

Development of a simplified standardized method for the assessment of the environmental impacts associated to the processes of soil and groundwater remediation

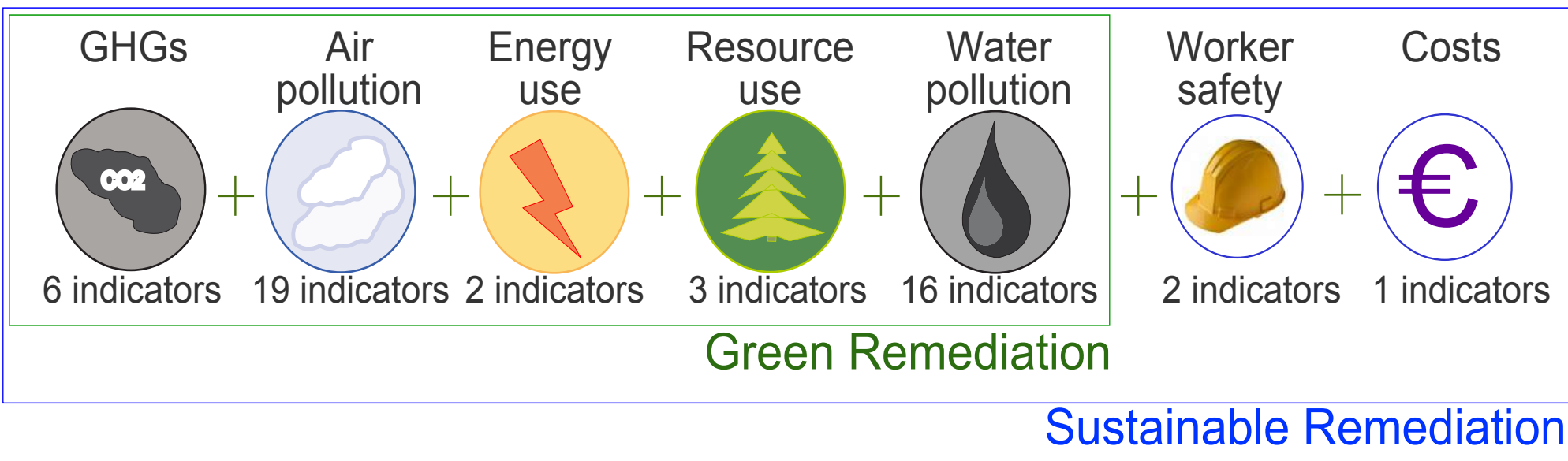
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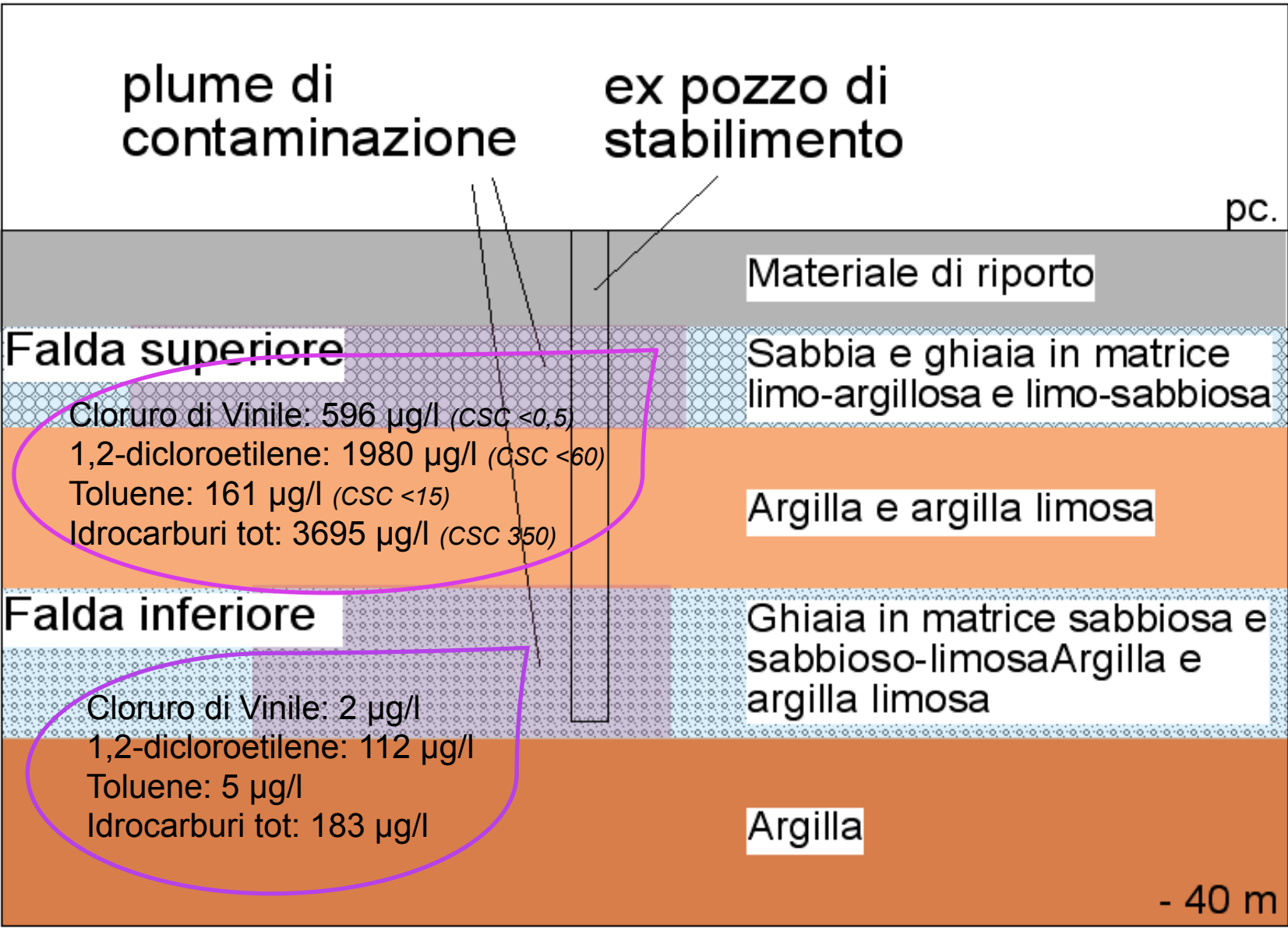
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Introduction

The project pretends to develop a simplified standardized method for the assessment of the environmental impacts associated to the processes of soil and groundwater remediation, considering specific indicators of the so called *green & sustainable remediation*.



Study case



The study case refers to the examination and confrontation of the main indicators for an environmental impacts assessment using the software SiteWise™. The comparison was conducted for three different groundwater remediation options for an industrial operative area which have been polluted by hydrocarbons and organo-chlorinated compounds.

The Risk Analysis highlighted the absence of sanitary risk, therefore the remediation interventions “Messa in Sicurezza Operativa” (MISO) have the objective of respecting the Contamination Thresholds (CSC) (tab. 2, Allegato V, parte IV, D.lgs. 152/2006).

The subsoil of the site is characterized by the presence of a continuous clay layer at the scale of the site that separates the groundwater at 6 m depth and at 18 m depth.

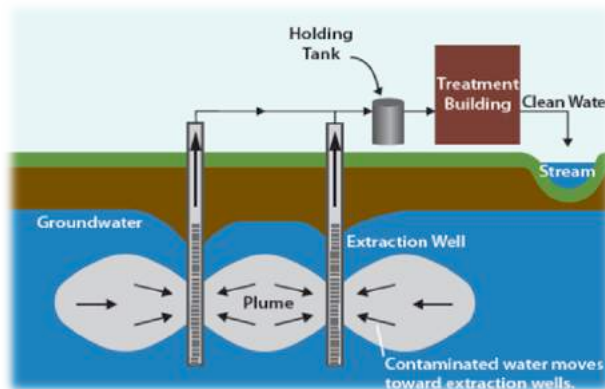
Both groundwater stratus are contaminated and the presence of a well of establishment, decommissioned about 10 years ago, is probably the cause of the transfer of contamination from the upper groundwater to the lower one. Remediation strategies relevant to the site examined in a comparative are: Pump & Treat (P&T), in-situ chemical oxidation (ISCO) and monitored natural attenuation (MNA). It is currently under way evaluating the applicability of bioremediation.

Method

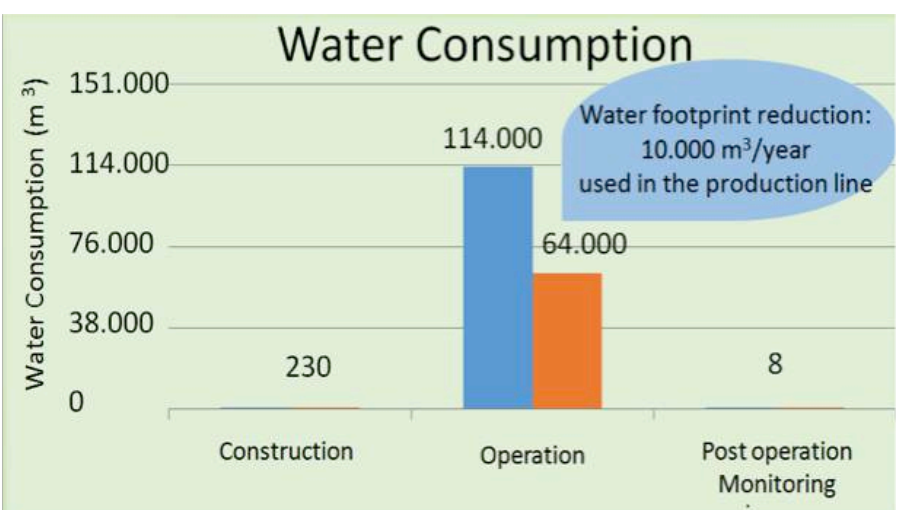
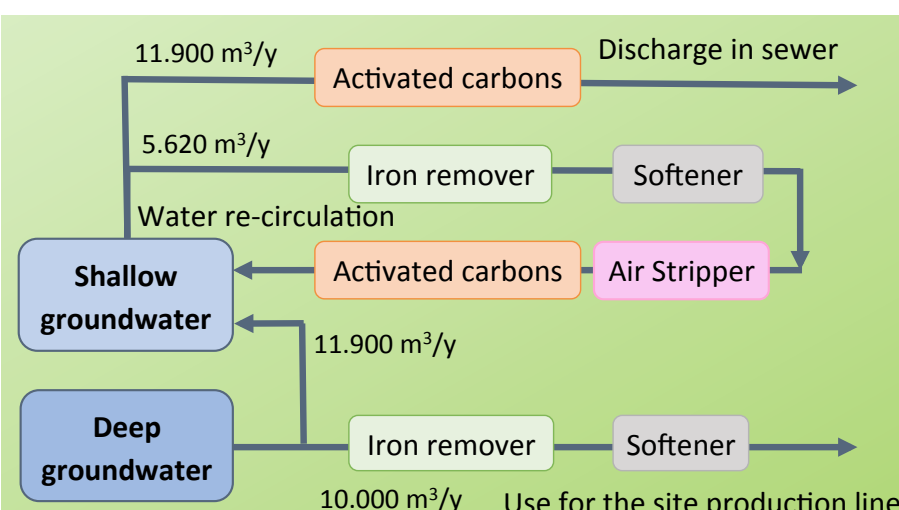
The software SiteWise™, V3 of 2013, a free use software developed by Battelle powered by the Environmental and technical assistance of the U.S. Navy, e U.S. Army Corps of Engineers, was used for the Environmental Impacts assessment associated to the remediation of the groundwater. The assessment indicators are: Emissions of SO_x, NO_x and greenhouse gases, PM₁₀, water and energy consumption and workers safety.

S&G REMEDIATION PHASES: PRELIMINARY ANALYSIS PLANTS CONSTRUCTION OPERATIVE PHASE MONITORING			
ACTIVITIES FOR EACH PHASE			
EQUIPMENT USE	RESOURCE CONSUMPTION	MATERIAL PRODUCTION	
EARTHWORK	WATER CONSUMPTION	WELL MATERIALS	
DRILLING	ON-SITE LAND AND WATER	TREATMENT CHEMICALS & MATERIALS	
TRENCHING	RESOURCE CONSUMPTION	TREATMENT MEDIA	
PUMP OPERATION		CONSTRUCTION MATERIALS	
DIESEL/GASOLINE PUMPS		WELL DECOMMISSIONING	
BLOWER, COMPRESSOR, MIXER, AND EQUIPMENT		BULK MATERIAL QUANTITIES	
GENERATORS			
AGRICULTURAL EQUIPMENT			
CAPPING EQUIPMENT			
MIXING EQUIPMENT			
INTERNAL			
COMBUSTION ENGINES			
OTHER FUELED EQUIPMENT			
OPERATOR LABOR			
LABORATORY ANALYSIS			
OTHER ON-SITE ACTIVITIES			
	TRANSPORTATION	WELL MATERIALS	Well type 1
	PERSONNEL TRANSPORTATION	Input number of wells	1
	EQUIPMENT TRANSPORTATION	Input depth of well (m)	10,20
		Chose specific casing material	Sch 40 PVC
		Chose well diameter (m)	0,30
		Input quantity of sand (kg)	0
		Input quantity of gravel (kg)	240
		Input quantity of bentonite (kg)	30
		Input quantity of cement (kg)	20
	DURATION AND COST		
	DURATION OF THE COMPONENT		
	COMPONENT COST / UNIT TIME		

Pump & Treat (P&T)

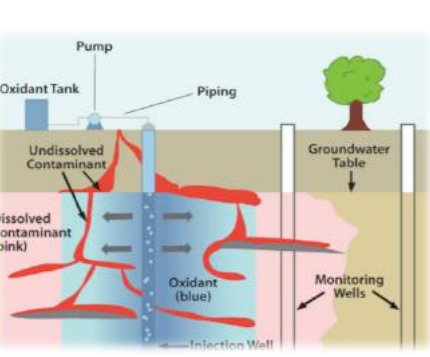


Intervention phase
Construction
Operation (5 years)
Monitoring post operation (5 years)

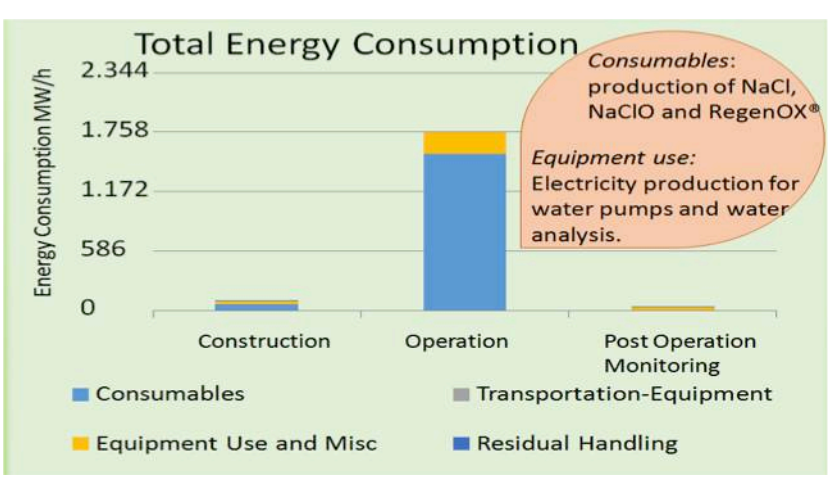
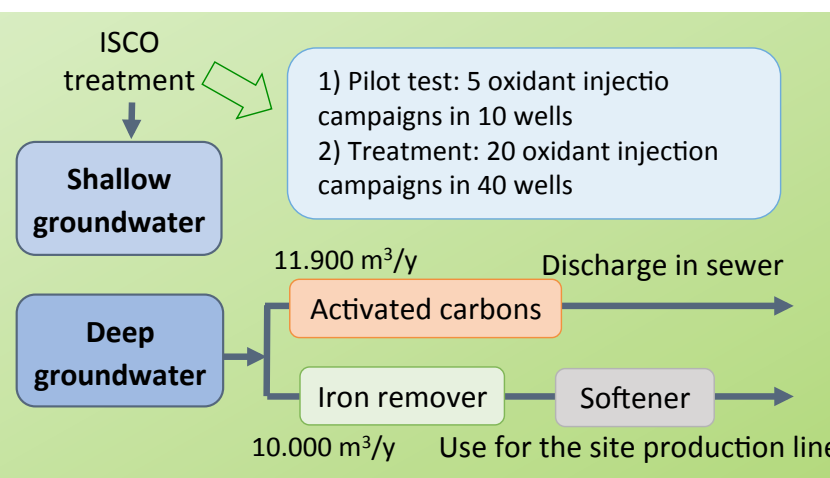


The water consumption due the extraction of groundwater is around 40.000 m³/y, about the half of the water amount extracted is able to be used in the production line of the company.

In-situ Chemical Oxidation (ISCO)

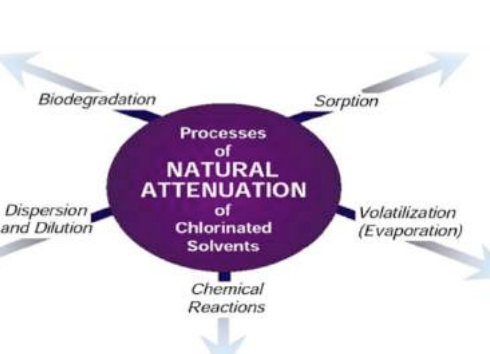


Intervention phase
Construction
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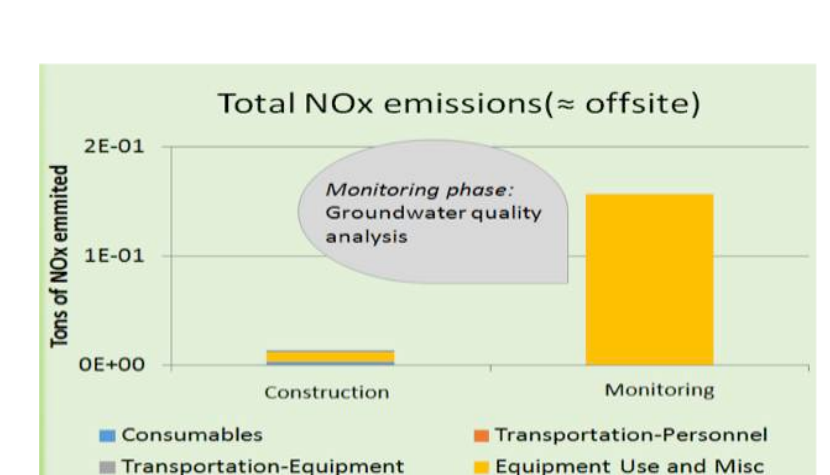
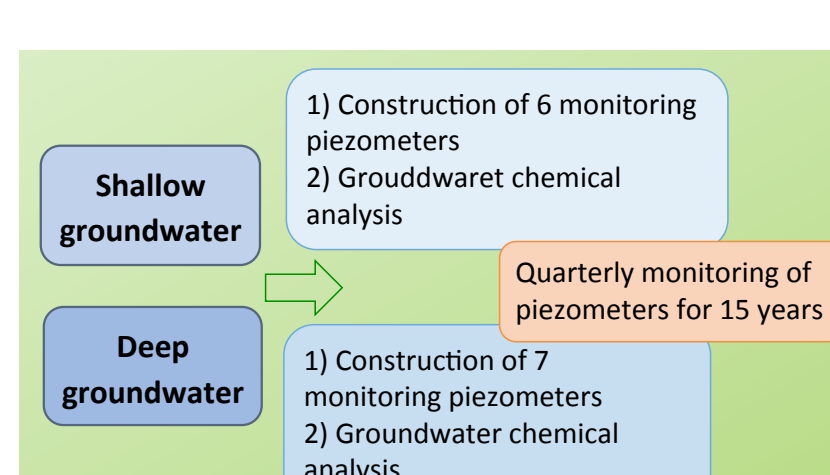


The SO_x, NO_x and PM₁₀ emissions are caused by the construction of wells for the injection of oxidants in the groundwater and the extraction of water from the lower aquifer.

Monitored Natural Attenuation (MNA)



Intervention phase
Construction: 5 piezometers and water analysis
Monitoring: quarterly 13 piezometers (15 years)



The off-site emissions are prevalent, compared to on-site emissions, during hydro-chemical monitoring of groundwater quality, which is the main activity of the MNA.

References

- D.Lgs. 152/2006, “Decreto Legislativo n. 152 del 3 aprile 2006: Norme in materia ambientale”
- Martina Costanza (2016) L'impatto ambientale delle operazioni di bonifica delle acque sotterranee. [Laurea magistrale], Università di Bologna, Corso di Studio in Ingegneria per l'ambiente e il territorio [LM-DM270].
- NAVFAC, 2013, SiteWise™ Version 3 User Guide, Naval FACilities Engineering Comman
- US EPA, 1996, Pump & Treat Ground-Water Treatment. A Guide for Decision Makers and Practitioners, U.S. Environmental Protection Agency
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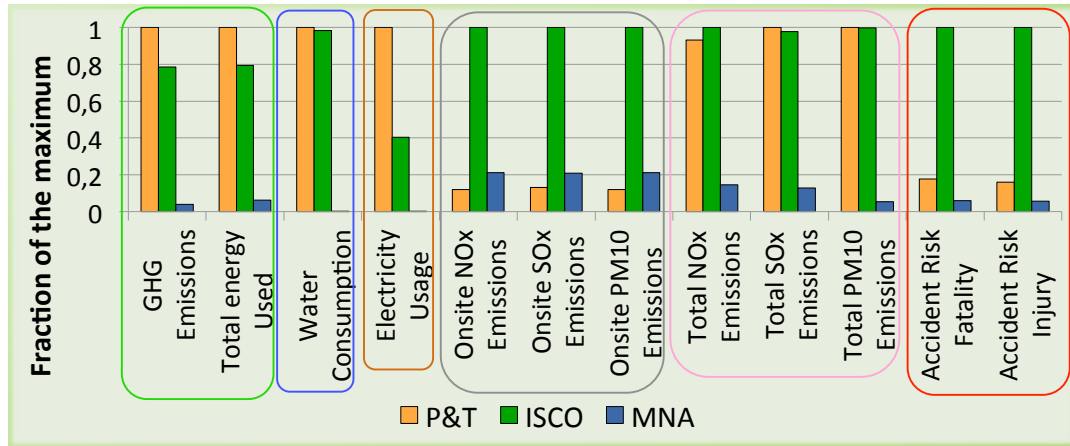
Results summary

The study pointed out:

- The comparison of the treatment options:

	P&T	ISCO	MNA
Total Cost	Low	High	Medium
Environmental impacts			
GHG Emissions	High	High	Low
Energy Usage	High	High	Low
Water Usage	High	High	Low
Electricity Usage	High	Medium	Low
Onsite NO _x Emissions	Low	High	Low
Onsite SO _x Emissions	Low	High	Low
Onsite PM ₁₀ Emissions	Low	High	Low
Total NO _x emissions	High	High	Low
Total SO _x Emissions	High	High	Low
Total PM ₁₀ Emissions	High	High	Low
Accident Risk Fatality	Low	High	Low
Accident Risk Injury	Low	High	Low

- the calculated normalized values for the environmental Impacts:



- a list of the treatment options based on impacts and costs:

Placement of the examined technologies		
Environmental indicators	low	Total costs
1) MNA	↓ high	1) P&T
2) P&T		2) MNA
3) ISCO		3) ISCO

PhDITalents project

The realization of the “Portal for a simplified assessment of the environmental Impacts” is a three years research project proposed by Ecosurvey® under the PhDITalents program, giving the opportunity to post PhD to be positioned in diverse companies. The present project was selected on May 2016 and is co-funded by the Italian Government of Instruction, University and Research (MIUR), Confindustria and CRUI foundation.



Moreover, the project received the “Seal of Excellence” by the European Commission in the frame of Horizon 2020: “The proposal was successful in a highly competitive evaluation process as an innovative project”



Certificate delivered by the European Commission, as the institution managing Horizon 2020, the EU Framework Programme for Research and Innovation 2014-2020

The project proposal 652297, GR Label

Green Remediation label®, a label to certify the environmental footprint of a remediation

The project aims to compare the different methods to calculate the environmental impacts, including SiteWise™ and SEFA-USEPA. Based on the results obtained it will be possible to make available a simplified method trough a web portal, to evaluate the environmental footprint of remediation activities. The calculation in real time of the environmental impacts will be supported by remote control systems of the plans. The environmental footprint calculation procedure will be validated on active remediation in Italy and shared with ISPRA and SEFA-US_EPA. For collaboration on the project and interest please visit: www.ecosurvey.it/ contatti.

Further information

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