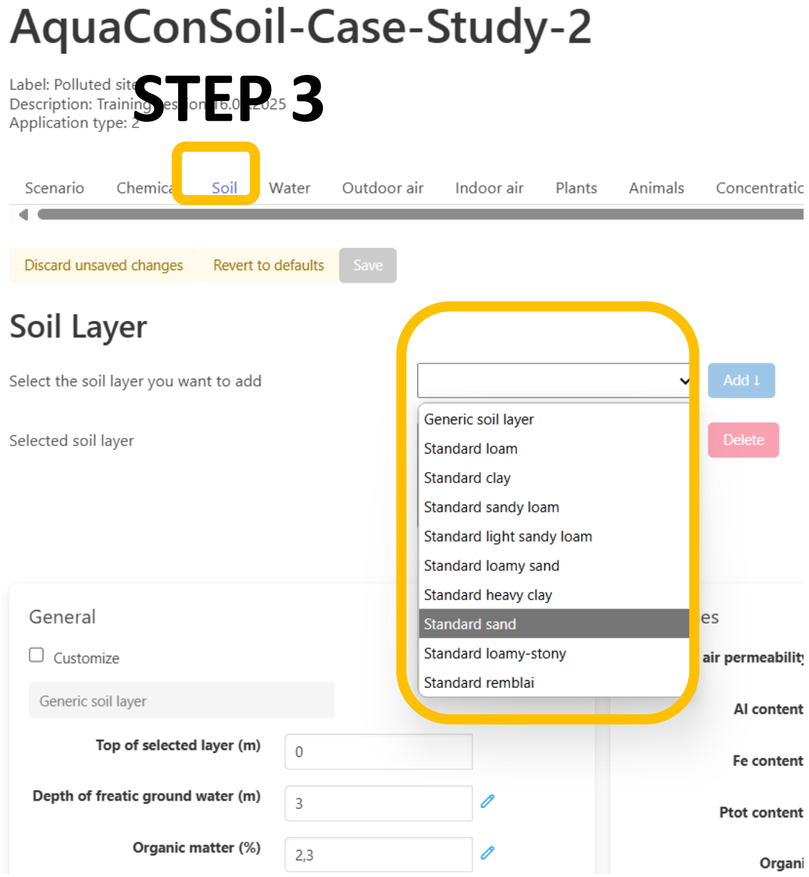
Selected scenario
= Light industry
= industry but also office

Case study n°2 :
A Soil Expert (service provider) wants to assess the risk due to the soil or/and groundwater pollution on a site



Selected chemicals

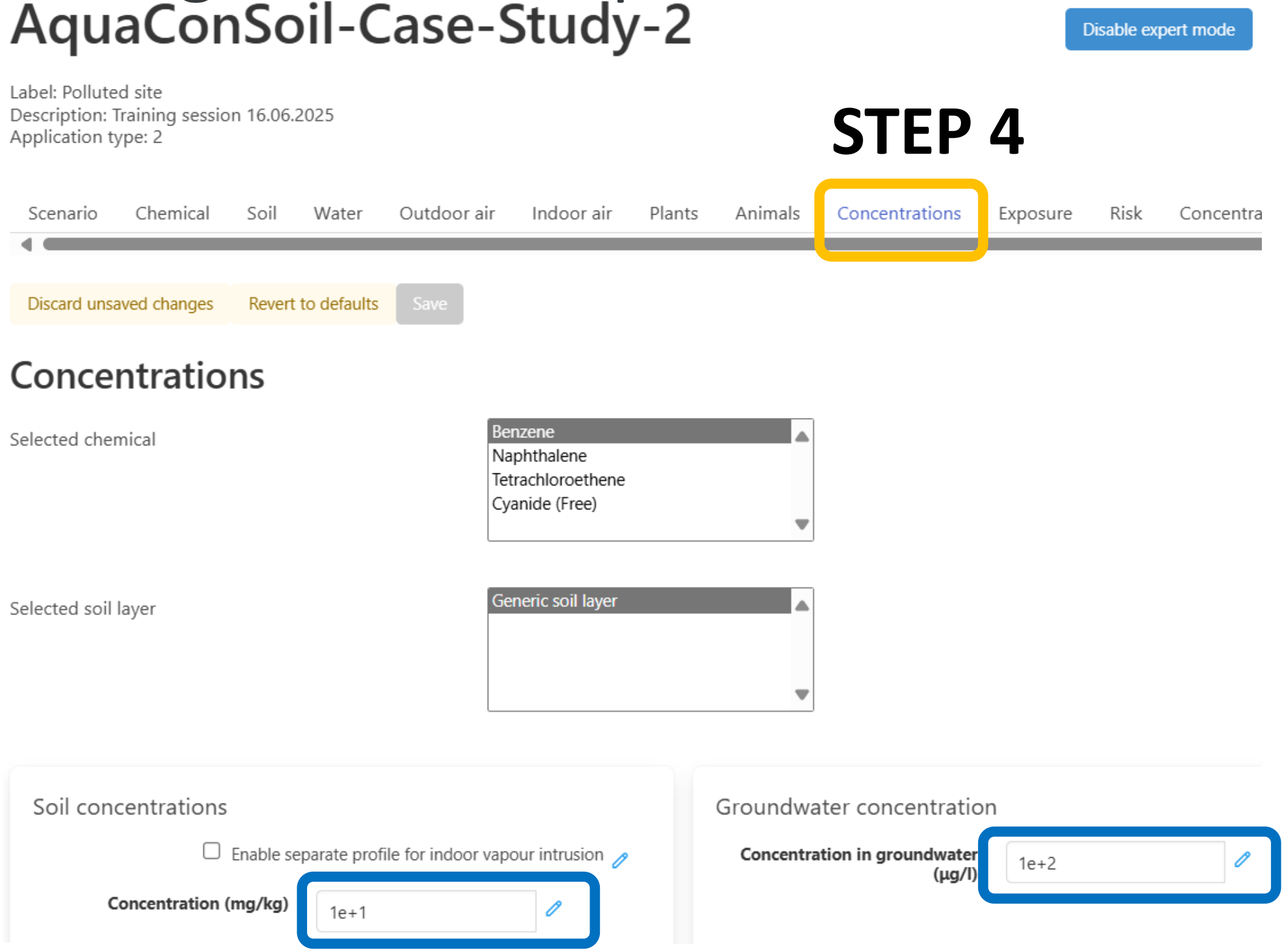
Case study n°2 :
A Soil Expert (service provider) wants to assess the risk due to the soil or/and groundwater pollution on a site



Define the soil profile : one soil layer or several soil layers

Case study n°2 :

A Soil Expert (service provider) wants to assess the risk due to the soil or/and groundwater pollution on a site



Soil and/or groundwater concentrations to enter

Case study n°2 :

A Soil Expert (service provider) wants to assess the risk due to the soil or/and groundwater pollution on a site

Calculate | Print | Download PDF | Download raw data (Excel)

STEP 5

Administrative information

Name	AquaConSoil-Case-Study-2
Description	Training session 16.06.2025
Label	Polluted site
Application	II Site specific risk assessment
Region	Wallonie

Main results

Chemical	Highest RI	Highest ExCR	Highest pRI	Highest CI
	(>1)	(>10^{-5})	(>1)	(>1)
Benzene	1.755e+1	2.558e-4		2.416e+1 (Water CI)
Naphthalene		9.358e-6		(Indoor air CI)
Tetrachloroethene	3.337e-1	6.398e-5		5.768e-1 (Water CI)
Cyanide (Free)	2.371e+1			(Indoor air CI)

Conceptual site model

Scenario

Land use	Light industry
Based on	Light industry

in black → risk < acceptable limit

in red → risk > acceptable limit

One step further :

these chemicals are volatile →
to carry out soil gas measurements and
to encode them in S-Risk

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Case study n°2 :
A Soil Expert (service provider) wants to assess the risk due to the soil or/and groundwater pollution on a site

Extract of the summary report

List of modified parameters

In the table below the parameters are listed that are different from the default value in the system. If the format of the values shown is not immediately clear, refer to the extended report for more details.

Topic	Soil layer	Chemical	Parameter	Value	Comment
Soil	Generic soil layer	Benzene	Concentration in the soil (mg/kg)	10	
Soil	Generic soil layer	Tetrachloroethene	Concentration in the soil (mg/kg)	5	
Soil	Generic soil layer	Naphthalene	Concentration in the soil (mg/kg)	15	
Soil	Generic soil layer	Cyanide (Free)	Concentration in the soil (mg/kg)	7	
Water		Benzene	Concentration in groundwater (µg/l)	100	
Water		Tetrachloroethene	Concentration in groundwater (µg/l)	10	
Water		Naphthalene	Concentration in groundwater (µg/l)	50	
Water		Cyanide (Free)	Concentration in groundwater (µg/l)	50	
Water			Groundwater concentration calculated or user encoded (check boxes)	0	

Clearness principle 

Only modified values are indicated in the summary report 

→ easy check for the user and the regulator

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Case study n°3 :
A Soil Expert (service provider) wants to calculate the remediation goal (= clean-up level) in the soil or/and in the groundwater

Case study n°3

Future land-use: residential area with houses only with slab-on-grade

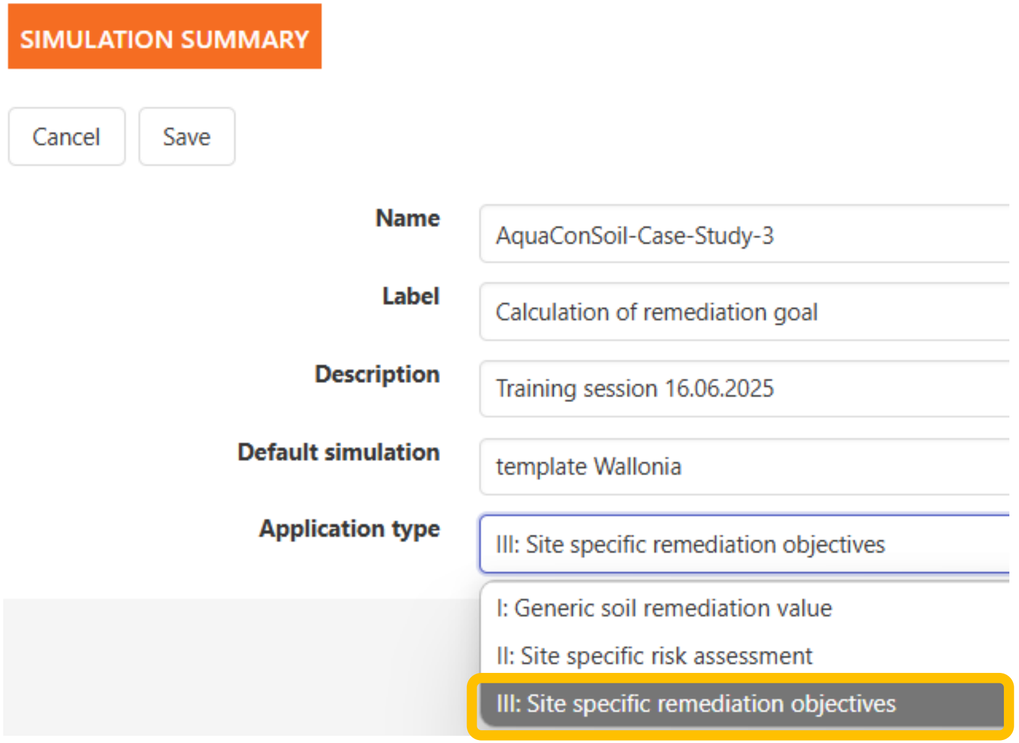
Type of soil: backfill material layer = « remblai » (0-4 m)

Depth of groundwater : 4 m

Pollution discovered for cadmium, benzene, benzo(a)pyrene, trichloroethene in soil

No pollution observed in groundwater

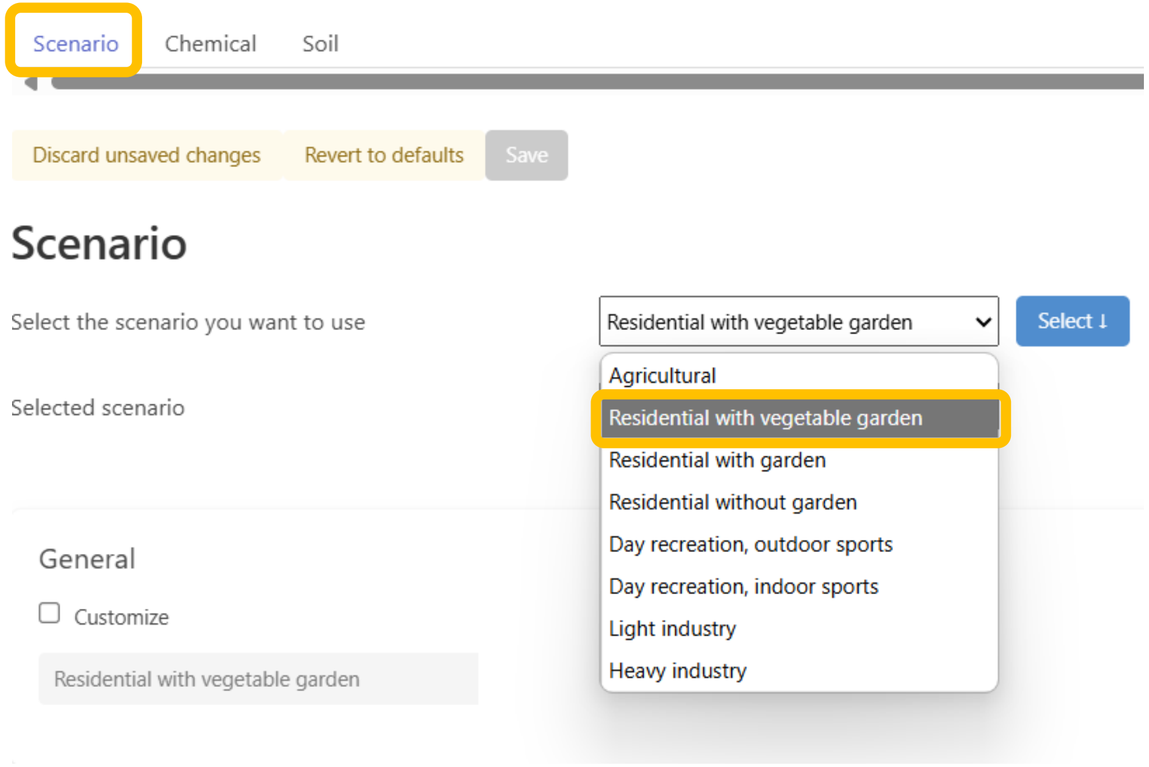
What are the clean-up levels for these 4 chemicals ?



Case study n°3 :

A Soil Expert (service provider) wants to calculate the remediation goal (= clean-up level) in the soil or/and in the groundwater

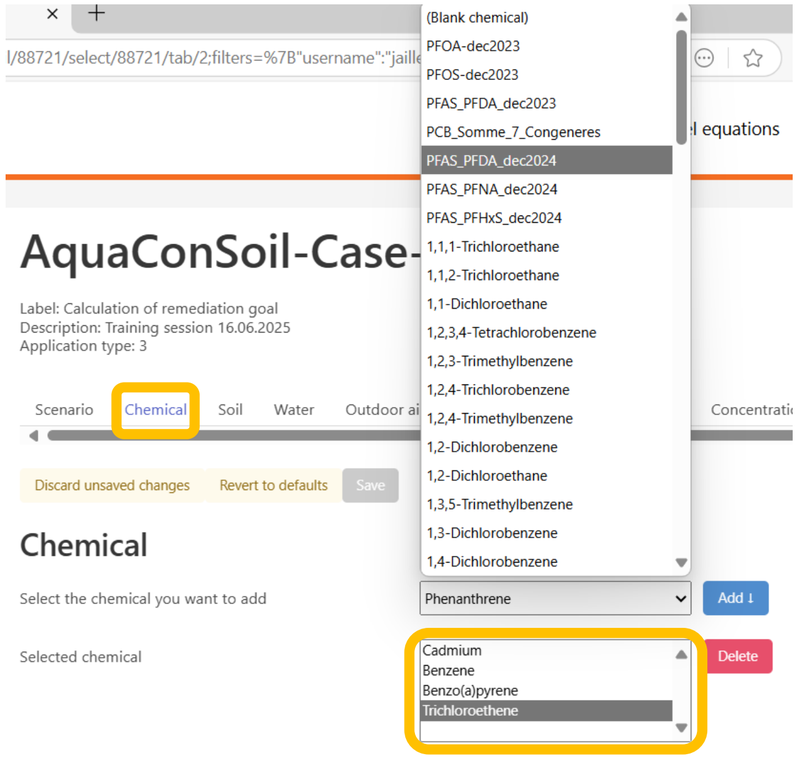
STEP 1



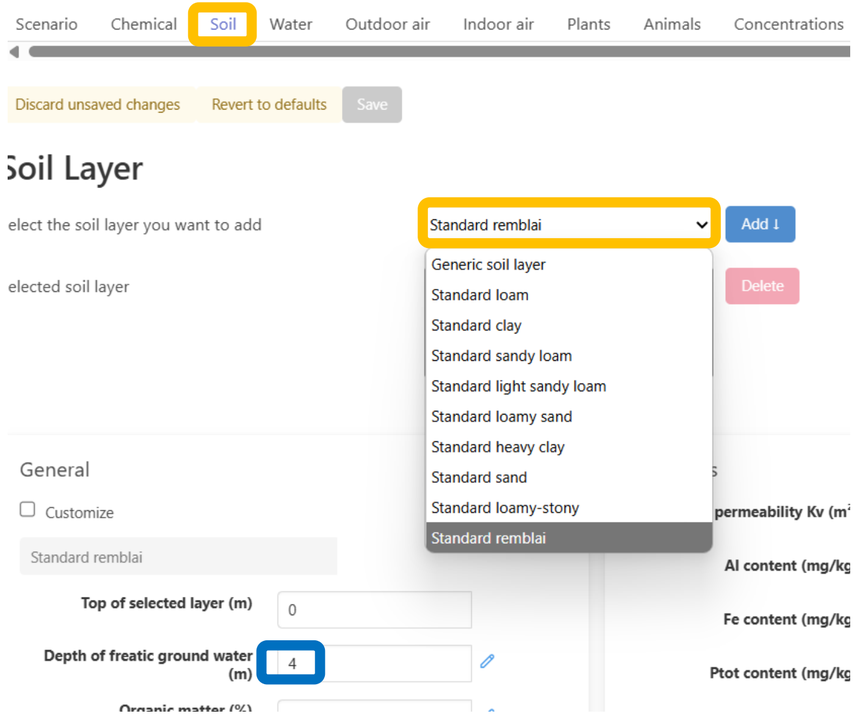
Case study n°3 :

A Soil Expert (service provider) wants to calculate the remediation goal (= clean-up level) in the soil or/and in the groundwater

STEP 2



STEP 3



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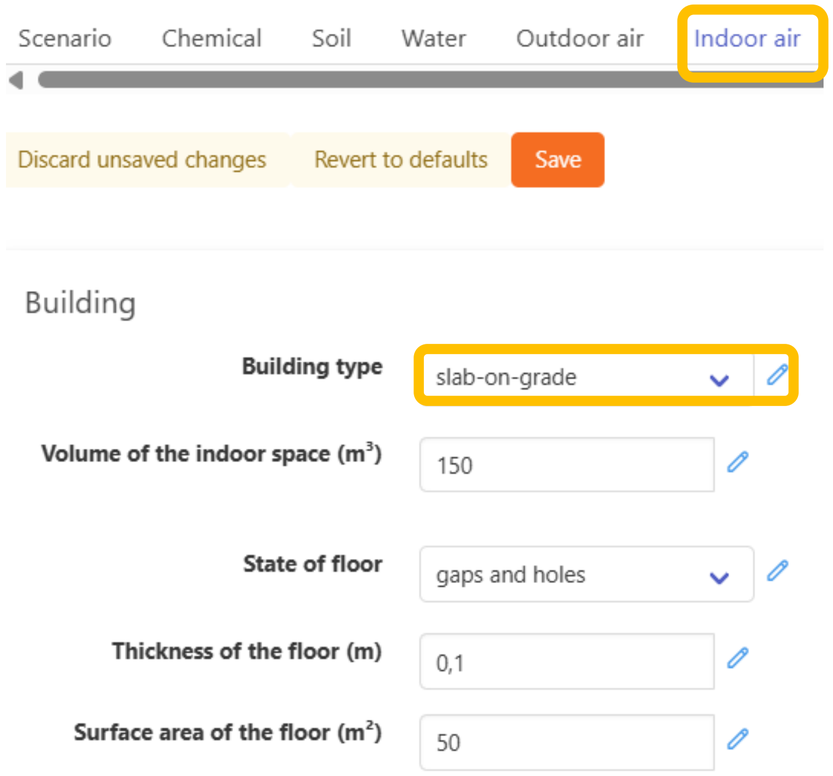
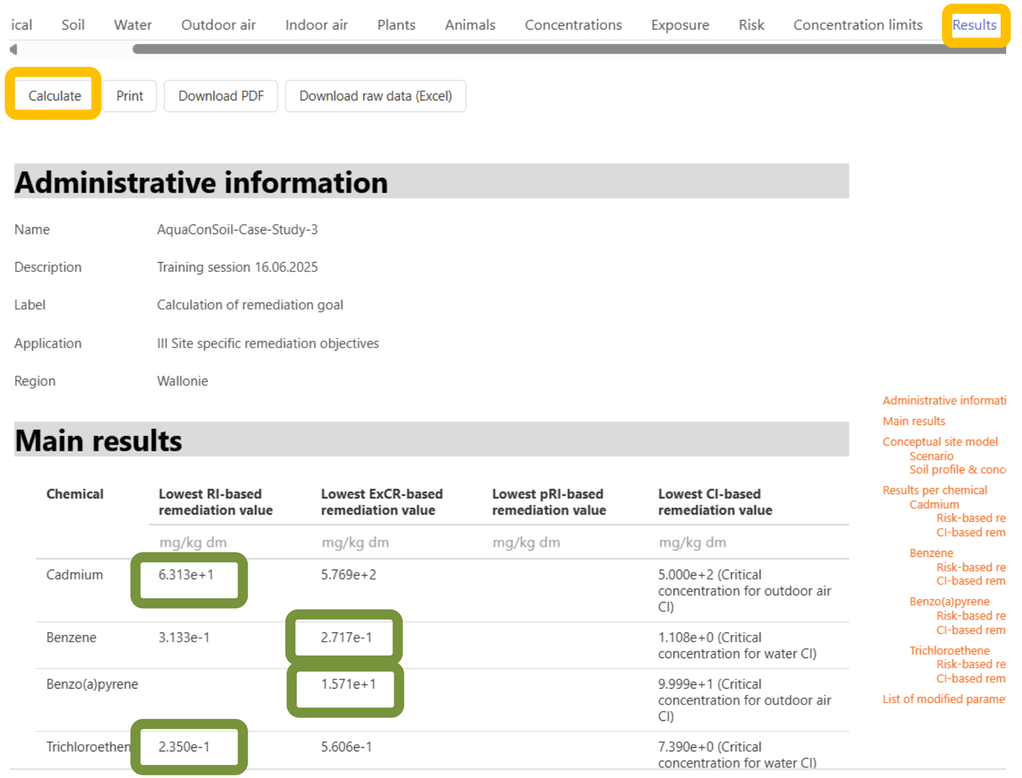
Case study n°3 :

A Soil Expert (service provider) wants to calculate the remediation goal (= clean-up level) in the soil or/and in the groundwater

STEP 4



STEP 5



Safety measures : land-use, type of house, type of soil

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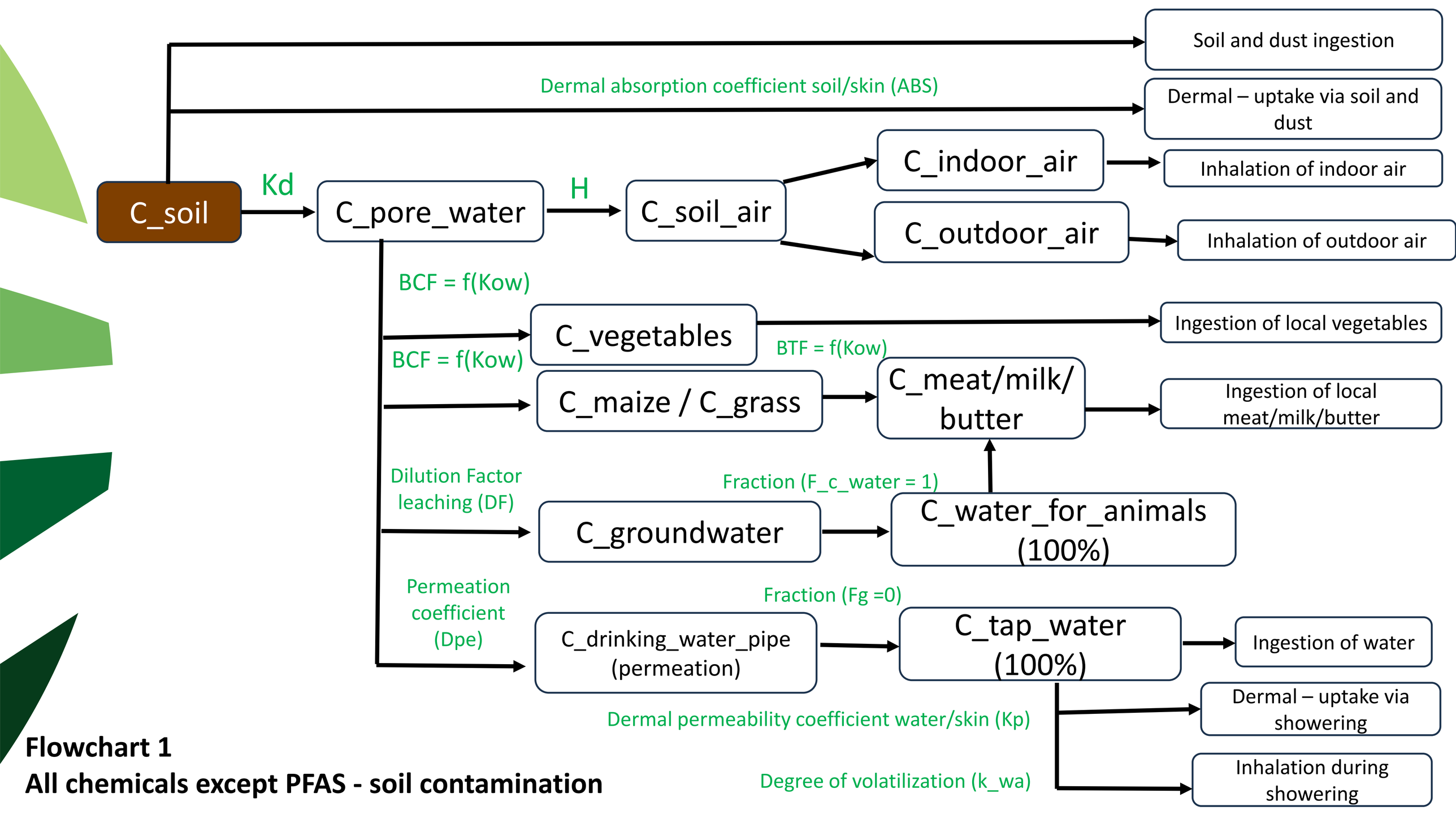
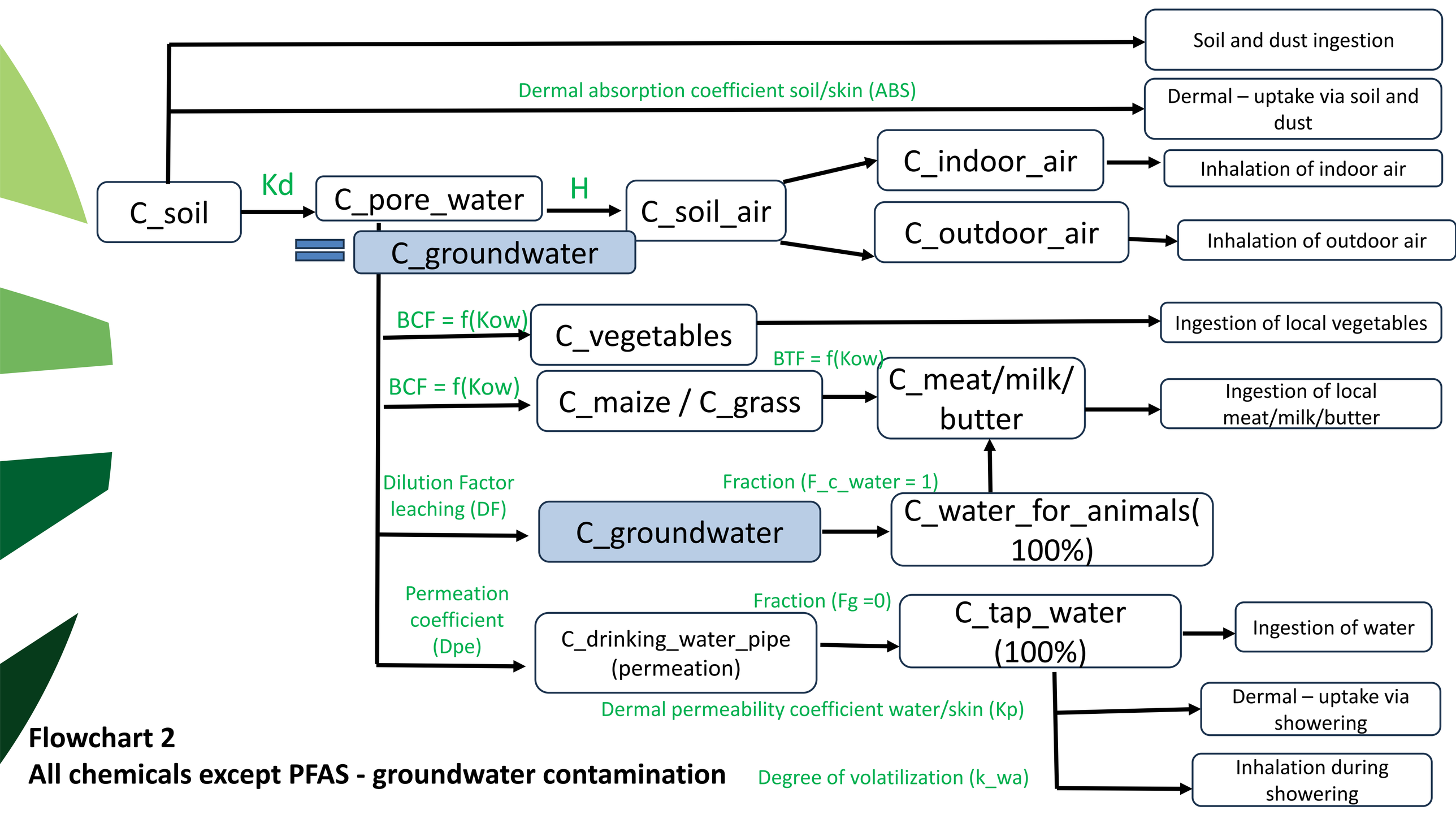


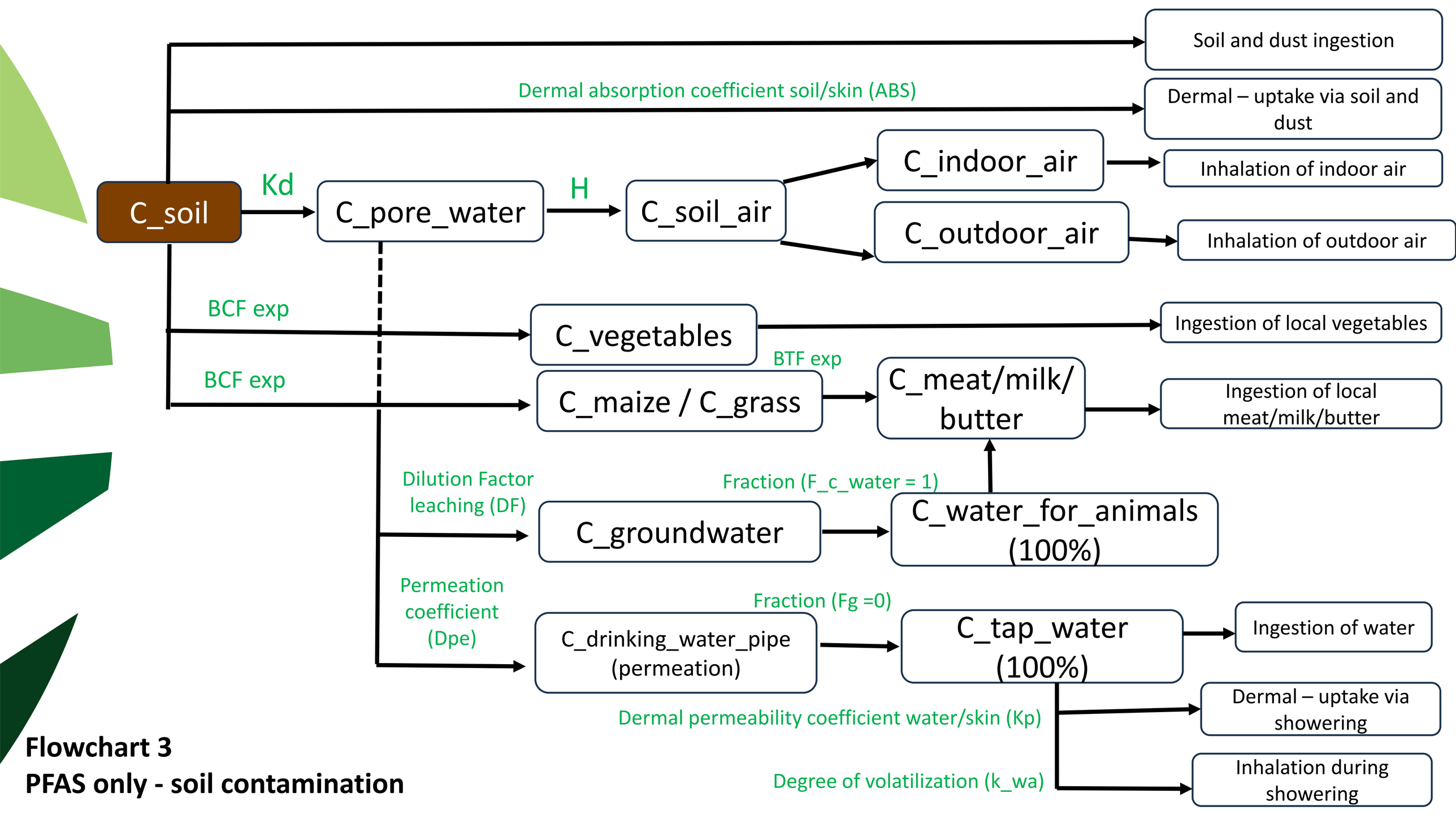
Flowchart 1

All chemicals except PFAS - soil contamination

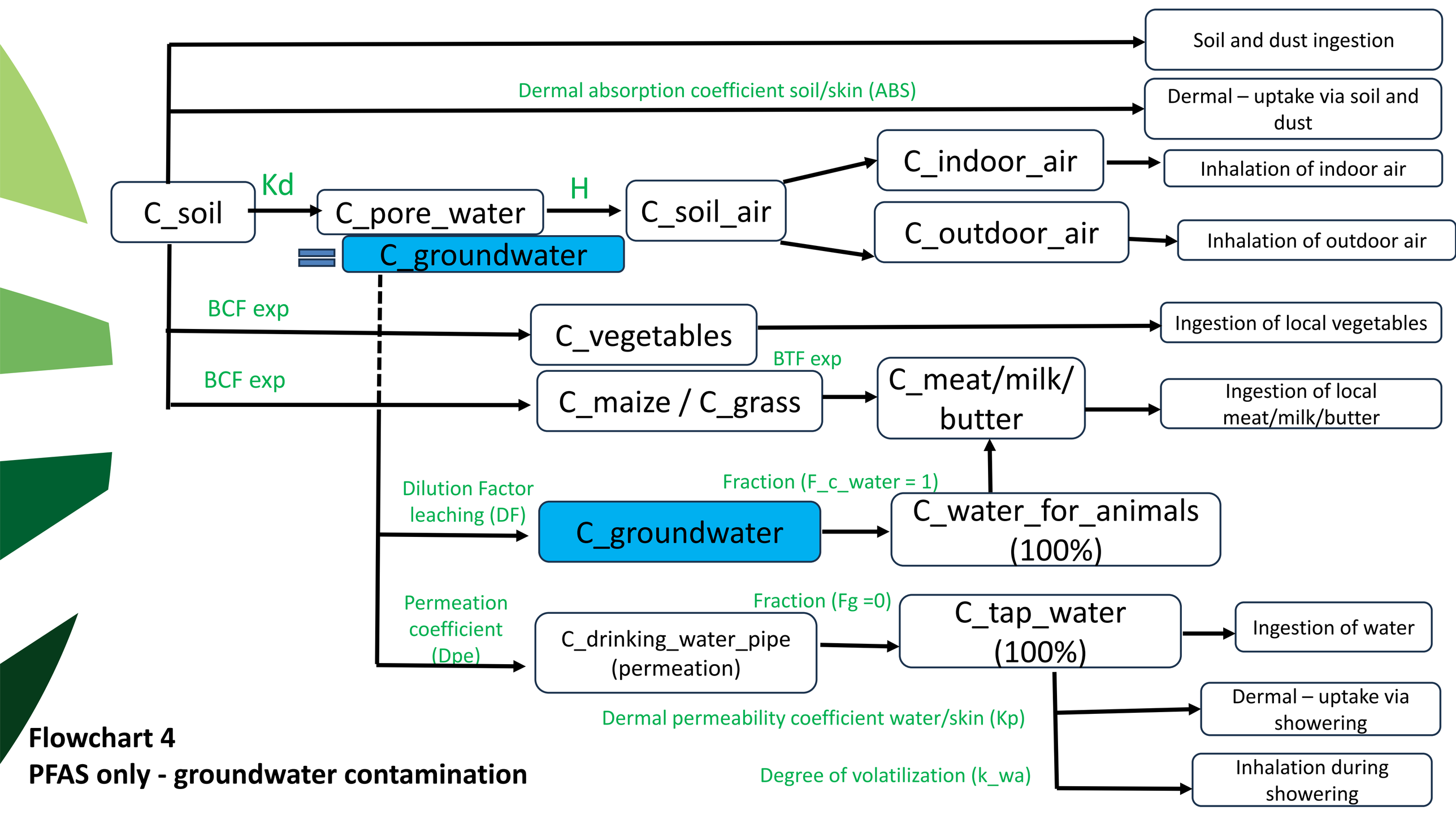


Flowchart 2

All chemicals except PFAS - groundwater contamination

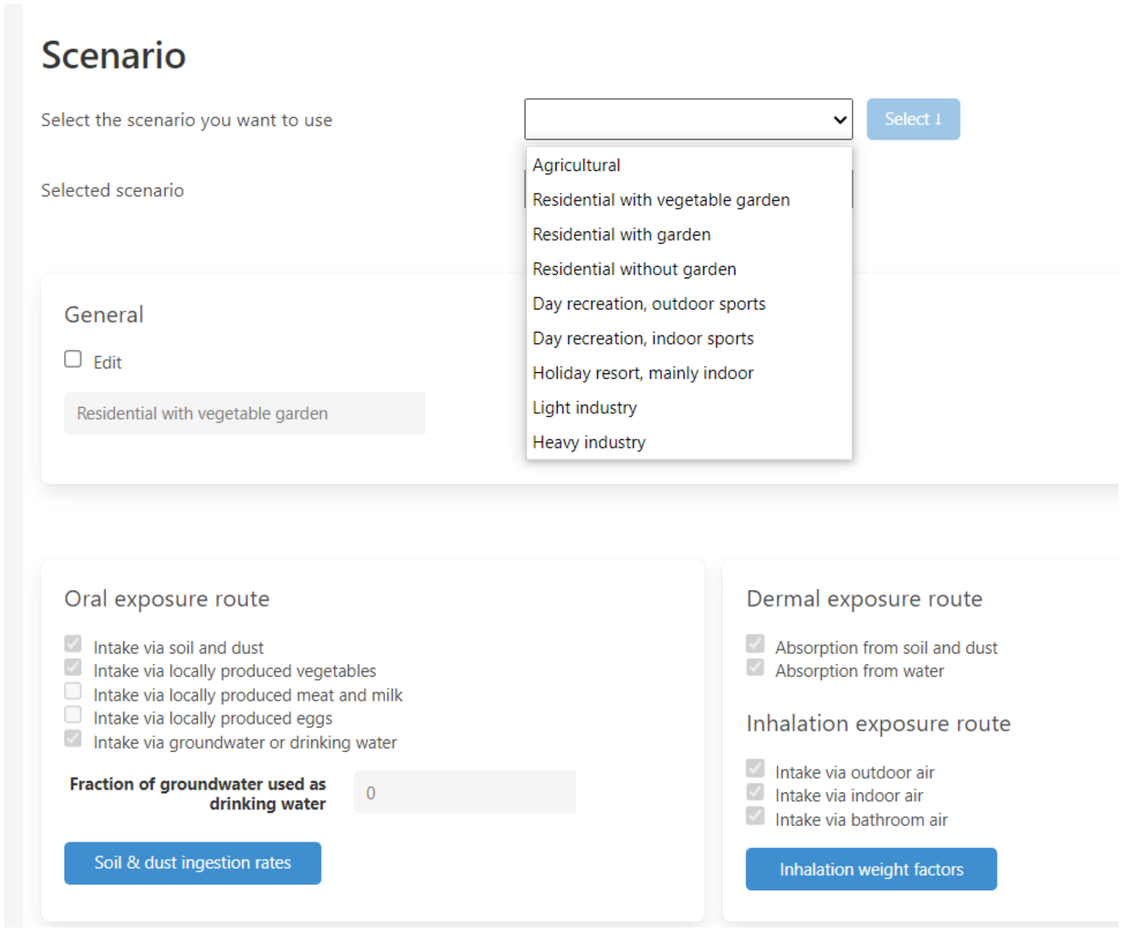


Flowchart 3
PFAS only - soil contamination



Flowchart 4
PFAS only - groundwater contamination

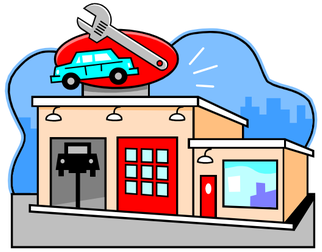
The choice of the scenario



Why different land-uses?
You don't clean with a same degree:

The operating theatre

The kitchen

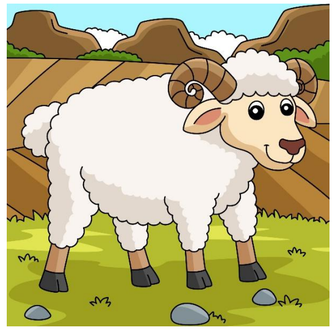


The garage

The « Agricultural » standard scenario

Adults and children living in a farm (building)
Consumption of home products = local source

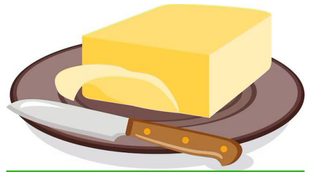
Vegetables : 100 % local except potatoes 50%



Sheep meat : 100 % local

Liver (foie)
: 100 % local

Milk : 100 % local

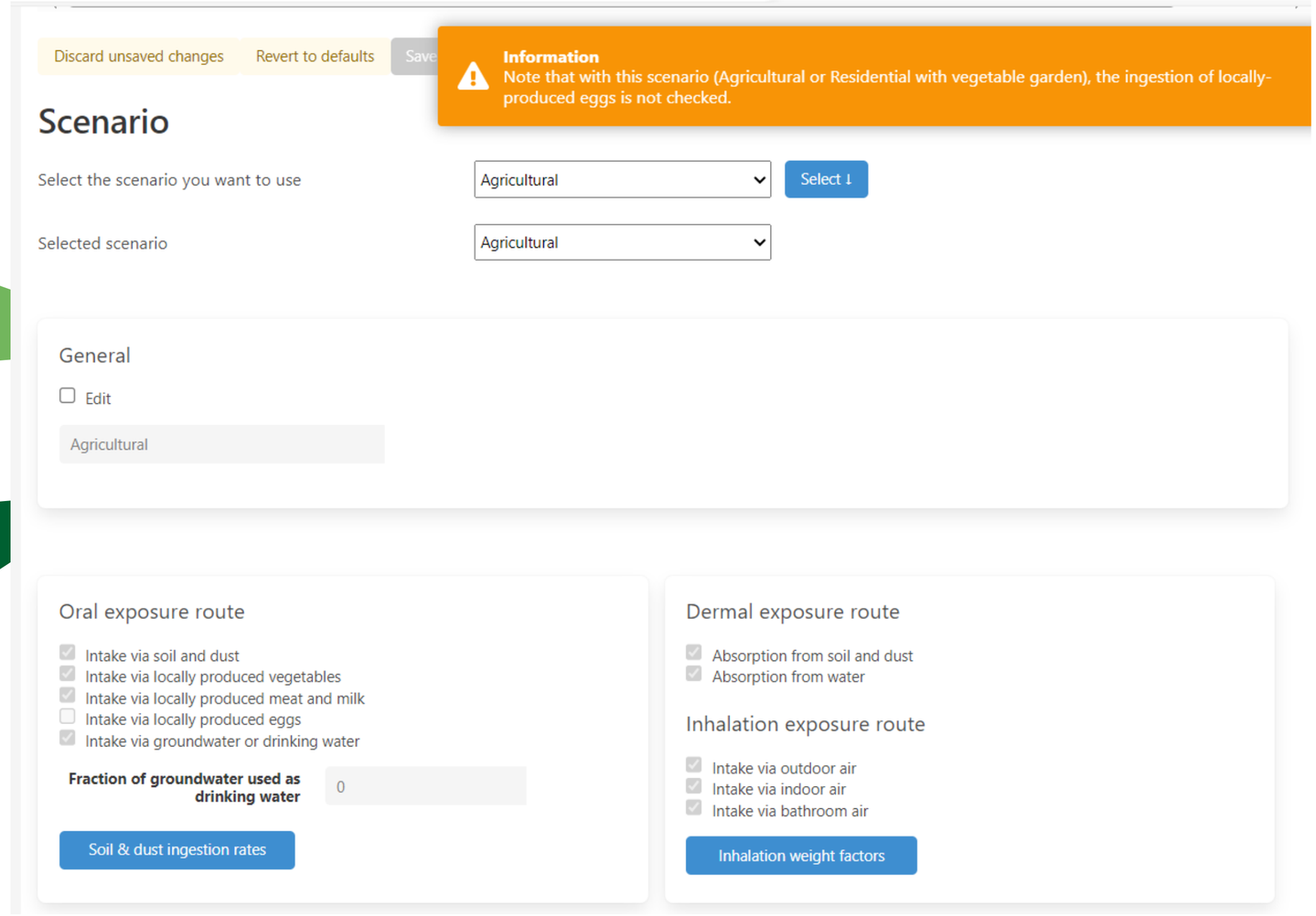


Butter : 100 % local

Beef meat : 100 % local

Kidney (rognons)
: 100 % local

The « Agricultural » standard scenario



Time spent inside (in the building) : 20 h/day

Time spent outside (in the garden) : 1,5 h/day

7 days/week – 52 weeks/year

Adults and children

Building with a basement

Dermal contact with soil

The « Residential with vegetable garden » standard scenario

Source : Espace Environnement

Vegetables : from 10% to 52% homegrown

Adults and children living in a house (building)
Consumption of home (=local) products

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Wallonie

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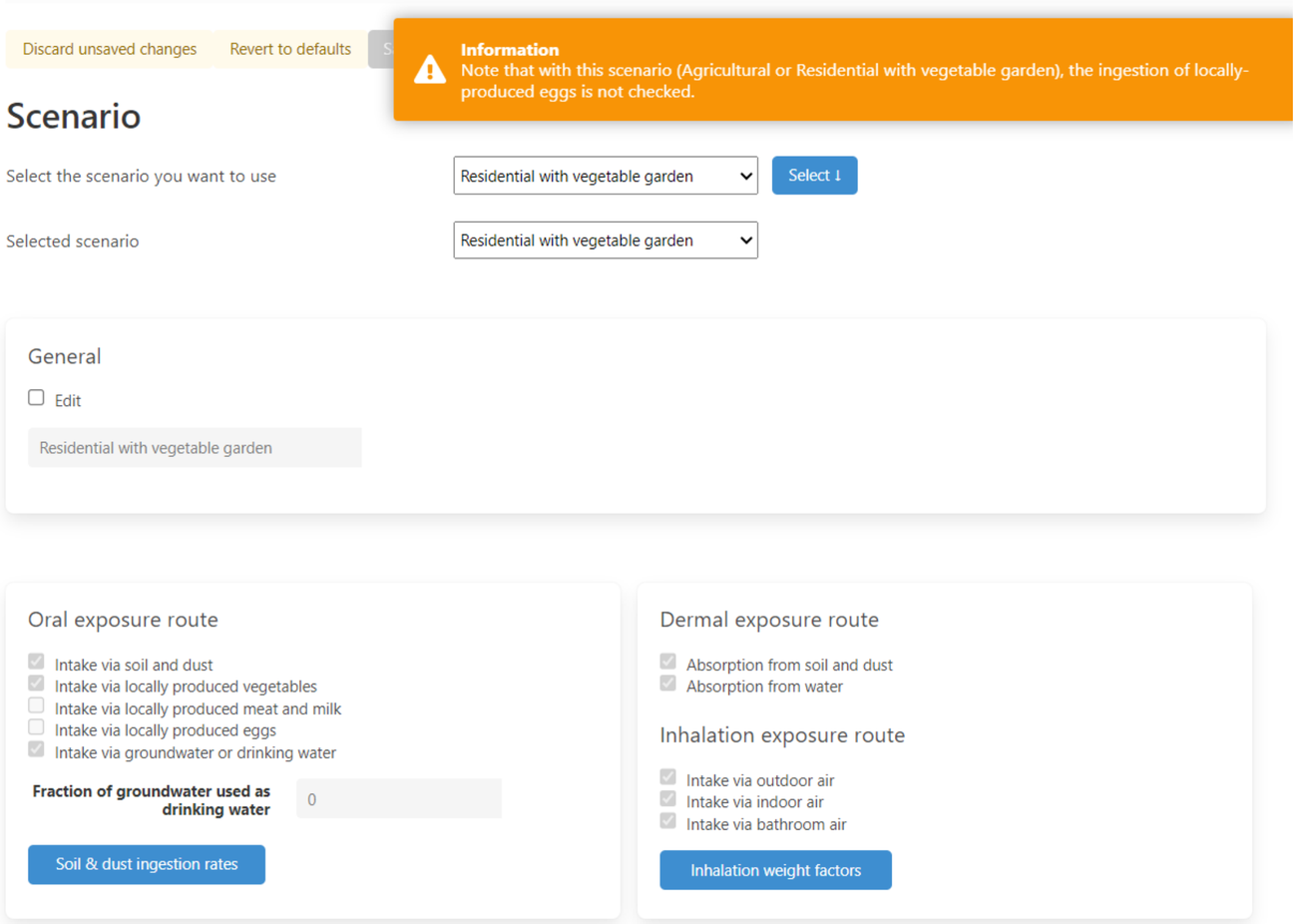
The « Residential with vegetable garden » standard scenario



Time spent inside (in the building) : 20 h/day

Time spent outside (in the garden) : 1,5 h/day

7 days/week – 52 weeks/year

Adults and children

Building with a basement

Dermal contact with soil

The « Day recreation outdoor sport » standard scenario

Source : David Shankbone

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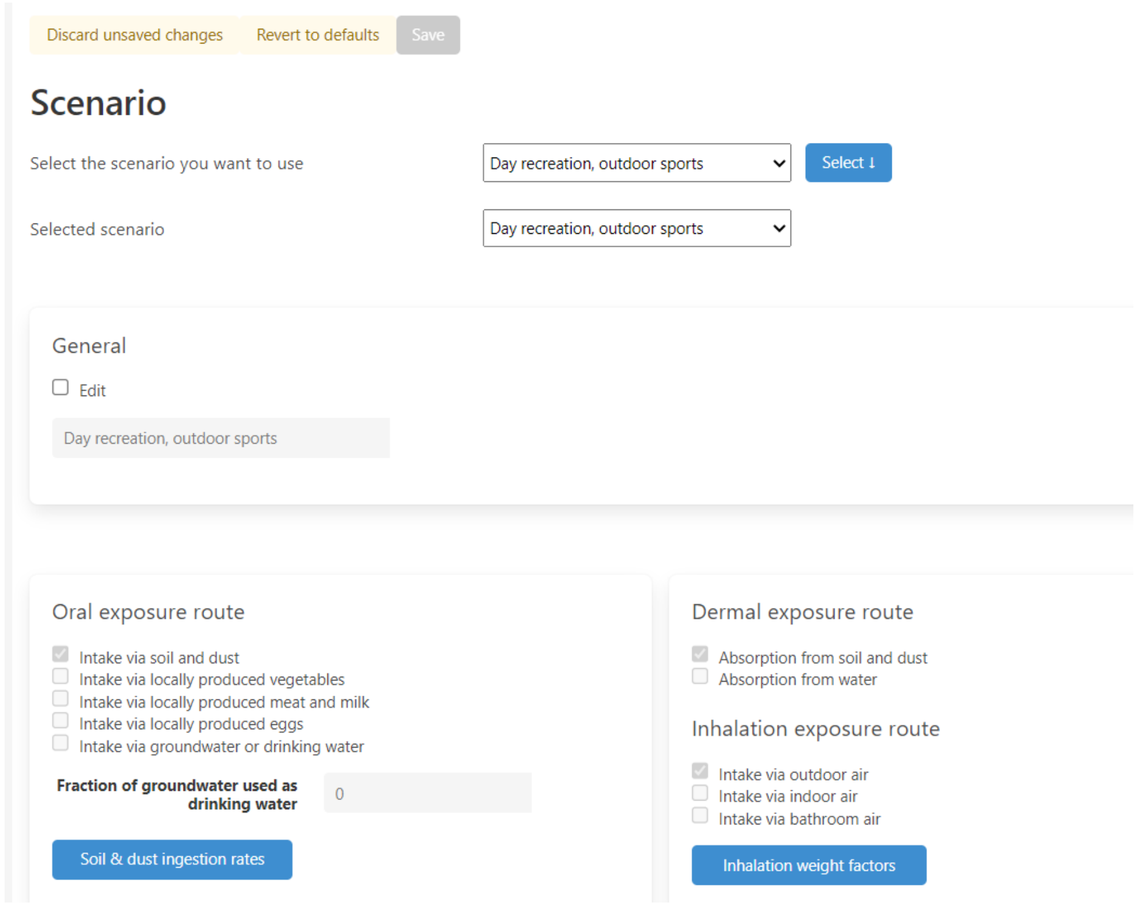
The « Day recreation outdoor sport » standard scenario



Time spent inside (the building) :
/

Time spent outside (on the site) :
Children = 8 h/day - 5 days/week – 8 weeks/year
Adults = 2 h/day - 2 days/week – 44 weeks/year

Adults and children

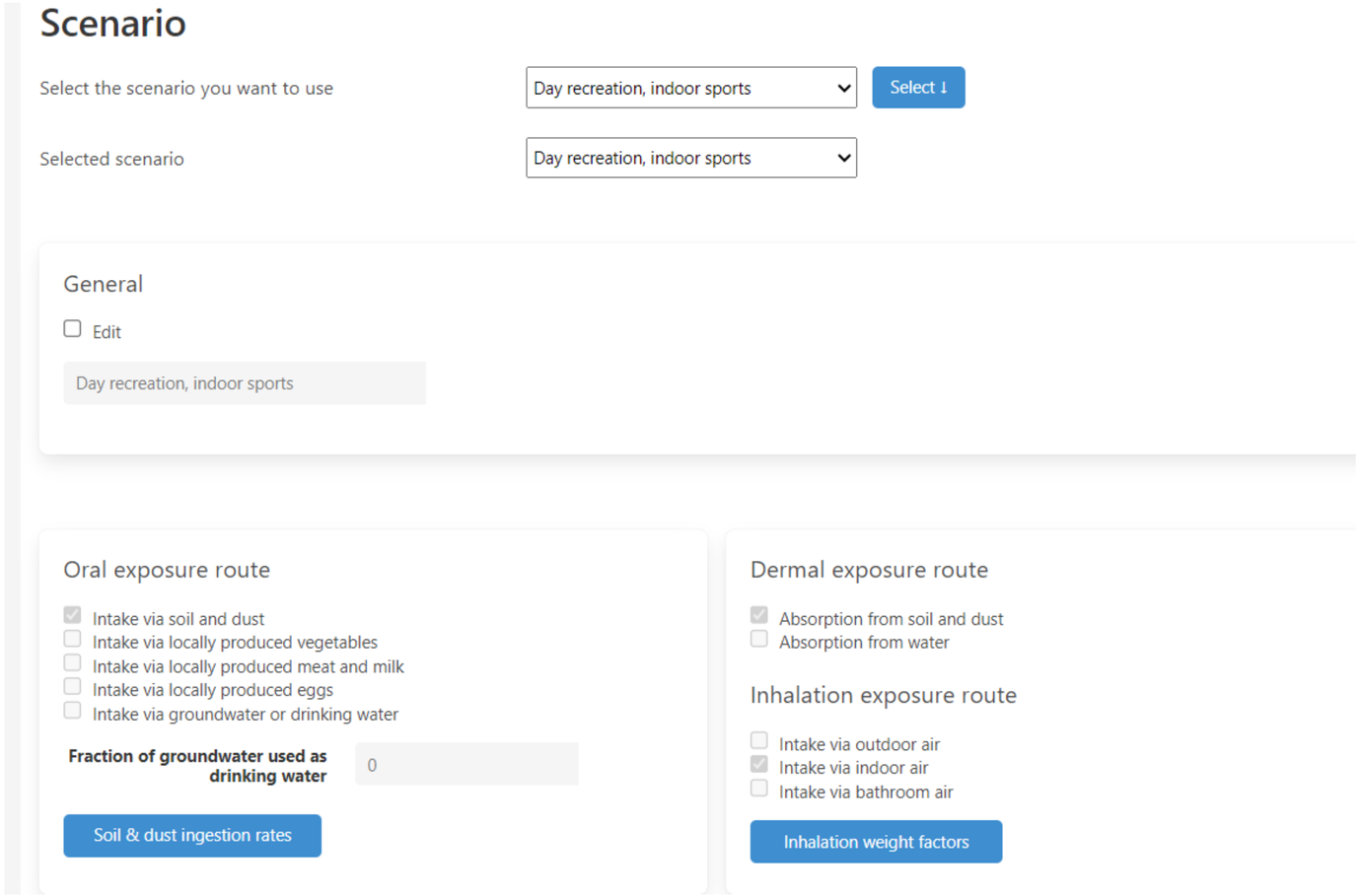
No building

Dermal contact with soil

The « Day recreation indoor sport » standard scenario

Source : David Shankbone

The « Day recreation indoor sport » standard scenario



Time spent inside (the building) :
2 h/day – 2 days/week – 44 weeks/year

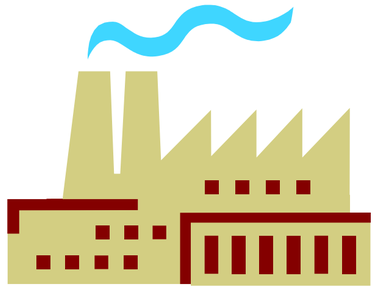
Time spent outside :
/

Adults and children

Building with a basement

Dermal contact with soil

The « Light industry » standard scenario



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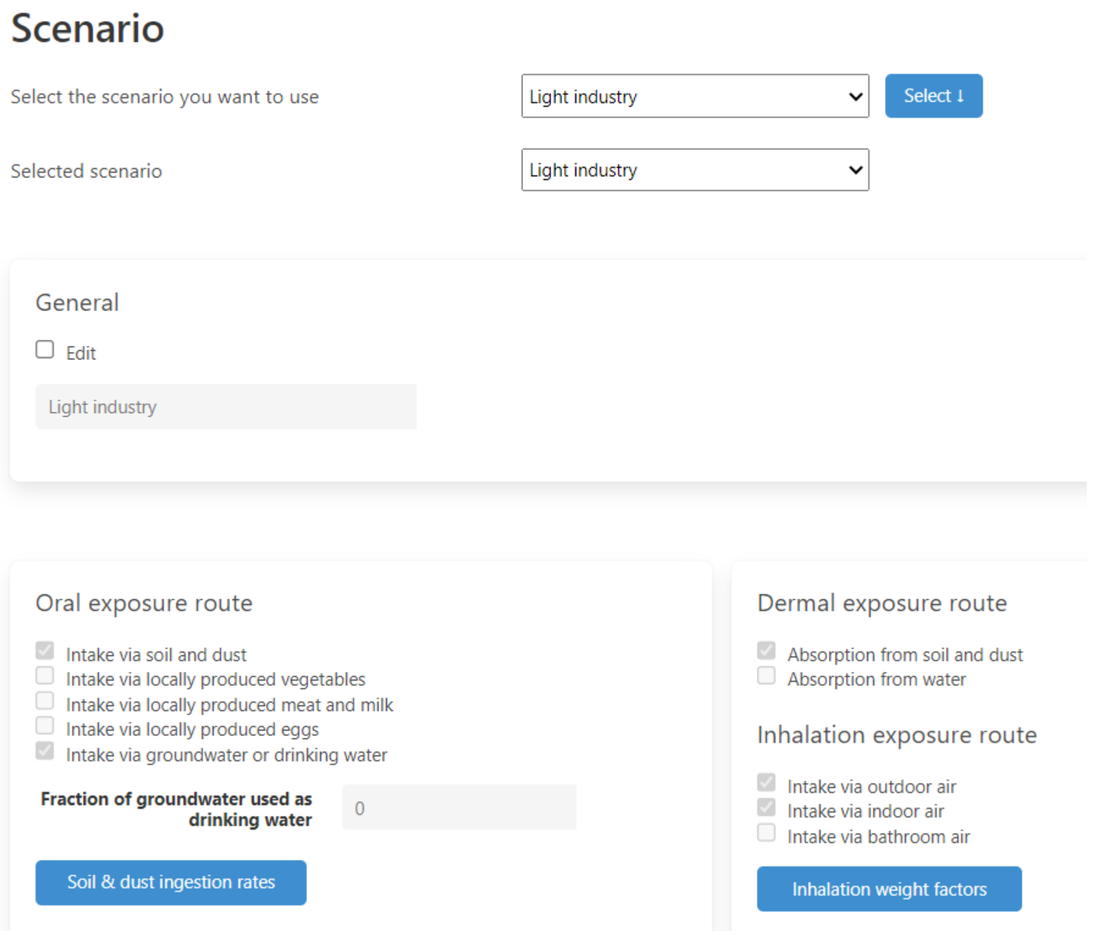
The « Light industry » standard scenario



Time spent inside (in the building) :
7 h/day

Time spent outside (car park):
1 h/day

5 days/week – 47 weeks/year

Adults only

Building with a basement

Dermal contact with soil

The « Heavy industry » standard scenario

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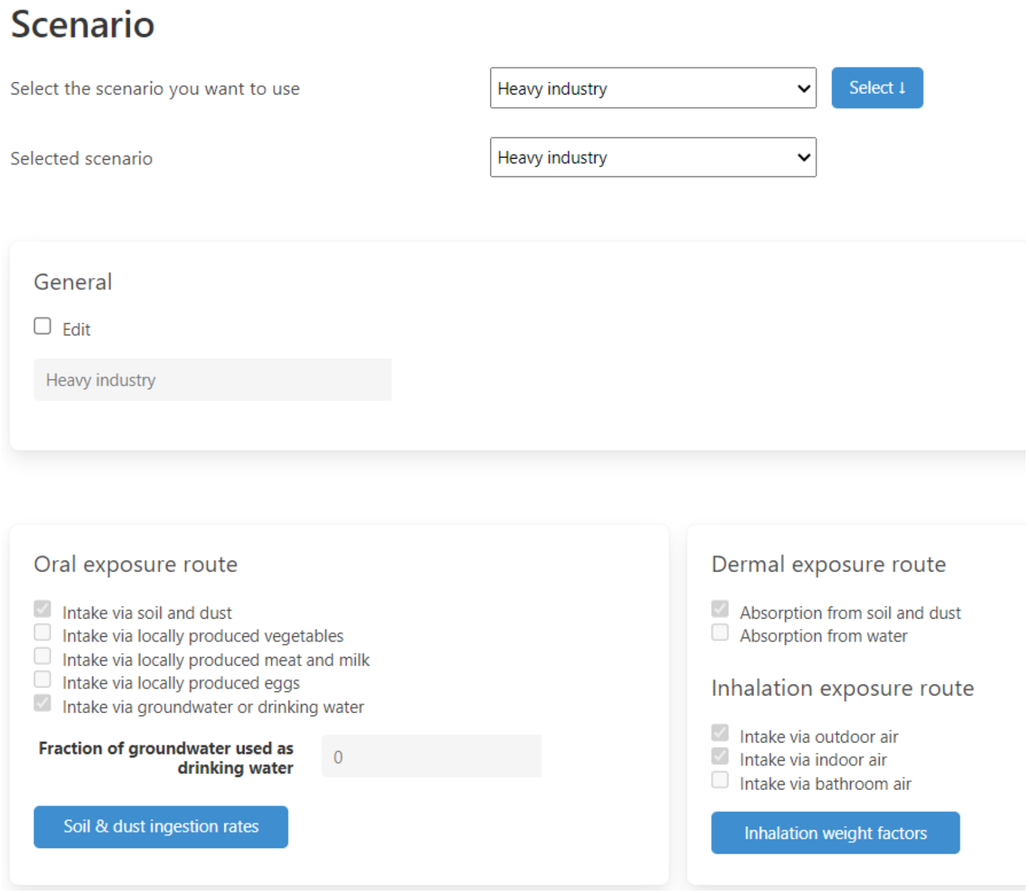
Construction workers in general

The « Heavy industry » standard scenario



Time spent inside (in the building) :
1 h/day

Time spent outside (on the site):
7 h/day

5 days/week – 47 weeks/year

Adults only

Building with a basement

Dermal contact with soil

Thanks for your attention

For any question :

s-risk@spaque.be

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