Development and application of decision support tools in ecologically sensitive areas: Syndial's experience

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ECOLOGICAL AND HEALTH RISK ASSESSMENT

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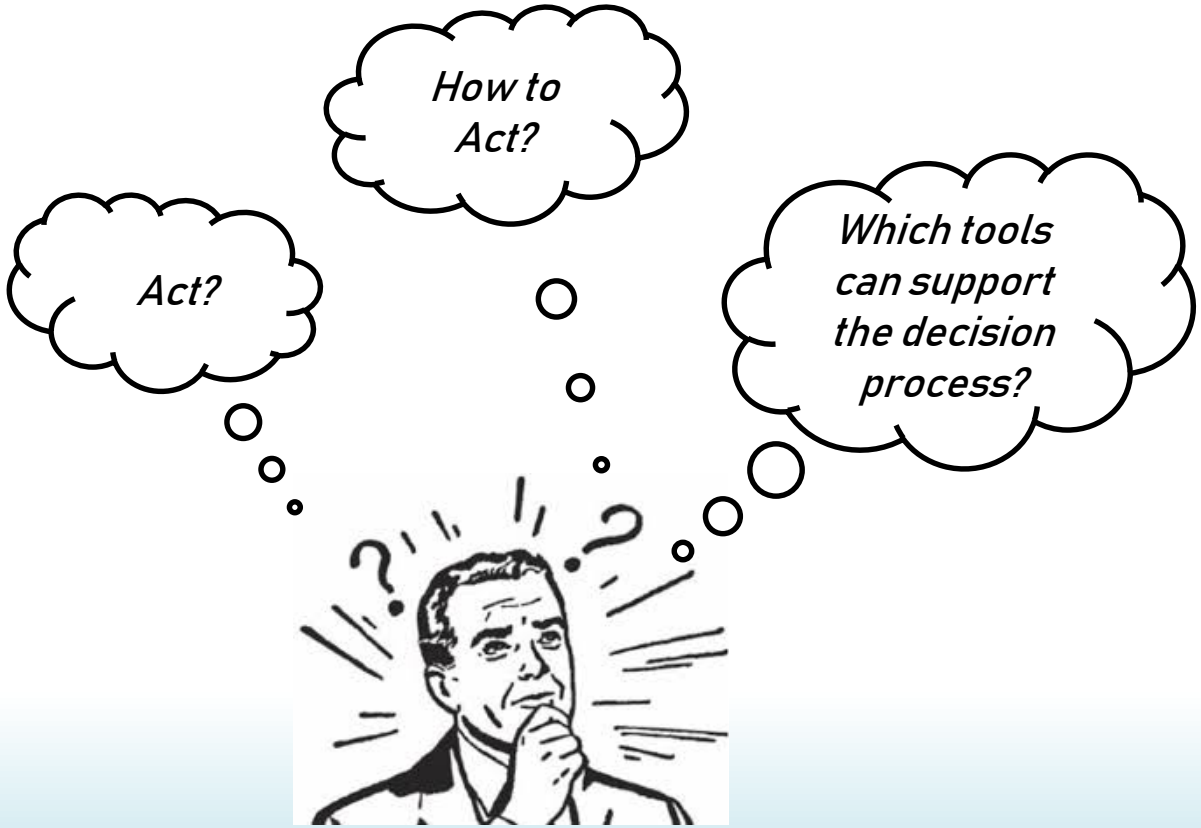
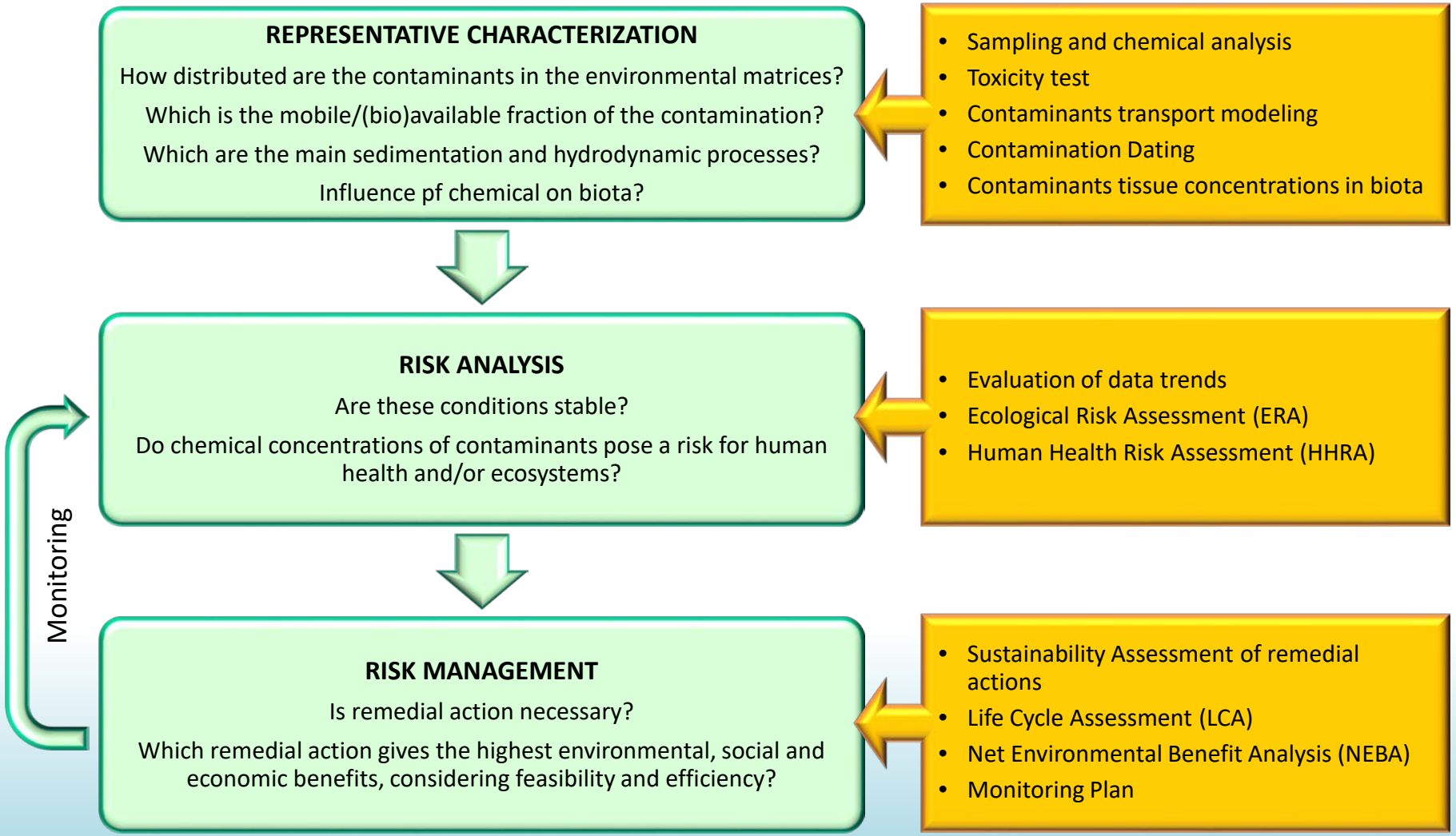
Contaminated Site Management in Ecologically Sensitive Areas

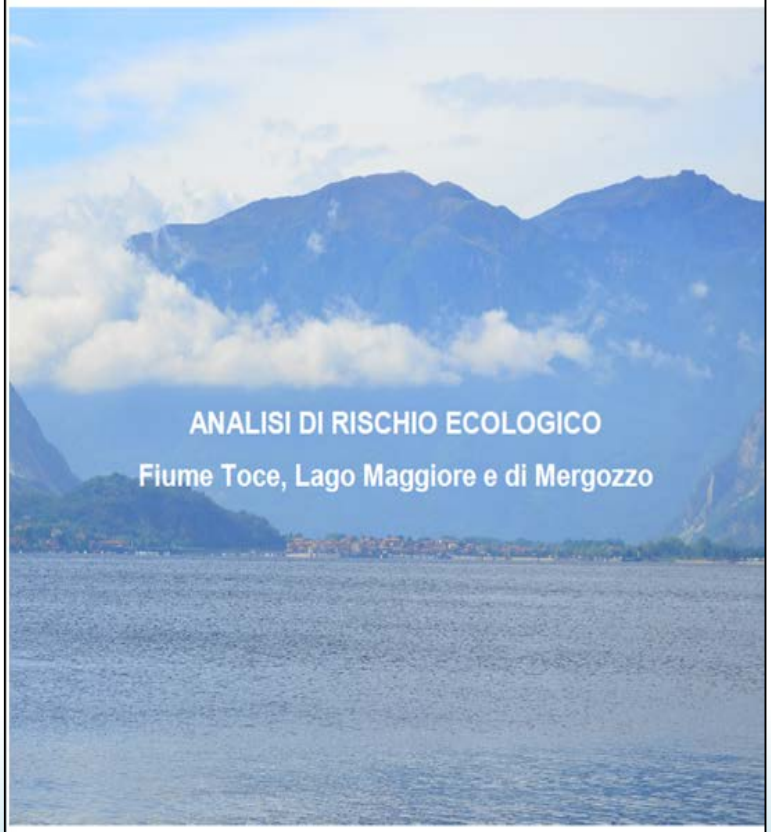


Decision Making Process



Syndial's Experience: Lake Maggiore Case Study

TERM OF REFERENCE (MACROAREA 2, TASK 5)



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Task 5 della Macroarea 2 - *Term of Reference* (Documento 2)

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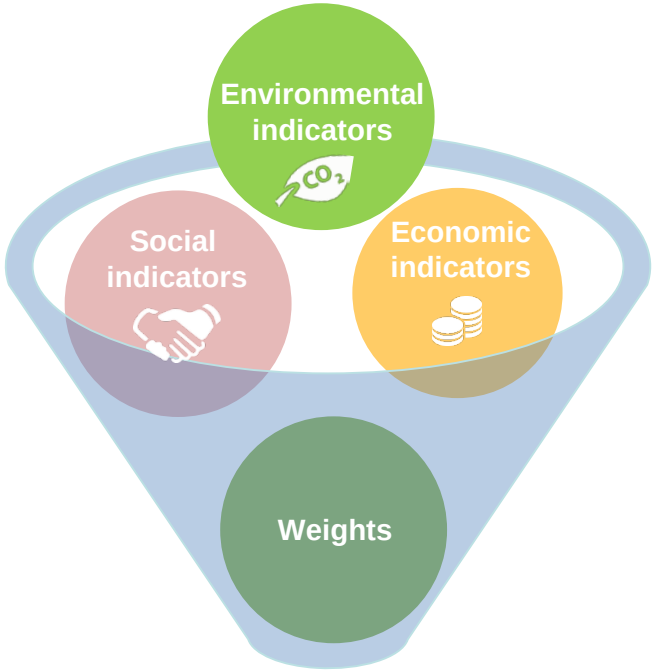
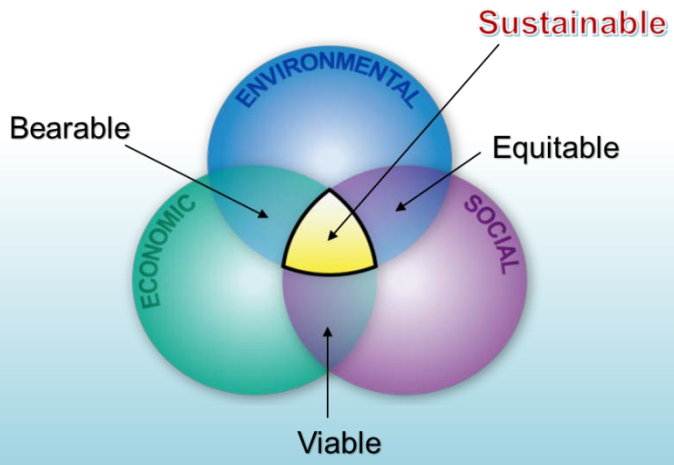
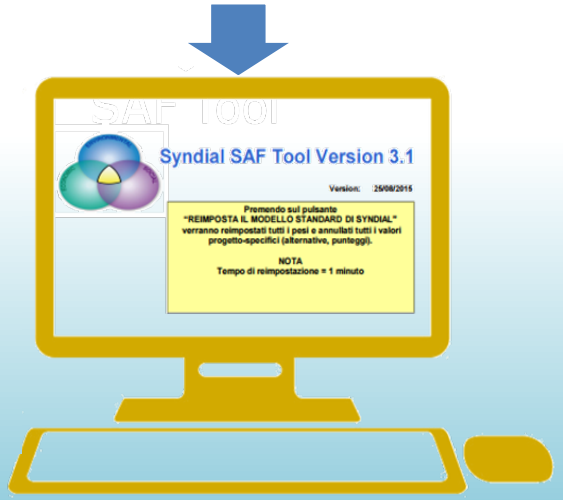
Syndial' s Experience: Sustainable Assessment Framework Tool

- Syndial has developed a decision-making tool (**Sustainable Assessment Framework Tool – SAF Tool**), to perform **Multi-Criterial Analysis** and compare different remedial alternatives based on sustainability criteria.
- SAF uses environmental, economic and social indicators and weights which are selected considering site specific conditions and priorities.





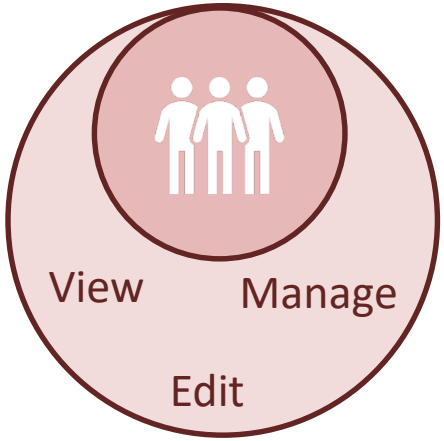


Collaboration between Syndial and Fondazione Università Ca' Foscari

- Upgrade of SAF implementing a new user friendly software (Responsive Progressive Web Application).
- Development of a specific LCA application for remediation technologies to be included in SAF.
- Development of a Social and Economic Model to evaluate impacts of remediation strategies and Corporate Social Responsibility to complement SAF assessments.
- Development of a general procedure for ERA applicable to sediments, internal surface water, transitional and marine-coastal water and to soil which could be potentially affected by contamination.
- Evaluating the inclusion of indicators associated to ERA in the SAF Tool.

Software improvements

- **Software infrastructure:** from a single Excel file to a **reactive web application**. This led to several improvements like:
  - **User management:** several users connected to the system each with own projects and data.
  - **Live data sharing:** different users simultaneously working on the same project.
  - **Transparent updates** allowing the system to be updated without requiring user intervention.

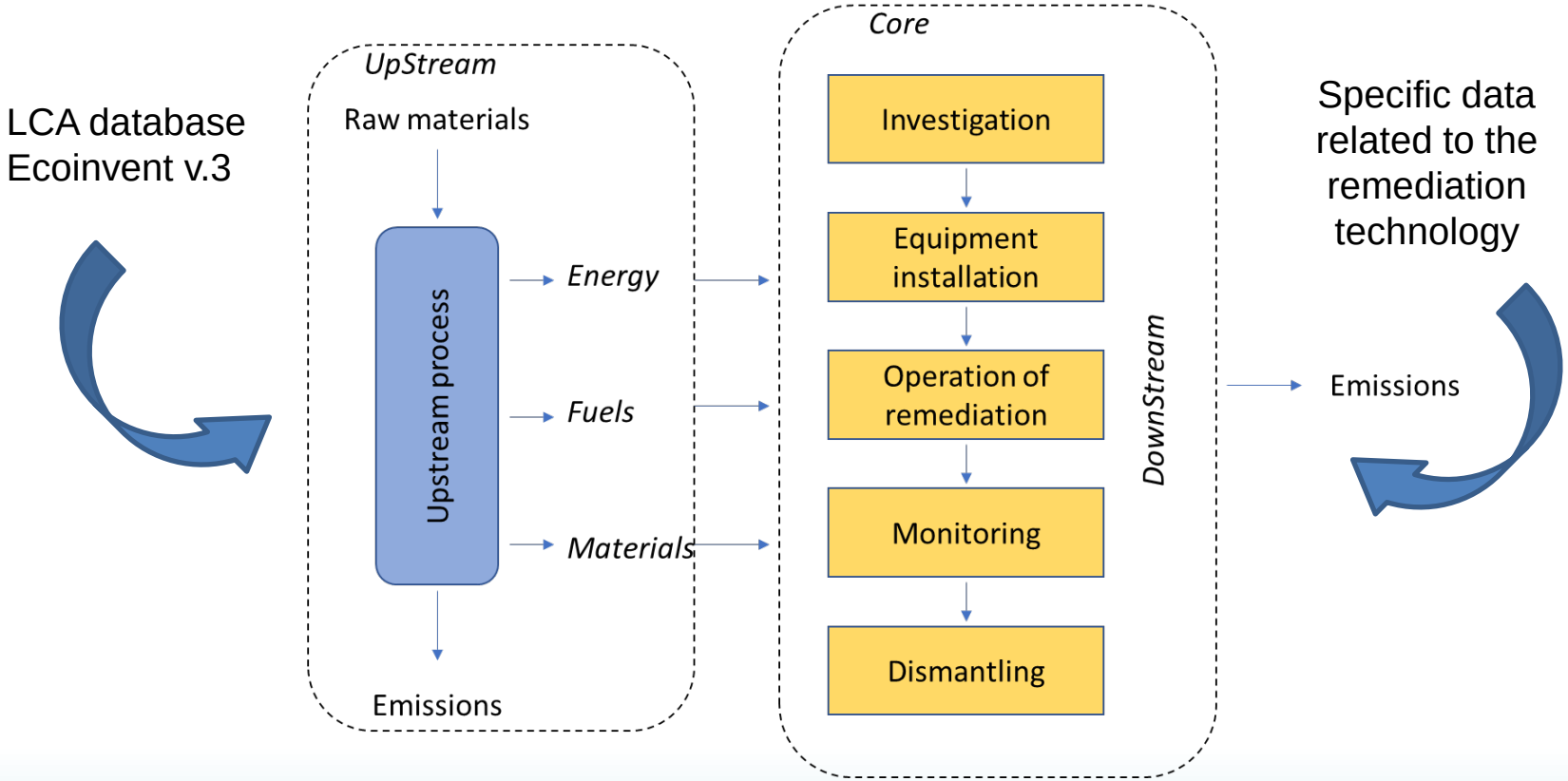


- The original **mathematical evaluation structure** based on weighted average has been **upgraded to a specific Multi-Criteria Decision Analysis (MCDA)** methodology built on Weighted Ordered Weighted Average (WOWA).
- The new **modular software infrastructure** allows for seamless feature additions which simplify future enhancements.

Life Cycle Assessment (LCA)

- From an inventory analysis to a impact assessment;
- From a USA-based tool to a Europe-based tool which include European and Italian data (Ecoinvent v.3);
- Remediation technologies are subdivided in components which are assessed and integrated in order to provide the impacts of that specific technology along the different life cycle stages;
- From a LCA software dependent assessment to a unconnected tool which can be run without using a LCA software.

General LCA model applied to remediation technologies



LCA "from cradle-to-grave", i.e. all the impacts deriving from the production processes of the consumer goods used during the remediation process. No consideration of the impacts deriving from the production of machinery and equipment used during the reclamation and of means of transporting materials to and from the site (capital goods).

Socio-economic assessment

- From indicators intended to measure exclusively the direct costs of the intervention, the costs of monitoring and the benefits of increasing the value of remediated land to a set of indicators which are divided in direct costs and benefits (i.e. directly related to the remediation), and indirect costs and benefits (i.e. related to the reuse of areas);

- Inclusion of cost-benefit analysis (CBA) within the MCDA (to estimate the *Net Present Value)*;

- Input-output models for the estimation of indirect and induced effects to assess the economic and social effects of the remediation in the territory of intervention

Ecological Risk Assessment (ERA) guidelines

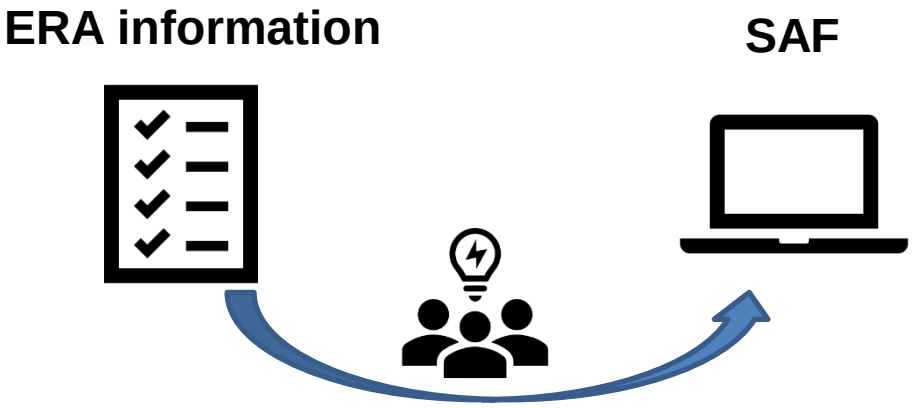
EPA
United States
Environmental Protection
Agency

Canada

CANADA-ONTARIO
DECISION-MAKING FRAMEWORK
FOR ASSESSMENT OF GREAT LAKES CONTAMINATED SEDIMENT

- ✓ Review of existing ERA guidelines (for contaminated sites) and EU technical documents (e.g. WFD)
- ✓ Analysis and extrapolation of methodologies and lessons learnt from a case study (Lake Maggiore)
- ➢ Development of a proposal for ERA guidelines for Italy (in progress)
- ➢ Evaluation of ERA indicators for SAF (future work)

Possible inclusion of ERA-related indicators in the SAF Tool



Site specific ERA provides several information on ecological sensitive areas, such as:

- identification of most sensitive ecological receptors
- relevant exposure pathways
- ecosystem structure and functions

These information potentially could be used to define indicators aimed to compare different remediation technologies (and related local ecological impacts). To be understood if and how these additional indicators could be included into the SAF analysis.

Conclusions

In sensitive ecological contexts, **if**, **how** and **where** to plan remediation actions cannot be done only considering soil screening values and human health risk assessment results, as currently required by the legislation, but should also consider:

- multi-disciplinary decision-making processes to frame the ecosystem context (ERA);
- the entire life cycle of the remediation intervention through a sustainability assessment (LCA-SAF).

To address these needs, a collaboration between Syndial and Fondazione Ca' Foscari has been started and will provide comprehensive tools integrating different aspects of sustainability (human health and ecological risk assessment, LCA, socio-economic assessment, multi-criteria decision analysis, etc.).

An evolution of the current legislation in this sector would assist those promoting the sustainable remediation of contaminated sites.

THANKS FOR THE ATTENTION

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