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# Turbo-Charged Contaminated Site Management and Closure Plans

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# 1. Introduction – ESAA Course on Business & Project Risk Management of Contaminated Sites

- ▶ Project Risk Management
- ▶ Remediation Cost Estimating
- ▶ Financial Measurement & Reporting of Liabilities
- ▶ Turbo-Charged Management & Closure Plans
- ▶ Portfolio Management (coming in 2014)
- ▶ Special Case of Mega-Contaminated Sites
- ▶ Sustainable Remediation

## 2. What Turbo-Charged Plans Are All About

- ▶ Variations also called Performance-Based Plans, Strategic Plans, Liability Management and Exit Strategies
- ▶ In USA, date back to 1990s, due in part to failure of pump-and-treat approaches ... see Santillan 2004, Ferries & Tyrell 2005, ITRC 2006 for examples
- ▶ ITRC 2007 Definition:
  - Plan to accomplish site-specific objectives to reach site closure (or exit an environmental liability) within a defined time period
  - Purpose is to clearly document path to closure, including consideration of contingency measures if ongoing results vary from performance-based metrics

# Turbo-Charged Plan Characteristics

- ▶ Protective of human health & environment
- ▶ Recognition of non-technical drivers and decision constraints
- ▶ Technical drivers focused on Conceptual Site Model
- ▶ Specific performance goals over defined time period with triggers for plan adjustments
- ▶ Pre-planned adjustment alternatives
- ▶ Multi-tracked program components
- ▶ Dynamic and succinct

# Key Turbo-Charged Plan Components (current Ken Lyon version)

- A. Project Drivers & Key Success Factors
  - Non-Technical Drivers and Decision Constraints
  - Conceptual Site Model and Technical Drivers
- B. Project Risk Assessment and Liability Reduction Options
- C. Site Management/Closure Plan



# A. Project Drivers – Non-Technical

- ▶ Regulatory and Legal Context Drivers

(some regulatory overlap with Technical Drivers)

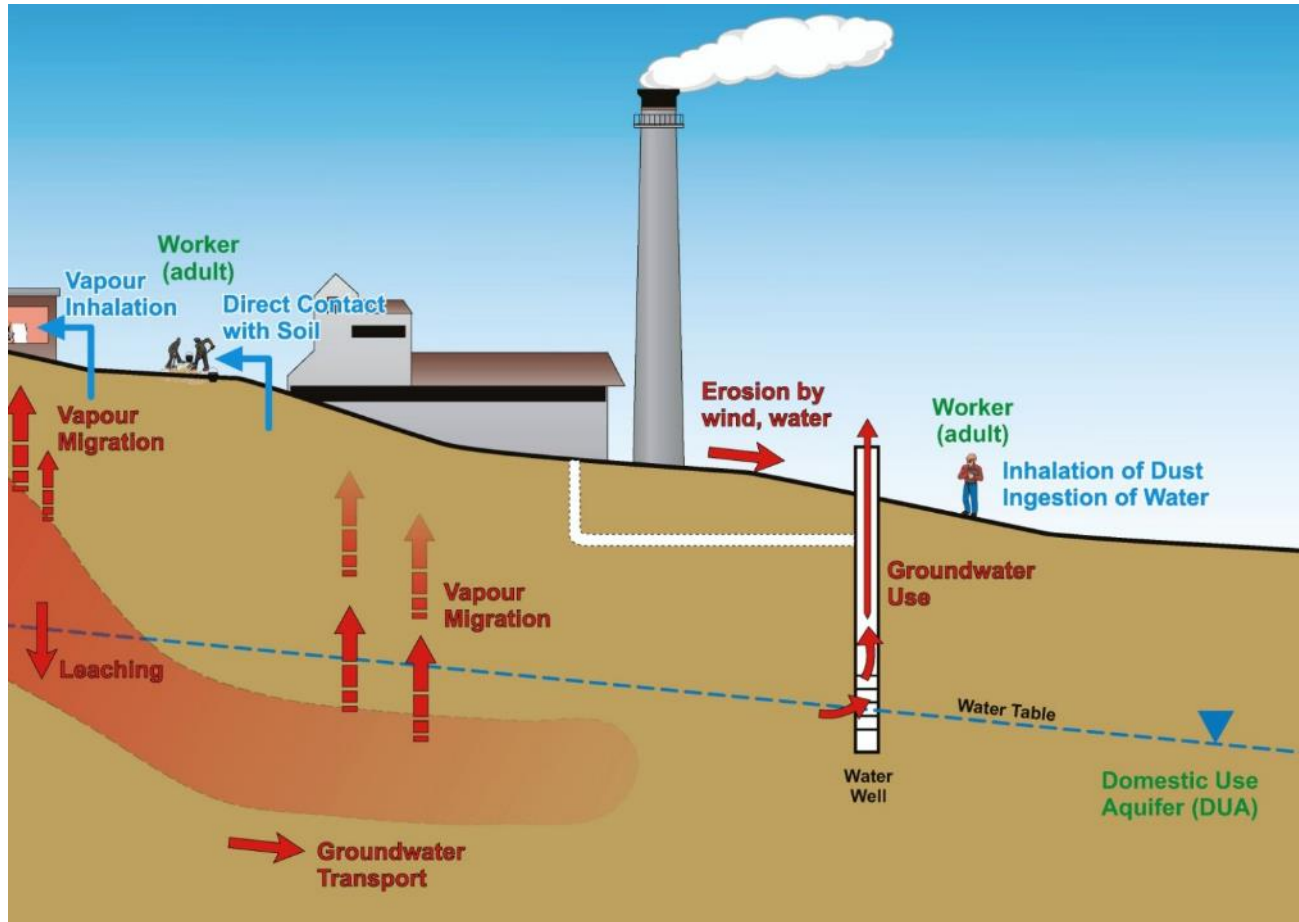
- ▶ Business Drivers

- Policies/culture, risk tolerance, internal stakeholders, contractual agreements, schedule, cost

- ▶ External Stakeholder Drivers

- Regulators, consultants and other external advisors, landowners, neighbours, First Nations

# Project Drivers - Technical



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Source – Contaminant/Exposure Pathway - Receptor



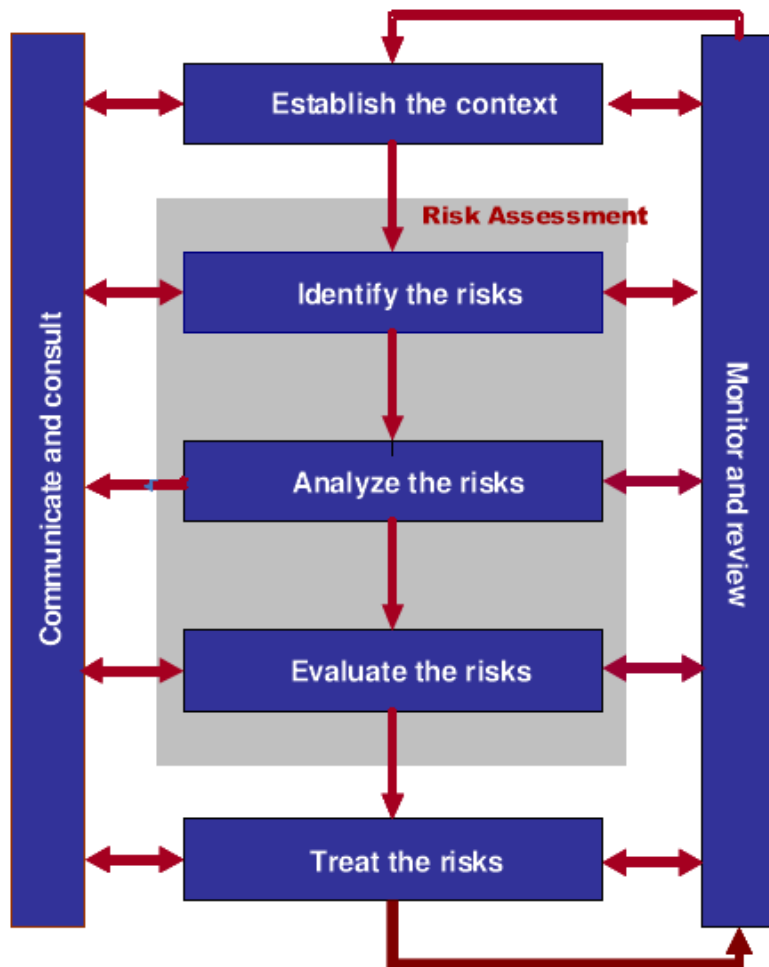
# Project Drivers - Technical

- ▶ Sources - areas (APECs) and chemicals (COPCs) of potential concern)
- ▶ Receptors and Contaminant and Exposure Pathways
- ▶ Assessment/Remediation Guideline Selection
- ▶ Delineation Status
- ▶ Remediation Feasibility Study Requirements
- ▶ Remediation System Performance
- ▶ Monitoring Results
- ▶ Technical or Access Limitations/Impracticability
- ▶ Plans often start with a gap analysis

# Some Common Gaps

- ▶ Phase 1 environmental site assessments incomplete or out-of-date
- ▶ Delineation incomplete, especially vertically
- ▶ Groundwater contaminant pathways not adequately characterized
- ▶ Tier 2 approaches not considered or misunderstood
- ▶ No or little basis for previous remediation cost estimates
- ▶ Porous media approaches don't work with “dual porosity” fractured rock conditions
- ▶ Site plans inaccurate and incomplete

# B. Project Risk Assessment and Liability Reduction Options



Seven phases of the risk management process based on the International Standard ISO 31000:2009, “Risk Management-Principles and Guidelines”.

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# C. Site Management/Closure Plan

- ▶ Objectives including time frame
- ▶ Preferred Alternative (Plan “A”)
  - Description
  - Status, likelihood of success
  - Cost estimates
- ▶ Performance Metrics
  - Operational (success/failure of engineered systems)
  - Risk reduction (e.g. concentration trends)
  - Timelines



# Site Management/Closure Plan cont'd

- ▶ Strategy Decision Logic
  - Expect success, plan for failure
  - Performance-based triggers (if, then)
- ▶ Alternatives (Plan “B”)
  - Remedial process optimization, alternative technologies, alternative objectives and remediation criteria, performance metrics adjustments
- ▶ Parallel-track feature
  - Filling Phase 1 ESA gaps
  - Delineation and CSM development
  - Ongoing remediation programs
  - Ongoing monitoring

# 3. Scaling Plans Down

- ▶ Use Section 2 of this presentation as a checklist
- ▶ Hold a meeting with key project staff to talk about the checklist and factors relevant to your site
- ▶ Document as appropriate
- ▶ Revisit and revise the notes as required

## 4. Scaling Plans Up for High-Risk and High-Cost Sites

- ▶ Formal project risk workshops and registers with adaptive management
- ▶ Decision-tree analysis (e.g. Allen et al., RemTech 2013)
- ▶ Probabilistic costing (top-down or bottom-up)
- ▶ Risk transfer (e.g. fixed-price remediation, insurance cost-caps, liability transfer companies)
- ▶ Management tool suites and portfolio management

# 5. Private Sector Case Study

## Managing the Business (And Engineering) Of Environmental Remediation Projects



By **Mark R. Ferries**, Director, **El Paso Corporation**, Houston, TX, and **Ken Tyrrell**, Vice President, Energy Services, **URS Corporation**, Houston, TX

El Paso Corporation ... 645 contaminated sites in 2005  
... retail gas stations, refineries, pipeline releases ...  
annual cleanup expenditures USD40-60M

Ferries & Tyrrell, Pipeline and Gas Journal, (Oct 2005)



# Private Sector Case Study cont'd

- ▶ Sites prioritized by potential to reduce risk and opportunity to accelerate closure
- ▶ Probabilistic costing to analyze scenarios and develop life-cycle strategies
- ▶ Performance Index to graph forecasted vs. actual risk reduction and project costs
- ▶ US Securities Compliance Process Flow Map
- ▶ Peer Review Forum to review strategies and costs
- ▶ USD7.8M in savings and accelerated closure of 21 sites in first 6 months of roll-out

# 6. Concluding Thoughts

- ▶ If you want to improve financial liability reduction of contaminated sites, consider developing performance-based site management and closure plans
- ▶ Approach may be new for Alberta, but well developed south of the border
- ▶ Plans can be scaled up or down
- ▶ Start at a level you are comfortable with, and scale the plans with time as needed to meet your objectives

# 7. References & Additional Resources

- Allen, D.E., et al., Oct. 2013. Options Evaluation for Remediation of the Gunnar Site Using a Decision Tree Approach. RemTech 2013, Banff, AB. [www.esaa-events.com/remtech/2013abstracts/Abstracts%2044.pdf](http://www.esaa-events.com/remtech/2013abstracts/Abstracts%2044.pdf)
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Thank you.