



# **Botany Groundwater Cleanup Project Strategy Review Community Workshop**

Item 7 Workshop with International Experts in December 2007

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# Presentation Outline

- Botany Groundwater Strategy Review Workshop
  - Need
  - Participants
  - Objectives
  - Conclusions
- Full-scale source area remediation evaluation

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**Botany Groundwater Strategy Review Workshop**

Full-Scale Source Area Remediation Evaluation

# Need for Strategy Review Workshop

- Seek the wisdom of local and international experts
  - Strategy review workshop in December 2007
    - Review the reports
    - Review the existing remedial approach and selected technologies
    - Identify alternative remedial technologies or strategies
- Develop coherent and complete review

# Workshop Participants

- Participants' selection based on:
  - Blend of unfamiliar and familiar
  - Blend of overseas and local
  - Reputation and references
  - No commercial technology alignment or “barrows to push”
- North America: Hans Stroo, Bernie Kueper, Mike Kavanaugh, Wilson Clayton, Al Laase, Dave Major
- Local: Dave Reynolds, Joe Duran, Greg Dasey, Andrei Woinarski, Garry Clews (facilitator)
- Orica: Greg Witcombe, Graeme Richardson, Pat Hanrahan, James Fairweather, James Stening, Steve Corish
- DECC (Niall Johnston, Craig Lamberton) invited to early session for current regulatory perspective

# Workshop Objectives

- Comprehensive independent review of the current remediation strategy, including reference documents
- Improved understanding of DNAPL source area remediation issues
  - Practical extent of DNAPL source area depletion in the Botany geological and site setting with current likely technologies
  - Possible new and significantly better DNAPL depletion technologies
  - Drivers for DNAPL depletion other than reduced cleanup duration and costs
  - Does DNAPL source area depletion makes sense?
- Other technologies or strategies that might better address DNAPL, sorbed mass and dissolved phase mass
- Produce a short-list of alternative integrated remediation strategies for further evaluation

# Workshop Conclusions

- Contaminant Mass Estimate, Solute Transport Model and Conceptual Site Model reports reviewed
  - Some issues for clarification/correction in a future revision – not material to conclusions of Strategy Review
  - Fit for purpose
- Current remediation strategy (pump & treat)
  - Risks appear to be acceptable with hydraulic containment and GTP
  - Short-listed DNAPL approaches are likely the most promising, but ...
    - Scale of issues means complete removal is unlikely
    - Understand full-scale costs and limitations before undertaking field trials
      - › Subsequent work by Mike Kavanaugh (Malcolm Pirnie, Inc.)
    - Thermal treatment technology is essentially proven, no need for “proof of concept” field trials – instead needs “proof of design”
    - Scepticism about ISCO for such a major DNAPL site

## Workshop Conclusions (Cont)

- Technology development is now likely to be by evolution rather than revolution (for all contamination phases)
  - Much still to be learned in best practice application
  - Thermal remedies for DNAPL becoming more reliably successful, but need clear access to the treatment area
  - Long-term cleanup will be controlled by the rate of desorption
- No compelling case for DNAPL depletion at Botany at this stage
- No significant alternative remedial approaches which met key criteria identified
  
- Follow-up action from workshop to understand costs of full-scale source area depletion with thermal and ISCO treatments

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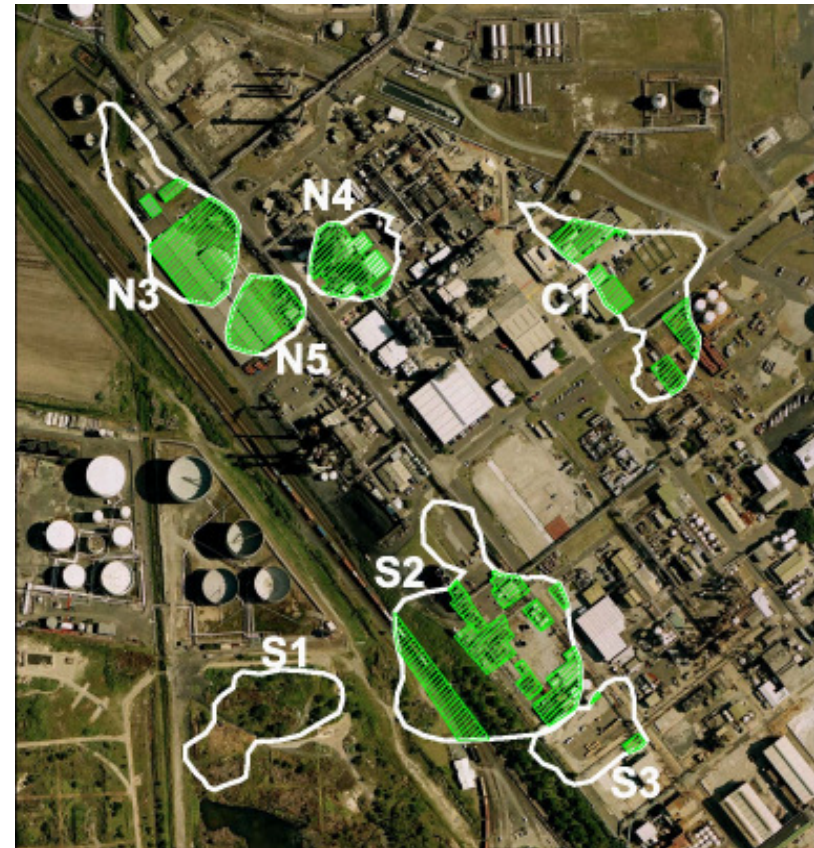
Botany Groundwater Strategy Review Workshop



**Full-Scale Source Area Remediation Evaluation**

# Full-Scale Source Area Remediation Evaluation

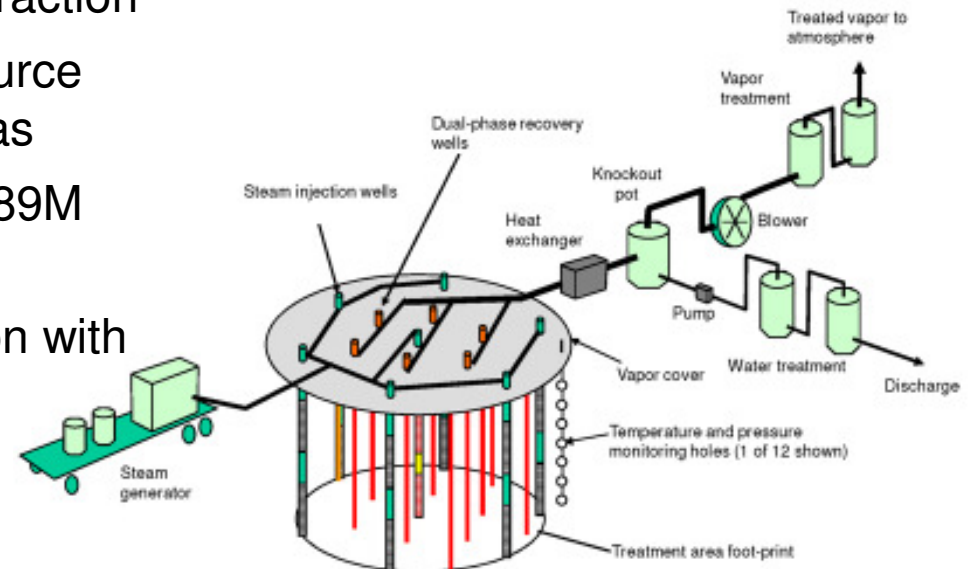
- Mike Kavanaugh, Malcolm Pirnie, Inc.
- Scope
  - Assess DNAPL source area remedial alternatives – thermal and ISCO treatments
  - Case studies of similar source depletion projects (mostly from North America)
  - Conceptual designs – with TerraTherm and Aquifer Solutions
  - Cost estimates



DNAPL source areas and surface physical impediments

# Full-Scale Source Area Remediation Evaluation (Cont)

- Thermal – Steam Enhanced Extraction
  - Capable of volatile DNAPL source depletion ... in accessible areas
  - ~70% mass removal @ ~\$US89M over ~11 years
  - Potential issues with integration with GTP
  - Huge energy demand



- In Situ Chemical Oxidation (ISCO) – pH-activated sodium persulphate
  - Enormous demand for oxidant and caustic soda
    - 90,000-110,000 t to treat 10,000 t DNAPL
    - \$US250-320M
    - Difficult to predict DNAPL mass destruction – especially in peat layers
    - Significant environmental degradation

# Full-Scale Source Area Remediation Evaluation (Cont)

- Conclusions
  - Thermal remedy is technically viable to remove DNAPL
  - However because of site limitations, significant mass remaining after application of thermal remedy (residual DNAPL, sorbed CHCs, semi-volatile CHCs)
  - Modelling results show limited impact on duration of GTP operations
  - Therefore, DNAPL source depletion provides limited benefits

