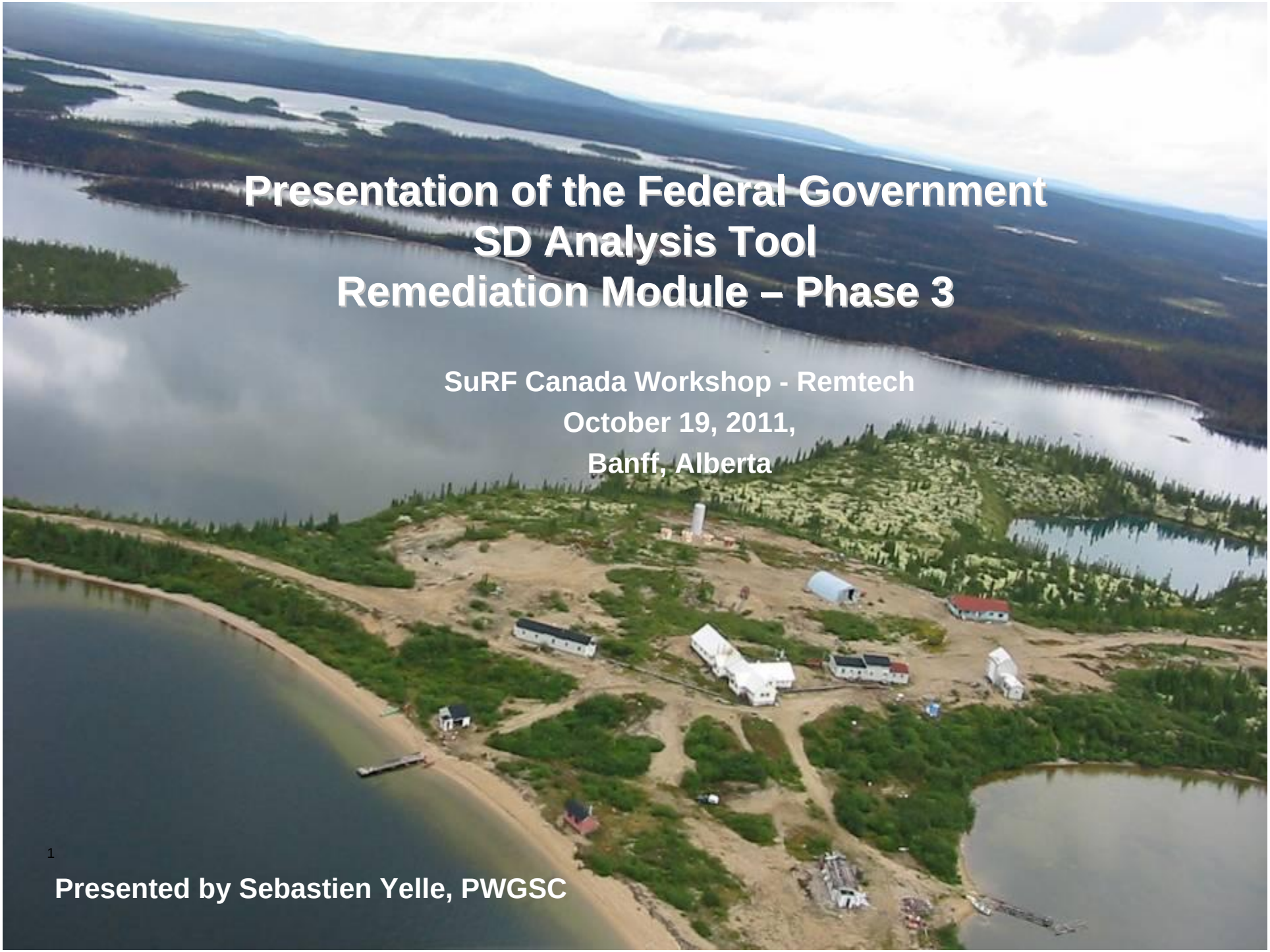


Presentation of the Federal Government SD Analysis Tool Remediation Module – Phase 3

SuRF Canada Workshop - Remtech

October 19, 2011,

Banff, Alberta

Presented by Sebastien Yelle, PWGSC

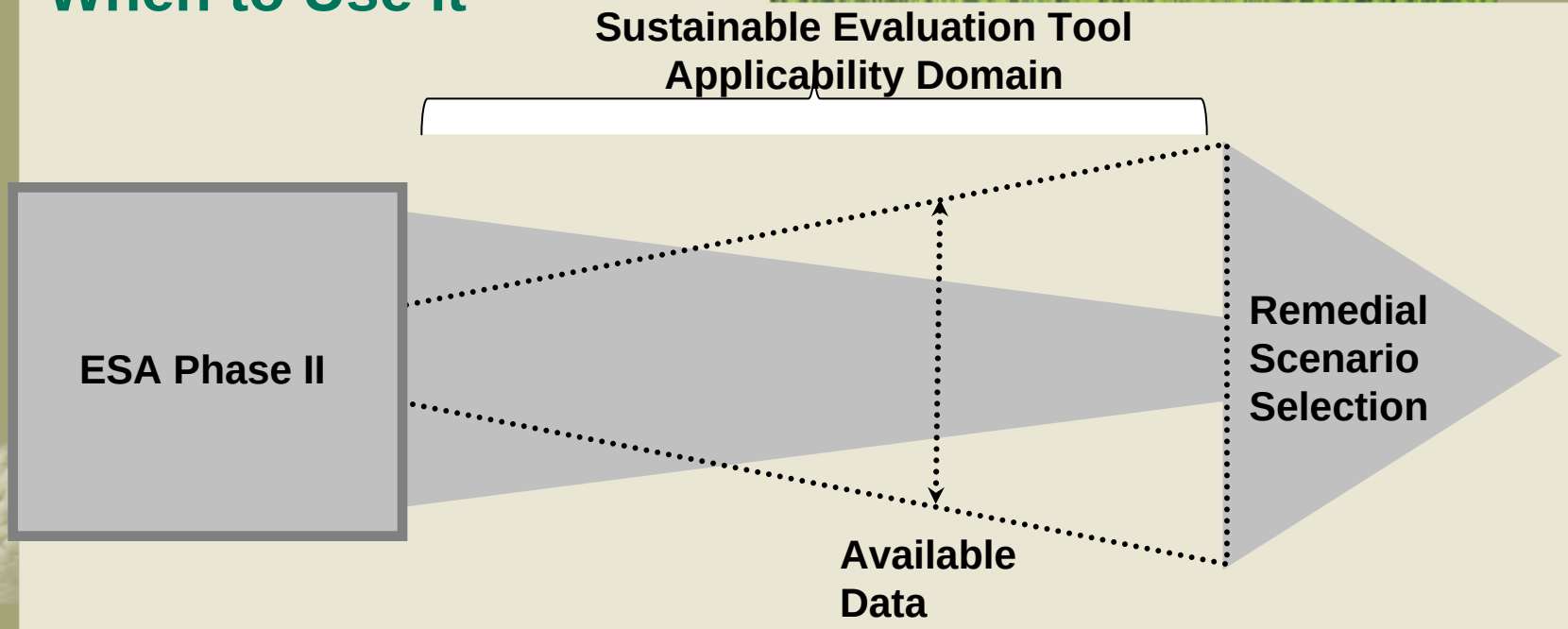
Introduction

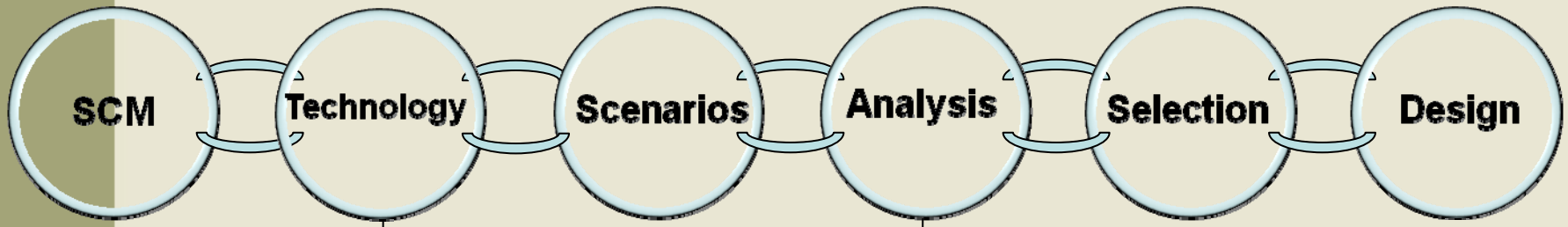
- Mains Objectives of the SD Tool
  - Integrate the three dimensions of SD in the Remedial Technologies Evaluation Process;
  - Allow the Evaluation Process using Readily Available Data (ESA Phase I and II);
  - Simplefy Communications of the Evaluation Process to the Different Parties Involved;
  - Better Understand Advantages and Limitations of Potential Applicable Remedial Technologies with Respect to SD Principles

Federal Contaminated Sites

2007	2008 - 2009	2009 - 2010	2010 - 2011
GoldSET©	**First Generation**	**Second Generation**	**Third Generation**
integrate SD principles into engineering projects with regards to the SD aspects: - Environmental - Social - Economic • Used commercially since 2007 worldwide	A literature review supporting the selection of indicators and SD aspects The adaptation of the GoldSET© remediation module to comply with the Federal Government's requirements The development of the tool to compare five technologies: - Pump and treat - *In situ* bioremediation - *In situ* chemical oxidation - Excavation and disposal - Multiphase extraction A simplified Life Cycle Analysis to quantify indicators: - Water Consumption - GHG Emissions - Energy Consumption - Solid Waste	The analytical process is simplified based on qualitative indicators only (except for costs) Eight technologies are added to the tool: - Phytoremediation - Excav. and soil washing - Excav. and *ex situ* thermal desorption - Permeable reactive barrier - Excav. and *ex situ* chemical oxidation - Natural attenuation - Excav. and landfarming - Excav. and biopiles The creation of a weighing module	Introduction of the treatment train concept More flexibility for remedial scenarios development Four technologies are added to the tool: - Solidification/stabilization - In situ bioventing - In situ thermal desorption - Excavation and on site biopile treatment Introduction of risk-based management approaches: - Institutional controls - Light works - Hydraulic containment

When to Use it





GOST

SD Tool

Type of Indicators

Type	Evaluation Scheme	Description	# of Indicators
Quantitative	Normalized	When quantitative values are known, they are compared the other options in order to obtain a value between 0 and 100 (100 being the best option).	1
Qualitative	Generic	Generic indicators receive a score of 0, 33, 66, or 100, depending on the technology`s efficiency, but independently of site-specific characteristics. The scores of the generic indicators are found in the *Reference (1)* tab.	18
	Semi-generic	Based on site-specific characteristics specified in the *Site Description* tab, semi-generic indicators receive a score of 0, 50, or 100, depending on the technology's efficiency. The scores of the semi-generic indicators are found in the *Reference (2)* tab.	4
	Custom	The custom scoring scheme is indicator-specific and is used to incorporate some indicators in the assessment. A good understanding of the technology, the project and its context is required to choose the appropriate score.	10

Federal Contaminated Sites

Environmental (15)	Social (9)	Economical (9)
Soil Quality	Public and Worker's Safety	Technology Cost
Soil Vapour Intrusion	Project Duration	Litigation Potential
Groundwater Quality	Quality of Life (During the project)	Nuisance to Normal Operations
Free Product	Public Benefits	Property Reuse
Surface Water Quality	Cultural Heritage	Environmental Liability
Impact on Drinking Water Supply	Federal Government's Image	Local Economic Benefits
Off-site Migration	Traffic	Technical Reliability (Maintenance & Repair)
Quality of Physical Environment	Impact on Landscape	Logistics
Impacts on Terrestrial Life (Fauna & Flora)	Innovation	Technological Uncertainty
Impacts on Aquatic Life (Fauna & Flora)		
Greenhouse Gas Emissions		
Residual Waste Production		
Natural Resources		
Energy Consumption		
Water Consumption		

Presentation of the Tool
Case Study

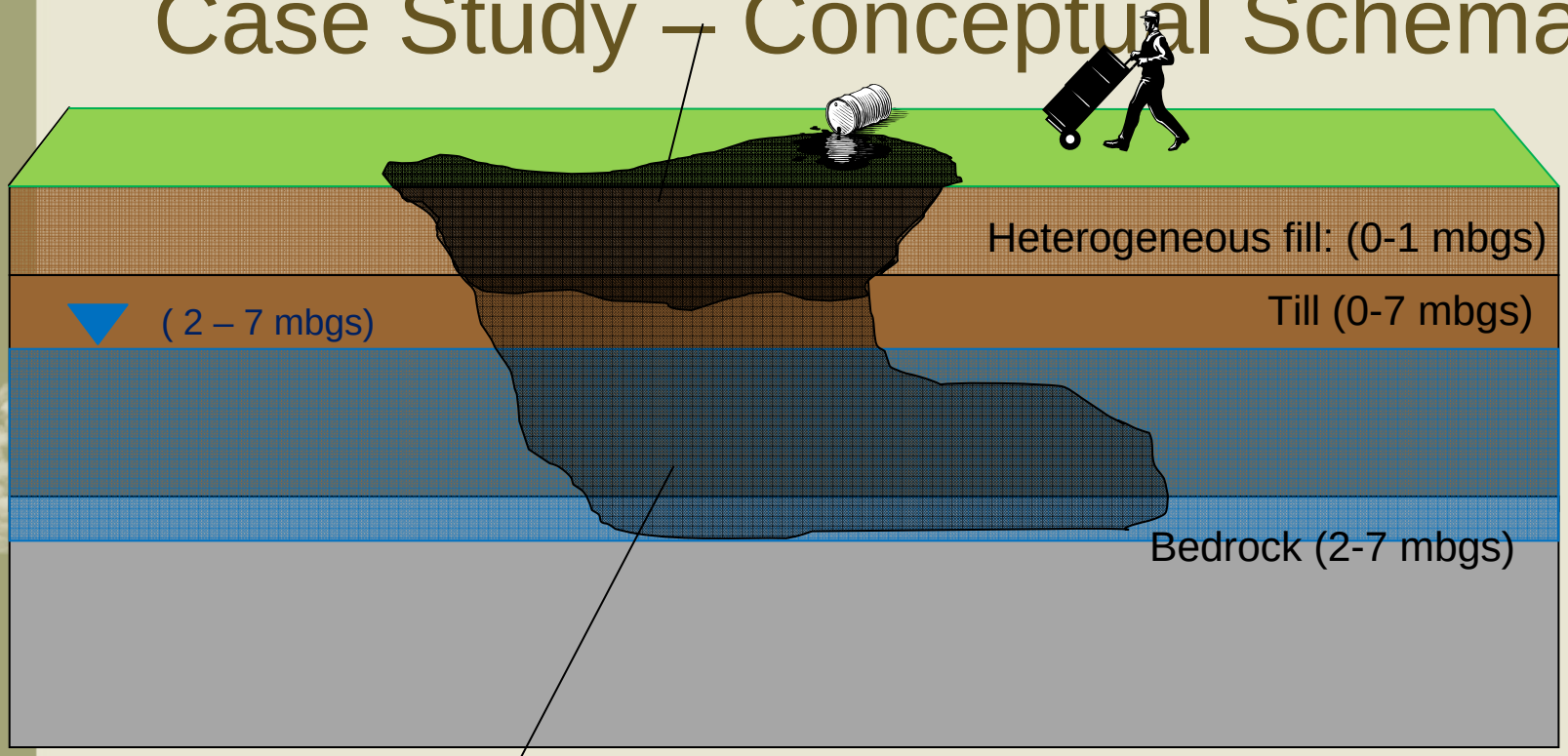
Evaluation Process

Case Study

- Site uses for:
  - Storage of deicing salts and sand;
  - Truck repair/fuel supply;
- Main contaminants are:
  - PH in soil
  - PH, Cl, Na in groundwater
- Main Potential Issues are :
  - Plume migration (seepage cliff face);
  - Contact with impacted surficial soils;

Soil impacted by hydrocarbons
(from surface to ~ 2 m)

Case Study – Conceptual Schema



Groundwater impacted with dissolved inorganic non-metallic compounds (Cl, Na), and hydrocarbons

Step 1 – Site Conceptual Model

Scenario:	Scenario A
Primary Contaminant Type:	Petroleum Hydrocarbons
Secondary Contaminant Type:	Non-Metallic Inorganic Compounds
Presence of Free Phase:	no
Remediation Objective(s)	Combination of full removal of contaminated soil in situ Reduce the off-site migration of the contaminants
Project Stakeholders	Provincial Government (BC), Residential area, Workers on site First nations?
Relative importance of primary and secondary contaminations (if applicable):	Situation 2

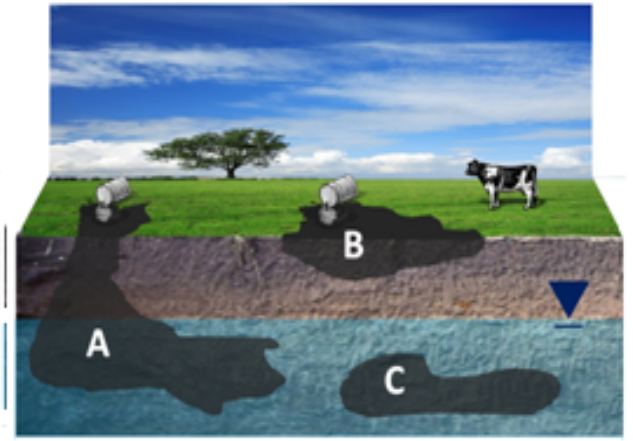


Figure 1: Choice of three environmental contamination scenarios proposed by the analytical tool.

	Vadose Zone	Saturated Zone
Contaminated Zone:	yes	yes
Soil Type:	Heterogeneous	Heterogeneous
Primary Contaminant Max. Depth:	Shallow (0-3 m)	Medium (3-10 m)
Secondary Contaminant Max. Depth:	Deep (deeper than 10 m)	
Primary Contaminant Concentration:	Low to Medium	Low to Medium
Secondary Contaminant Concentration:	Low to Medium	Low to Medium

Step 2- Indicators

- Most important indicators (higher weight)

Environment
- Soil & GW Quality
- Impact on Drinking Water Supply
- GHG Emissions
- E consumption

Social
- Public and Worker's Safety
- Federal Government's Image

Economic
- Technology Cost
- Nuisance to Normal Operations
- Environmental Reserve

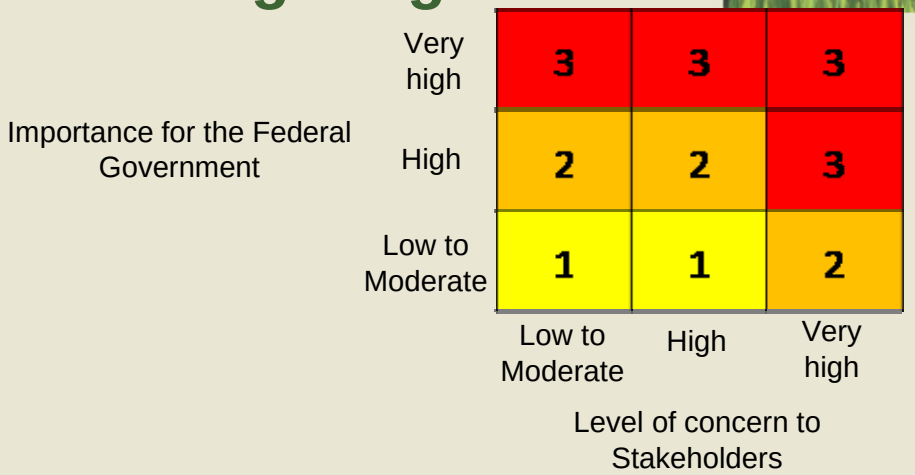
- "Not applicable" indicators:

Environment
- Free Product
- Surface water quality
- Quality of Physical Environment
- Impacts on Terrestrial & Aquatic Life

Social
- Public Benefits
- Cultural heritage

Economic
- Litigation Potential
- Property Reuse

Step 2 - Weighting



INDICATOR	FEDERAL GOVERNMENT (IMPORTANCE)	STAKEHOLDERS (LEVEL OF CONCERN)	COMMENTS / JUSTIFICATIONS	WEIGHT
ENVIRONMENTAL ASPECT				
Semi-generic	**Very high**	**High**		
Soil Quality: ENV-1	**The indicator is related to one of the objectives of the project or an objective of the FCSAP**	**Stakeholders regard the indicator as important but are not likely to react to this aspect of the project**		3
Applicable				

Step 3 - Treatment scenarios

Comparison of up to 5 different Remedial scenarios

For the current case – 3 scenarios:

1. Excavation and on-site Treatment combined with Pump & Treat

2. Bioventing combined with a Permeable reactive barrier

3. Excavation & off-site treatment combined with institutional control/NA

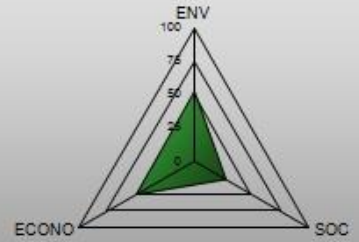
Step 4 - Technology Selection

		Option 1			Option 2			Option 3		
	Remediation Options	Exc. & on-site Treatment / Pump & Treat		Technological Applicability Indicator	Bioventing / Permeable Reactive Barrier		Technological Applicability Indicator	Exc. & off-site disposal / Institutional Control		Technological Applicability Indicator
Vadose Zone Applicable	**Primary Technology** — Primary Contaminant Type:Petroleum Hydrocarbons	Excavation and Biopiles		100	In Situ Bioventing		50	Excavation and Disposal		100
Vadose Zone Applicable	**Secondary Technology** — Secondary Contaminant Type:Non-Metallic Inorganic Compounds	Excavation and Biopiles		50	In Situ Bioventing		50	Excavation and Disposal		100
Saturated Zone Applicable	**Primary Technology** — Primary Contaminant Type:Petroleum Hydrocarbons	**Groundwater**	Pump and Treat	50	**Groundwater**	Permeable Reactive Barrier	100	**Groundwater**	Risk Management (Institutional Control)	100
Saturated Zone Applicable	**Secondary Technology** — Secondary Contaminant Type:Non-Metallic Inorganic Compounds	**Groundwater**	Pump and Treat	50	**Groundwater**	Permeable Reactive Barrier	100	**Groundwater**	Risk Management (Institutional Control)	100
	Free Phase Management	**Non Applicable**		Non Applicable	**Non Applicable**		Non Applicable	**Non Applicable**		Non Applicable
	Option Description									

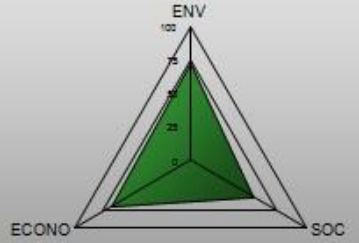
Step 5 - Results Analysis

The most sustainable option is represented by the biggest and most balanced triangle

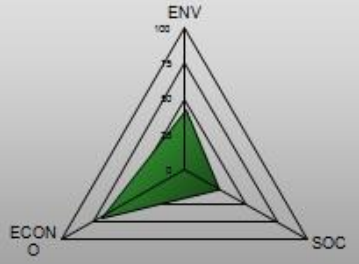
Exc. & on-site Treatment / Pump & Treat	
ENVIRONMENT	53%
SOCIETY	27%
ECONOMY	50%



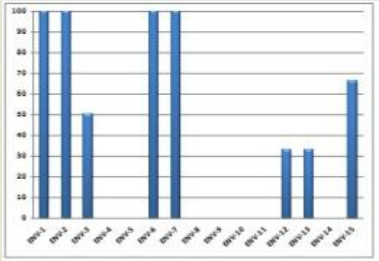
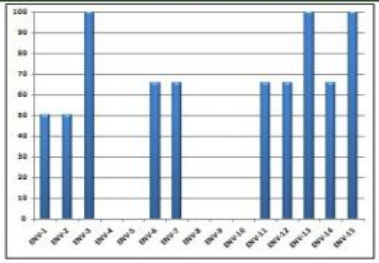
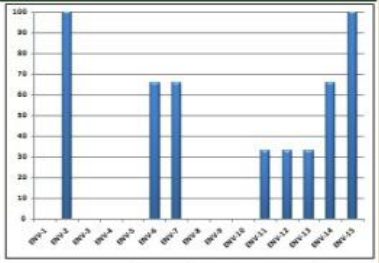
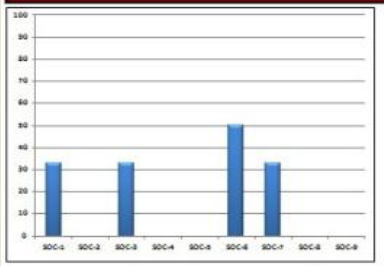
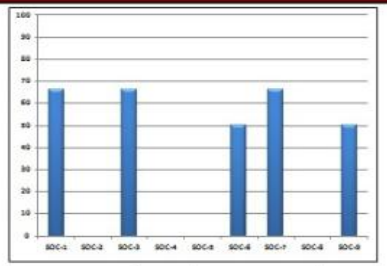
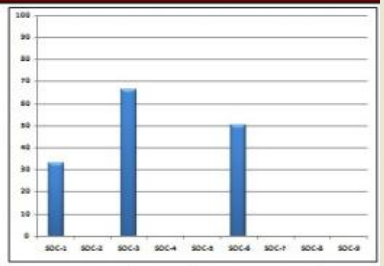
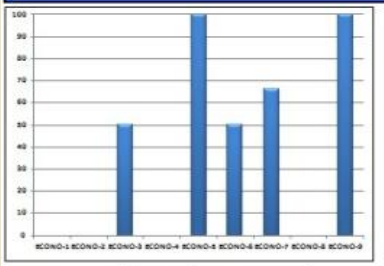
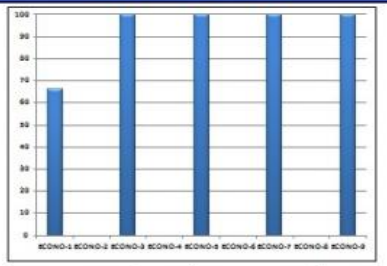
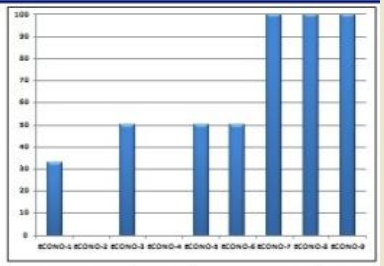
Bioventing / Permeable Reactive Barrier	
ENVIRONMENT	74%
SOCIETY	54%
ECONOMY	68%



Exc. & off-site disposal / Institutional Control	
ENVIRONMENT	43%
SOCIETY	27%
ECONOMY	68%



Federal Contaminated Sites

Exc. & on-site Treatment / Pump & Treat	Bioventing / Permeable Reactive Barrier	Exc. & off-site disposal / Institutional Control
PERFORMANCE ENVIRONNEMENTALE		
		
Rank: 2 Score: 53%	Rank: 1 Score: 74%	Rang: 3 Score: 43%
PERFORMANCE SOCIALE		
		
Rank: 2 Score: 27%	Rank: 1 Score: 54%	Rank: 2 Score: 27%
PERFORMANCE ÉCONOMIQUE		
		
Rank: 3 Score: 50%	Rank: 2 Score: 68%	Rank: 1 Score: 68%

Conclusions

- The SD Analysis Tool: Visual, User-Friendly & Flexible
  - Structures the decision process
  - Supports transparent decision-making
  - Simplifies the conceptualization process of abstract principles
  - Helps in project risk management
  - Serves as awareness tool for federal contaminated sites managers

- Provides tangible benefits:
  - Helps identify improvements
  - Serves as powerful communication tool for stakeholders
  - Helps display a positive image

Future Steps

Workshops

- To validate the selection and descriptions of the sustainability indicators
- To seek feedback on the generic and semi-generic scores for each technology
- To review and improve the final output of the tool, if needed

HTML Version

- Converting the tool to a HTML version, available externally of the federal government

Training

- To support the effective deployment of the SD Assessment Tool across Federal agencies with bilingual training sessions offered to contaminated site managers

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