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EcoNomics™

What is Sustainable Remediation? Answers from the Recent North American and European Literature

Ken Lyon

RemTech 2011, October 21, Banff, AB

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CONTENTS

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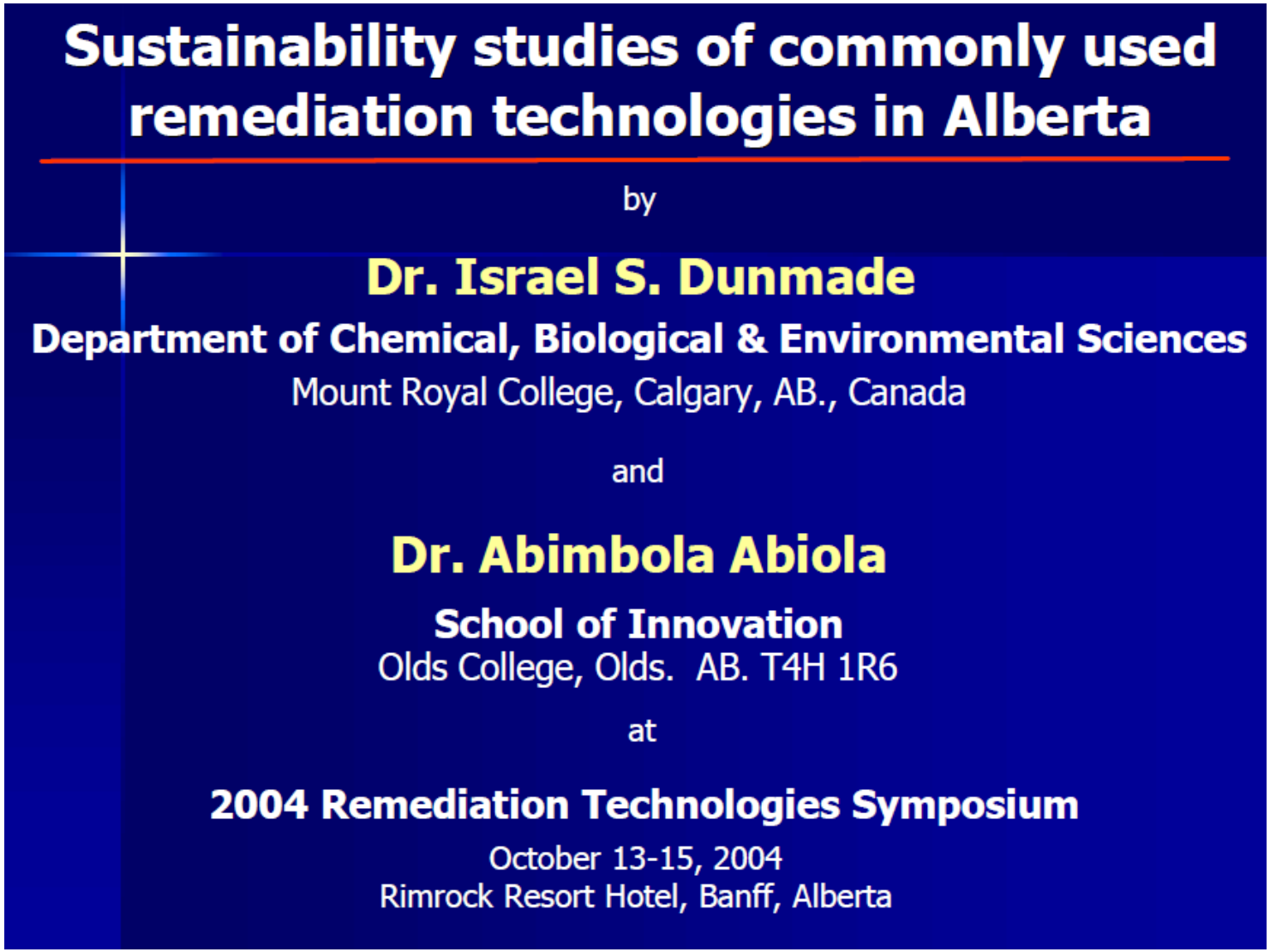
1. REMTECH THEN AND NOW – REMTECH THEN



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REMTECH NOW (2011)

Sustainable Remediation in Canada Workshop

- Dave Woodward, SURF the Globe
- Robert Noel de Tilly, Green vs Sustainable
- Sebastien Yelle, Sustainability Decision Support Tool for Remediation in Canada
- Alexis Troschinetz, BalancE3 Tool
- Mike Melross, Integrating Sustainability for Contaminated Sites in the City of Edmonton
- Stella Karniss, SURF USA Framework
- Justin Kelley, SURF Canada Update

Conference Presentations

- Dave Woodward, Green vs Sustainable Remediation and Its Evolution around the World
- Justin Kelley, The Varied Landscape of Tools for Green and Sustainable Remediation
- Francois Beaudoin, GoldSET©CN-SR: An Innovative Sustainable Decision Support Tool Adapted to CN's Needs
- Anju Wicke, Green Remediation and Contaminated Sites Risk Management Best Practices: A Framework for Evaluating Sustainable Remedial Options
- Dennis Sanscartier, Life Cycle Assessment of Remediation Approaches for a Remote Diesel-Contaminated Site in Labrador
- Ken Lyon, What is Sustainable Remediation? Answers from Recent North American and European Literature

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2. WHAT'S HAPPENED IN THE MEANTIME?

- 2006 - SURF-USA
- 2007 - SuRF-UK
- 2008 - USEPA Green Remediation website
- 2009 - SuRF-USA White Paper, ASTM GSR Subcommittee, SuRF-Australia
- 2010 – SuRF-Brazil
- 2011 – SuRF-UK Framework (Bardos et al.), ITRC State of Science and Practice, SURF-USA Framework & related, SuRF-Canada
- See Woodward (2011) and Noel de Tilly (2011) for overviews

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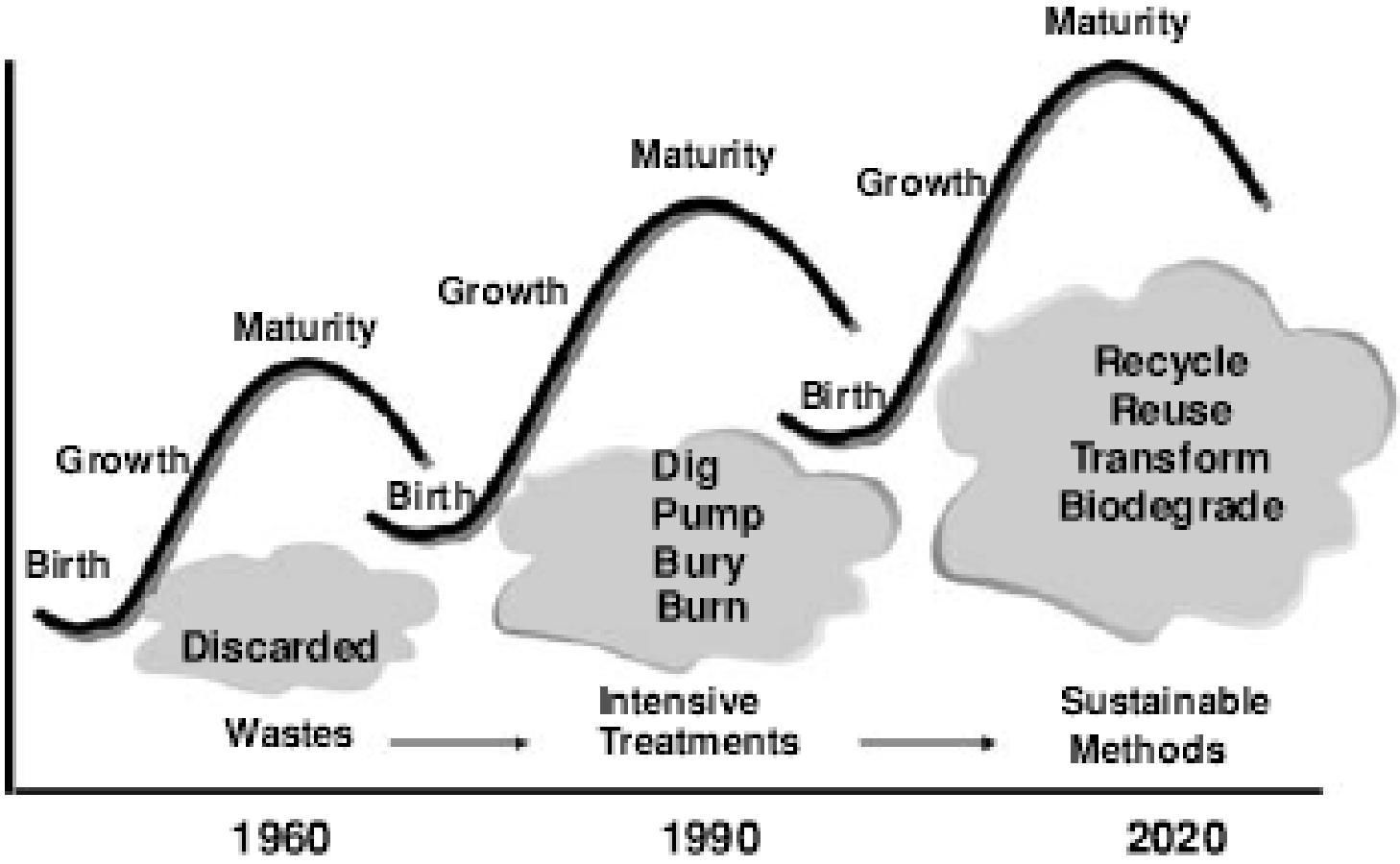
EVOLUTION OF APPROACHES



Ellis & Hadley (2009) Sustainable Remediation White Paper

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WHAT'S DRIVING THE EVOLUTION?

- Recognition of finite energy and resource use/availability
- Climate change, GHG emissions
- Contamination in "built" environment, mega-contaminated sites, environmental justice (E.g. USEPA Environmental Justice 2014 Plan)
- Corporate social licences/policies (E.g. impacts and potential impacts of Deepwater Horizon release, Enbridge Michigan and Northern Gateway pipelines, TCPL Keystone pipeline)
- **Full cost accounting** (Manning 2010)
- **Ethical investing**
- **Modelling of future cost increases**

FUTURE COST MODELLING

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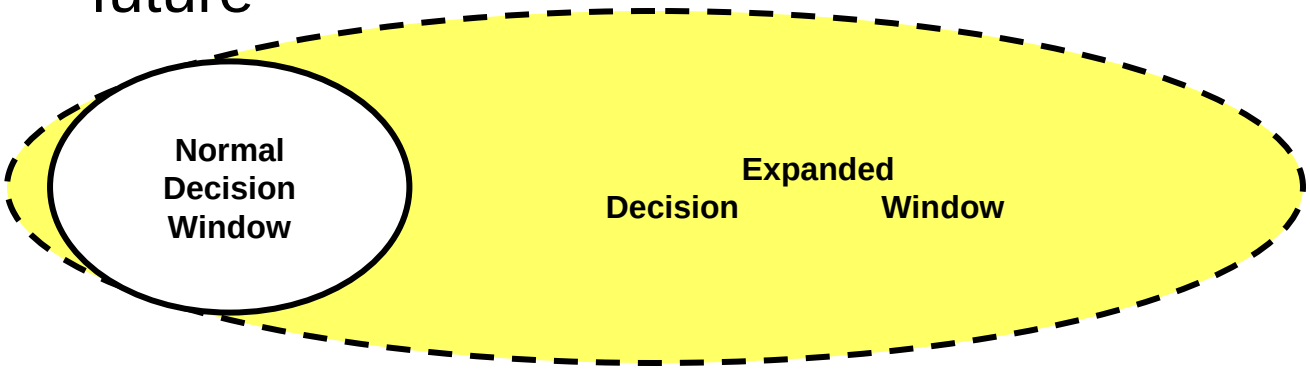
Move the perspective (decision window) out to the future



Now **20 Years** **50 Years**

$25/T	**$100/T?**	**$85/T?**	**Cost of CO_2 emissions**
$0.10/m³	**$ 1.00/m³?**	**$5/m³?**	**Cost of Water**
$0.08/kWh	**$ 0.50/kWh ?**	**$1/kWh?**	**Cost of Energy**
			Cost of Things Difficult to Cost

Courtesy of WorleyParsons

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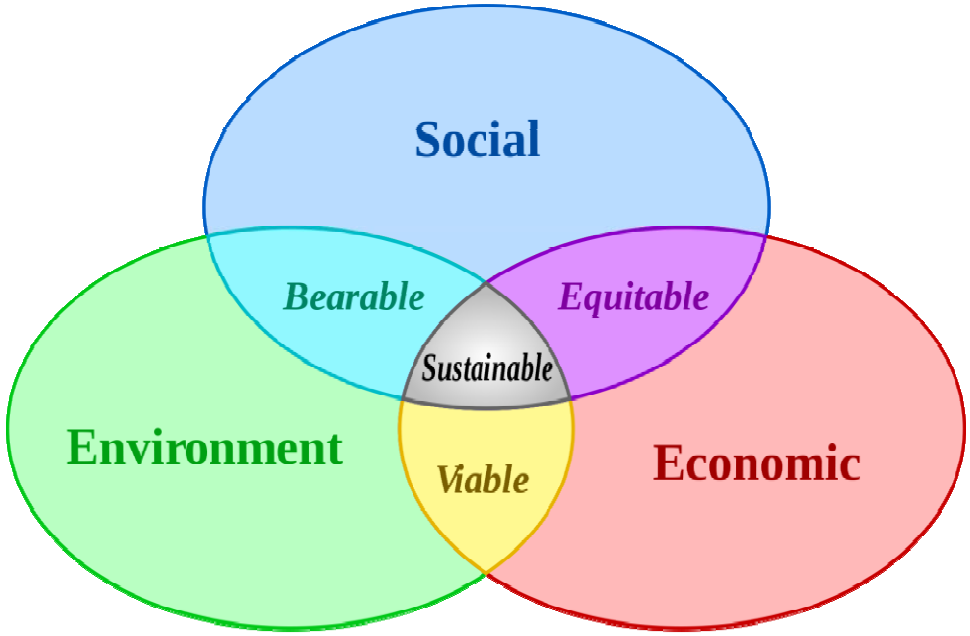
3. WHAT IS SUSTAINABLE REMEDIATION?

- Systematic consideration to the three dimensions of sustainability (social, economic and environmental), in decision-making about rehabilitation of and management of contaminated (SuRF Canada Mission Statement 2011)



J. Dreo (2006) Wikimedia Commons

Sustainable development meets the needs of the present without compromising the ability of future generations to meet their own needs.

Brundtland Commission 1987)

WHAT IS GREEN REMEDIATION? – SURF USA

- Provides net benefit on human health and the environment maximized through judicious use of limited resources (Ellis & Hadley 2009)

  - Minimize consumption of energy & natural resources

  - Reduce environmental releases, especially to air

  - Harness or mimic natural processes (e.g. MNA)

  - Reuse or recycle land or materials

  - Encourage technologies that permanently destroy contaminants

- Doesn't consider social impacts, not a TBL approach

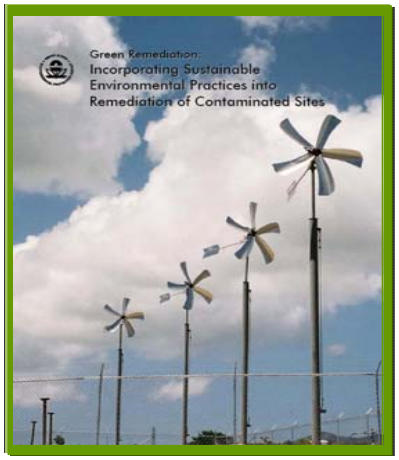
USEPA GREEN REMEDIATION

More Information from U.S. EPA

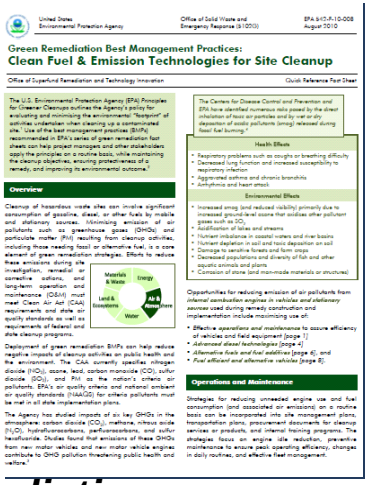
CLU-IN Green Remediation Focus

www.clu-in.org/greenremediation

- BMP Fact Sheets
- Policy References
- Technical Bulletins
- Case Studies
- Training Information
- Internet Resources



Aerojet-General Corporation	CA						
Altus Air Force Base	OK						
Apache Powder	AZ						
Barksdale AF Base	LA						
BP Casper	WY						
BP Paulsboro	NJ						
California Gulch	CO						
Crozet Orchard	VA						
De Sale Restoration Area	PA						
Delfasco Forge	TX						
Former Carswell Air Force Base	TX						
Former Ferdula Landfill	NY						
Former Nebraska Ordnance Plant	NE						
Former St. Croix Alumina Plant	VI						
Fort Carson	CO						
Frontier Fertilizer Superfund Site	CA						


Green Remediation Best Management Practices:
Clean Fuel & Emission Technologies for Site Cleanup

or: ***www.epa.gov/superfund/greenremediation***

Pachon (2011)

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4. HOW DO I DO GSR?

- Consider and select a process framework
  - SuRF-UK and Australia, SURF-USA (2011)
  - SuRF-Canada coming 2012/2013
- Consider and select indicator metrics
- Take a phased/tiered approach and consider and select tool(s)
- Look at some case studies

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GSR FRAMEWORKS – SuRF-UK Example

Six Steps

- Identifying need (and context)
- Identifying stakeholders to involve
- Agreeing on objectives for the assessment
- Agreeing on scope
- Agreeing on approach
- Execution

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GSR INDICATORS & METRICS – ENVIRONMENTAL (GREEN REMEDIATION)

- Main Indicators
  - Air including GHG emissions
  - Water including consumption
  - Resource use and waste
  - Energy use and source
  - Others – soil, ecology
- Consider direct and indirect project impacts
- Case Study – Wicke (2011) looked at GHG emissions, water consumption, waste generation & impact on enviro media

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GSR INDICATORS & METRICS – ECONOMIC AND SOCIAL

Economic Metrics

- Direct capital and operating costs of project
- Indirect costs and benefits (see Environmental & Social)

Examples of Social Metrics

- Health & Safety
- Infrastructure Wear-and-Tear
- Employment, Fit with Community Policy & Planning, Other Indirect Economic Spinoffs
- Environmental Justice
- Property Value

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GSR TIERS AND TOOLS
(Holland et al. 2011)

- Tier 1

  - Checklists, lookup tables, guidelines, matrices

- Tier 2

  - Spreadsheet scoring and weighting systems (multiple criteria analysis)

  - Quantitative air emission, water and energy calculations

  - RemTech 2011 Examples - GoldSET© (Beaudoin 2011) for all CN site work, GR Evaluation Framework for PWGSC (Wicke 2011), BalancE3 Tool (Traschinetz 2011)

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GRS TIERS AND TOOLS

- Tier 2 cont'd
- - See Kelley (2011) for overview, expects number of tools to double from about 20 in next several months
- Tier 3

  - Life cycle analysis, return on investment and other detailed financial analyses

  - Examples – WorleyParsons EcoNomics™ (see Hardisty 2010 for early case studies)

5. Concluding Thoughts and Next Steps

- Green and sustainable remediation gaining tremendous momentum
- USA and UK/Australia approaches in place, Canada in development
- Several tools available or coming soon … which are best?
- Don’t need spreadsheet tools to start thinking about it
- Need more case studies, more standardized indicators & metrics especially for social impacts
- Need to assure regulator that won’t compromise intent of adverse effect management frameworks
- Need to assure site owners/operators that can allow site closure

6. References & Additional Resources

Bardos, P., B. Bone, R. Boyle, D. Ellis, F. Evans, N.D. Harries, and J.W.N. Smith, 2011. Applying Sustainable Development Principles to Contaminated Land Management Using the SuRF-UK Framework. Remediation Journal, 21(2), pp.77-100.

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Holland, K.S., et al., 2011. Framework for Integrating Sustainability into Remediation Projects. Remediation Journal, Spring 2011, pp.7-38. *www.sustainableremediation.org.*

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Pachon, C., 15 Mar 2011. Introductions. In USEPA CLU-IN Seminar, US and EU Perspectives on Green and Sustainable Remediation Part 2. www.cluin.org

Sustainable Remediation Forum Canada (SuRF Canada) www.surfcanada.org

Sustainable Remediation Forum UK (SuRF UK). *www.claire.co.uk*

Sustainable Remediation Forum USA (SURF), *www.sustainableremediation.org*.

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US Environmental Protection Agency websites. www.clu-in.org/greenremediation/, www.epa.gov/superfund/greenremediation/

World Commission on Environment and Development, Apr 1987. Our Common Future. Oxford University Press, 416 p.

See slides 3, 4 and 5 for RemTech 2011 references.