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Innovative Solutions Using Risk Assessment Tools as a Map for Site Portfolio Management

FEDERAL CONTAMINATED SITES NATIONAL WORKSHOP

April 14 - 16, 2014

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OUTLINE

- History
- Objectives
- Perspective
- Solutions
- Outcome

Perspective

- Global Perspective
- National Perspective
- Risk Assessment as a Management Strategy
- Examples
- Tools
- What a Risk-based Management Approach Can Offer

History

- Portfolio of approximately 700+ sites (Central and Western Canada)
- Global Strategy to Manage Environmental Liability with Risk Assessment (Risk Based Site Asset Management RBSAM introduced in 2011)
- Post-Closing Rights and Obligations (PCRO)
- In 2014, actively operate on 373 Sites (179 PCRO)

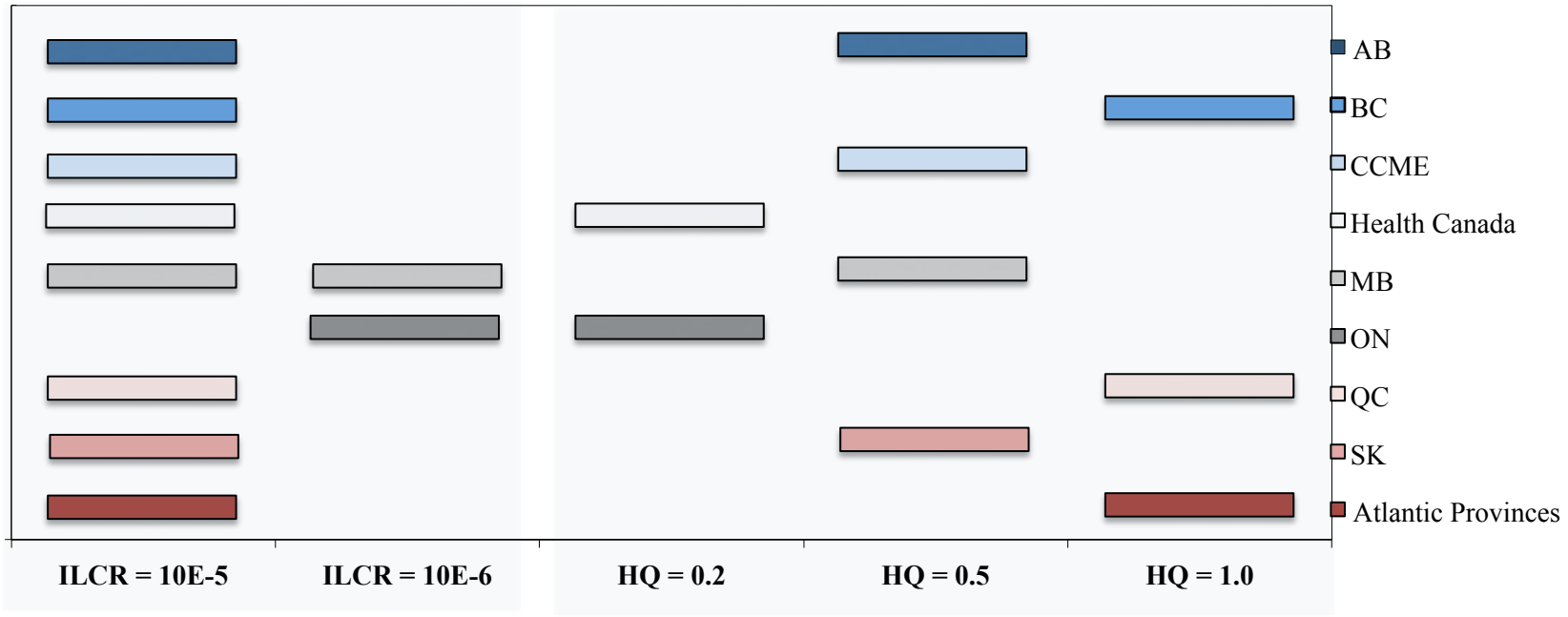
Portfolio Management

- Minimize Environmental Liability
- Streamline Efficiencies in Environmental Management
- Brownfield Redevelopment
- Categorization of Sites According to Risk Based Corrective Actions

Overview of One Exposure Pathway

- Common Risk Assessment Strategy
- Vapour Intrusion as a Governing Pathway
- Variables Nationally
- Province Specific Management of Contaminated Sites

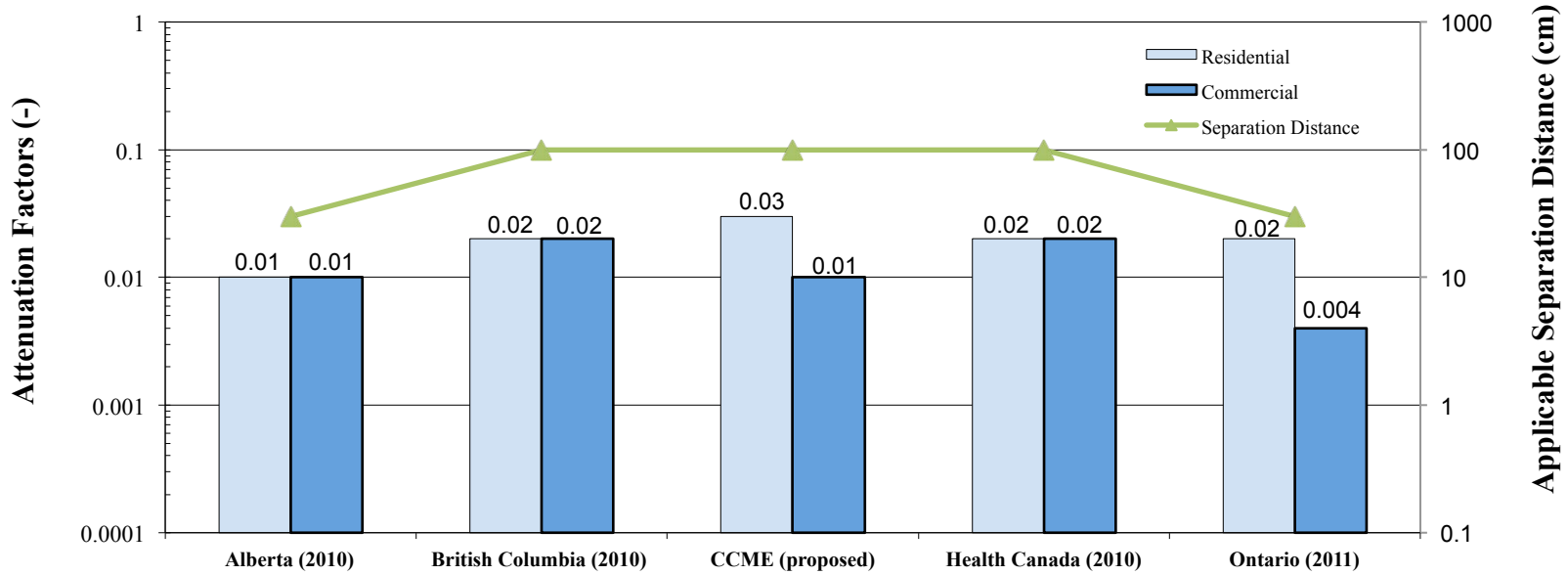
Variations in Acceptable Risk Levels for BTEX Across Canada



Variations in Applicable Pathways for Different Media

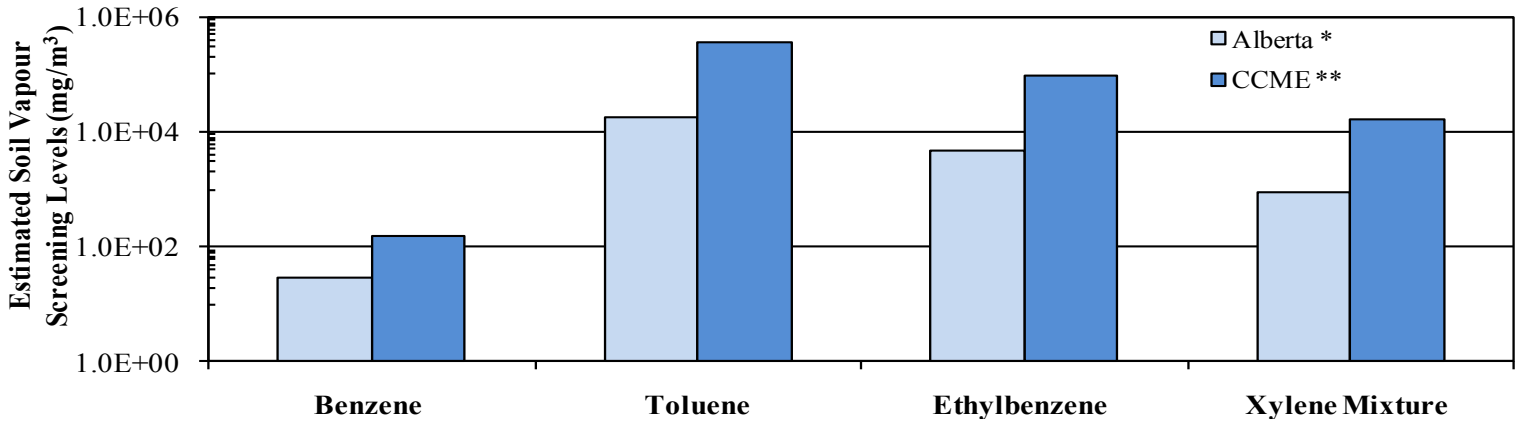
Applicable Pathways	CCME	AB	ON
SOIL			
Environmental Pathways			
Soil to Groundwater for Agricultural Use Protection	X		
Soil to Groundwater for Aquatic Life Protection	X	X	X
Soil Direct Contact and Ingestion	X	X	X
Nutrient & Energy Cycling Check	X	X	
Off-site Migration Check	X	X	
Human Health Pathways			
Soil Direct Contact, Ingestion, and Inhalation	X	X	X
Vapour Inhalation	X	X	X
Food Consumption Check	X	X	
Off-site Migration Check	X	X	
Potable Water Protection	X	X	X
Management Check			
Saturation Limits or Others	X	X	X
GROUNDWATER			
Environmental Pathways			
Contact by Soil Organisms	X	X	
Groundwater to Surface Water for Aquatic Life Protection	X	X	X
Groundwater for Agricultural Use Protection	X		
Human Health Pathways			
Vapour Inhalation	X	X	X
Potable Water Protection	X	X	X
Management Check			
Solubility Limits or Others	X	X	X
SOIL VAPOUR			
Human Health Pathways			
Vapour Inhalation	X	X	X
Saturation Limits or Others	X	X	X

Variations in Sub-Slab Attenuation Factors Across Canada

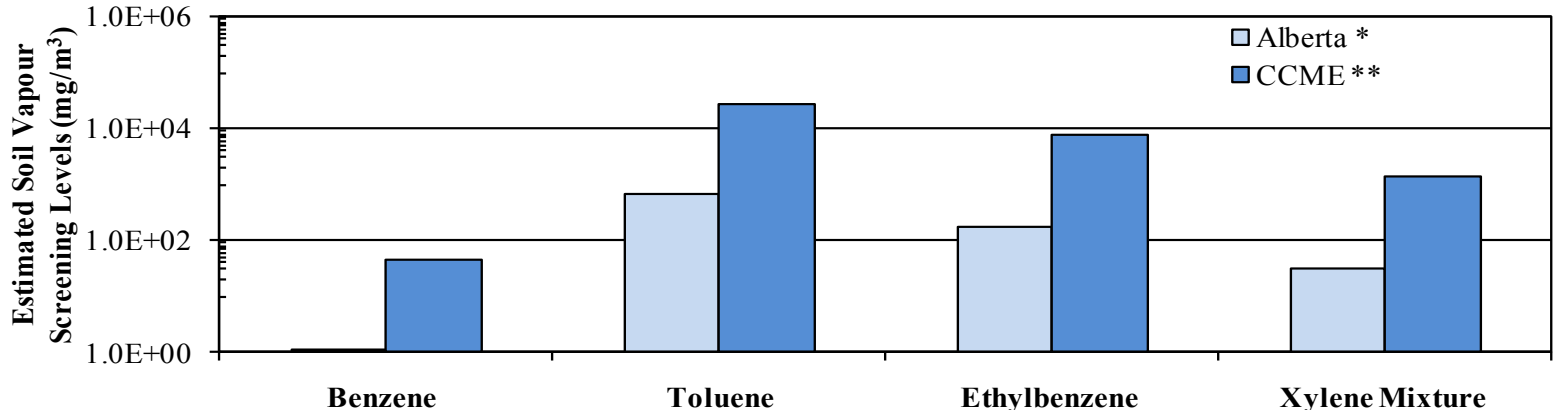


Differences in Estimated Soil Vapour Screening Levels for VI with L_T = 100cm

Commercial and Coarse-textured Soil



Residential and Coarse-textured Soil



* Calculated based on TG4 table (BC MOE 2010) ** Calculated based on CCME 2008 approach

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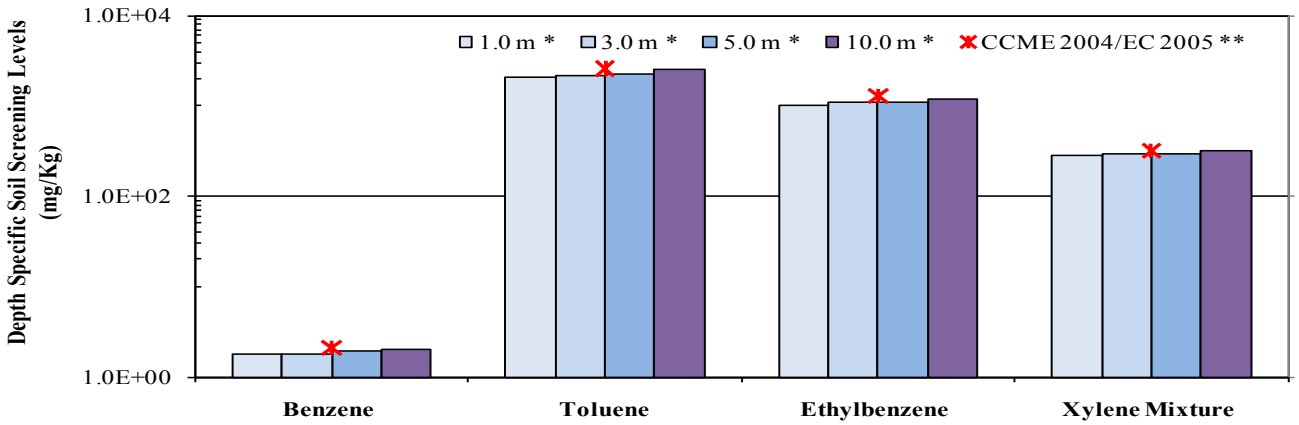
Variations in Soil Parameters within CCME

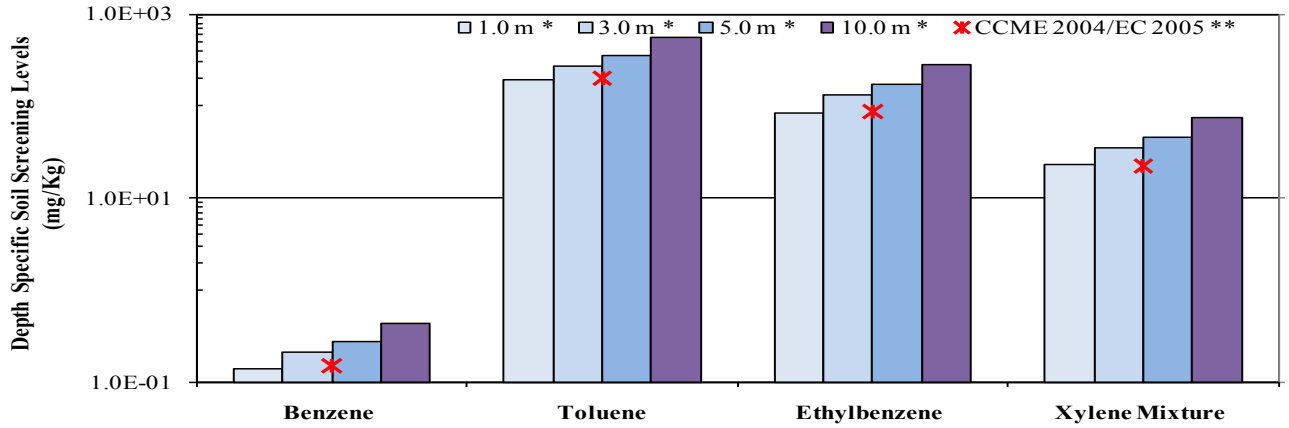
Parameters	Symbol	CCME (Current Draft)		CCME (2008)		CCME (2006)	
		Coarse	*Fine*	*Coarse*	*Fine*	*Coarse*	*Fine*
Moisture-Filled Porosity (unitless)	θ_w	0.05	0.168	0.119	0.168	0.217	0.266
Vapour-Filled Porosity (unitless)	θ_a	0.31	0.302	0.241	0.302	0.363	0.424
Soil Vapour Permeability (cm^2)	K_v	-	-	$5x10^{-8}$	10^{-9}	$6x10^{-8}$	10^{-10}
Soil Gas Flow Rate (cm^3/s)	Q_{soil}	167	83	calculated	calculated	calculated	calculated
Building Height (cm)	H_B	360 for Residential & 300 for Commercial		360 for Residential & 300 for Commercial		488 for Residential & 300 for Commercial	
Air Exchange Rate (1/h)	ACH	0.9 for Commercial & 0.5 for Residential		0.9 for Commercial & 0.5 for Residential		2.0 for Commercial & 1.0 for Residential	
Separation Distance from Vapour measurement to Building Foundation (cm)	L_T	100		30		30	

Differences in Estimated Depth Specific Soil Quality Screening Levels for VI

Residential and Fine-textured Soil



Residential and Coarse-textured Soil



* Calculated based on CCME 2008 approach

** Reported values for surface soil (CCME 2004/EC 2005)

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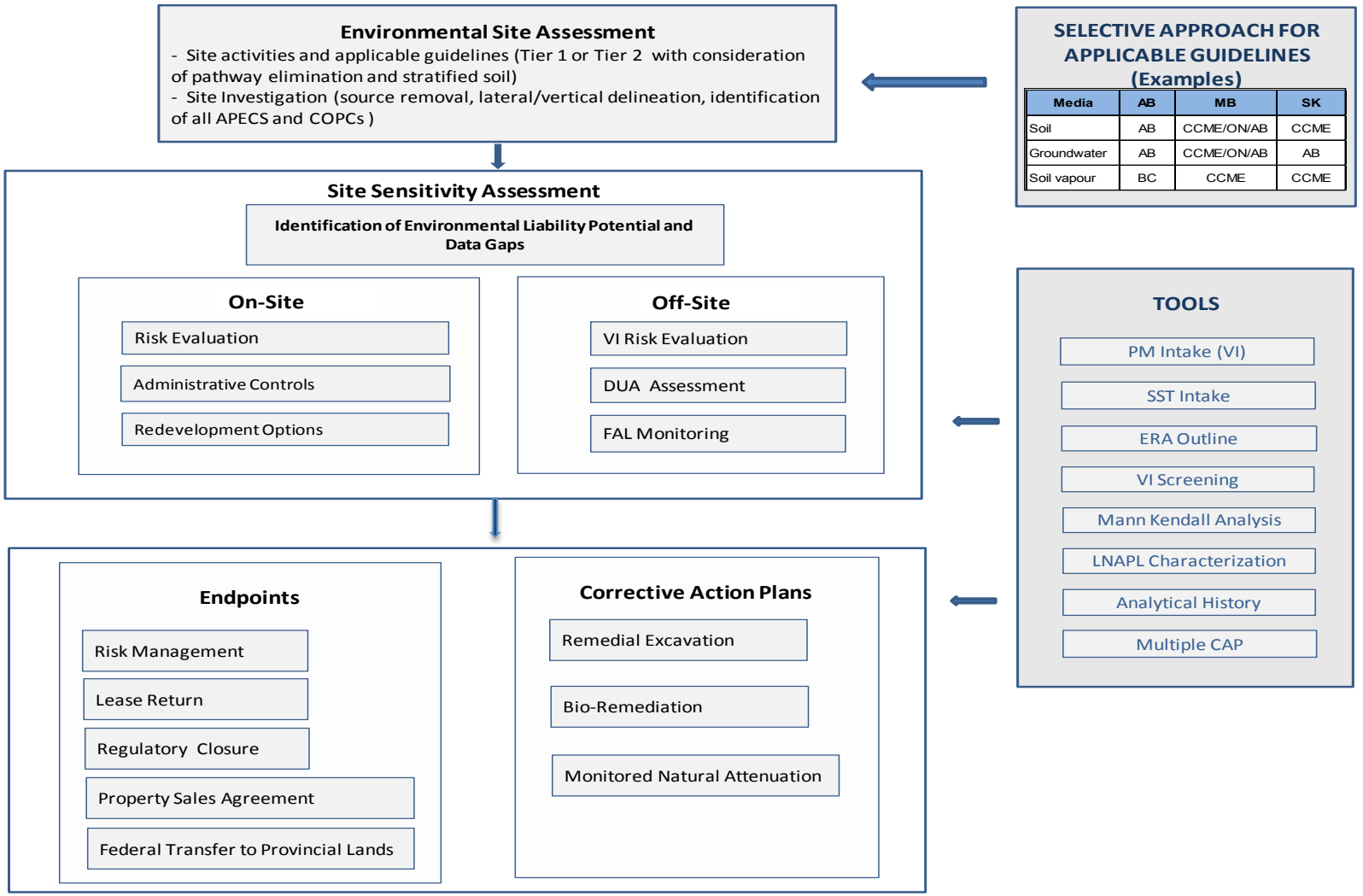
Strategies for Site Portfolio Management

- Equip Environmental Management with Tools That Can be Used Across Regulatory Boundaries
- A Portfolio Map for Multiple Site Management
- Partnership Across Stakeholders
- Resultant Regulatory Advocacy and Partnership

Toolbox

- Site Sensitivity Assessment
- Risk Assessment
- Off-Site Risk Management
- Multiple CAP
- Regulatory Closure
- Property Sales Agreement
- Closure Reporting

Portfolio Map



Remedial Options

- In-situ bioremediation
- Targeted risk based excavation
- Brownfield redevelopment management
- Passive risk management systems
- Non-conventional building designs
- Combined land use alternatives
- Administrative controls

Outcomes

- Categorizing remedial programs into levels of risk and remedial methods; result - effective prioritization of sites and coordination with appropriate remedial options
- Multiple corrective plans submitted and approved in a timely manner accommodating the short remediation season in the Prairies
- Tools for project managers to streamline reporting deliverables with prevailing resource limitations in the Prairies
- Acknowledgement of regulatory differences

Outcomes (cont'd)

- PCRO Portfolio in 2014 involves over 170 sites currently
- Multiple year regulatory closures
- In Saskatchewan, estimated cost savings of >$100k on multiple CAP submission (not including value of time savings)
- In Manitoba, estimated cost savings of >$100k were reported on the portfolio closures alone in 2013
- Overall, recorded >>$100k in cost savings on the active PCRO portfolio

Outcomes (cont'd)

- Portfolio Perspective for Environmental Management Objectives Served to Meet Business Objectives
- This Perspective Served to Develop Tools that Appealed to Regulatory Agencies (Often with Similar Economic/Resource Restrictions)
- Business Objectives Translated into Regulatory Advocacy and Leadership

Lessons Learned

- Initial struggles and frustrations with regulatory subtleties both for Shell and SNC-Lavalin quickly evolved into substantial cost-savings and improved land redevelopment timelines
- The program is in its last years for the majority of the PCRO sites and will meet the endpoint objectives on a significant percentage of sites
- Business objectives translated into ***Regulatory Advocacy and Leadership***

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WE CARE
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WE CARE embodies SNC-Lavalin's key corporate values and beliefs. It is the cornerstone of everything we do as a company. **Health and safety, employees,** the **environment, communities and quality:** these values all influence the decisions we make every day. And importantly, they guide us in how we serve our clients and therefore affect how we are perceived by our external partners. **WE CARE** is integral to the way we perform on a daily basis. It is both a responsibility and a source of satisfaction and pride by providing such important standards to all we do.

WE CARE about the health and safety of our employees, of those who work under our care, and of the people our projects serve.

WE CARE about our employees, their personal growth, career development and general well-being.

WE CARE about the communities where we live and work and their sustainable development, and we commit to fulfilling our responsibilities as a global citizen.

WE CARE about the environment and about conducting our business in an environmentally responsible manner.

WE CARE about the quality of our work.