



## “Wicked” Risk

Anita Meyer DABT

US Army Corps of Engineers  
Environmental and Munitions  
Center of Expertise (EM CX)

E<sup>2</sup>S<sup>2</sup> Symposium Denver, CO

May 7, 2009

| Report Documentation Page                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                    |                                     |                                                                  | Form Approved<br>OMB No. 0704-0188                  |                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-------------------------------------|------------------------------------------------------------------|-----------------------------------------------------|------------------------------------|
| Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number. |                                    |                                     |                                                                  |                                                     |                                    |
| 1. REPORT DATE<br><b>07 MAY 2009</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                    | 2. REPORT TYPE                      |                                                                  | 3. DATES COVERED<br><b>00-00-2009 to 00-00-2009</b> |                                    |
| 4. TITLE AND SUBTITLE<br><b>'Wicked' Risk</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                    |                                     |                                                                  | 5a. CONTRACT NUMBER                                 |                                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    |                                     |                                                                  | 5b. GRANT NUMBER                                    |                                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    |                                     |                                                                  | 5c. PROGRAM ELEMENT NUMBER                          |                                    |
| 6. AUTHOR(S)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                    |                                     |                                                                  | 5d. PROJECT NUMBER                                  |                                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    |                                     |                                                                  | 5e. TASK NUMBER                                     |                                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    |                                     |                                                                  | 5f. WORK UNIT NUMBER                                |                                    |
| 7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)<br><b>US Army Corps of Engineers,Environmental and Munitions Center of Expertise (EM CX),P.O. Box 1600 ,Huntsville,AL,35807</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                    |                                     |                                                                  | 8. PERFORMING ORGANIZATION<br>REPORT NUMBER         |                                    |
| 9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                    |                                     |                                                                  | 10. SPONSOR/MONITOR'S ACRONYM(S)                    |                                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    |                                     |                                                                  | 11. SPONSOR/MONITOR'S REPORT<br>NUMBER(S)           |                                    |
| 12. DISTRIBUTION/AVAILABILITY STATEMENT<br><b>Approved for public release; distribution unlimited</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                    |                                     |                                                                  |                                                     |                                    |
| 13. SUPPLEMENTARY NOTES<br><b>Presented at the NDIA Environment, Energy Security &amp; Sustainability (E2S2) Symposium &amp; Exhibition held 4-7 May 2009 in Denver, CO.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                    |                                     |                                                                  |                                                     |                                    |
| 14. ABSTRACT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                    |                                     |                                                                  |                                                     |                                    |
| 15. SUBJECT TERMS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                    |                                     |                                                                  |                                                     |                                    |
| 16. SECURITY CLASSIFICATION OF:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                    |                                     | 17. LIMITATION OF<br>ABSTRACT<br><b>Same as<br/>Report (SAR)</b> | 18. NUMBER<br>OF PAGES<br><b>11</b>                 | 19a. NAME OF<br>RESPONSIBLE PERSON |
| a. REPORT<br><b>unclassified</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | b. ABSTRACT<br><b>unclassified</b> | c. THIS PAGE<br><b>unclassified</b> |                                                                  |                                                     |                                    |



## “Wicked” Problems

- Every implemented solution has consequences.
- No well-described set of potential solutions.
  - Various stakeholders will have differing views of acceptable solutions. Correct path is a matter of judgment.
- Every wicked problem is essentially unique.
- Interlocking issues and constraints which change over time.
- Causes of a wicked problem can be explained in numerous ways.

Source: Poppendieck.LLC



## Solutions to “Wicked” Problems

- Recognition as a Wicked problem
- Attempt to tame the project
  - Executive support
  - Clear problem definition
  - Separation of concerns/reduction of stakeholders
- Adaptive processes (within a systematic framework)

Source: Poppendieck.LLC



US Army Corps of Engineers



# Tri-Service Environmental Risk Assessment Workgroup

Air Force, Army and Navy

- Surgeon General organizations
- Execution organizations
- Research organizations





# DoD Vapor Intrusion Handbook

- Screening level assessment
- Evaluate acute risk potential
- Sufficiently volatile and toxic chemicals present?
  - Revised/updated EPA 2002 table consistent with Regional Screening Levels (RSLs)
  - Includes chemicals of interest to DoD

## DoD VAPOR INTRUSION HANDBOOK



JANUARY 2009

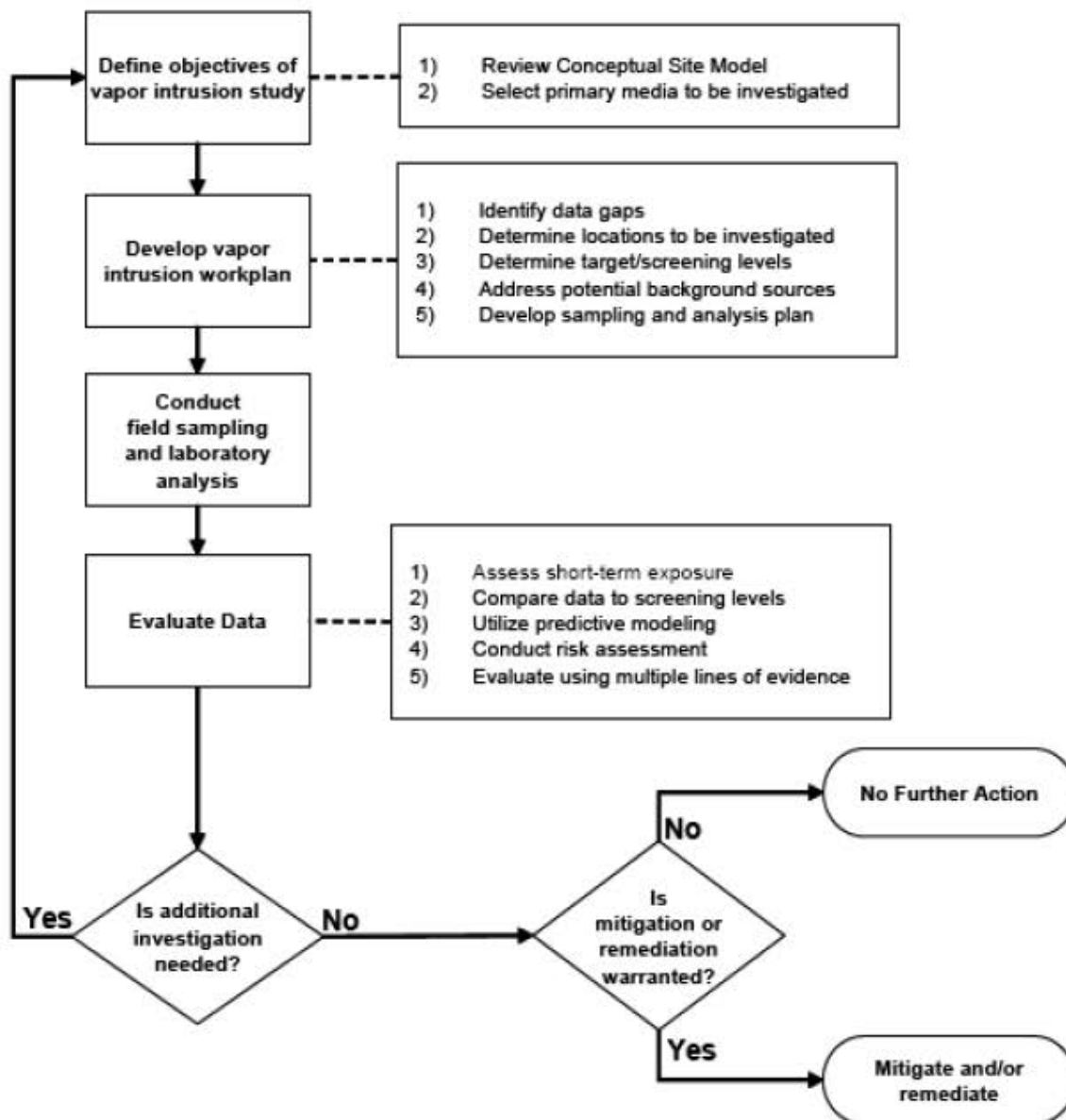
PREPARED BY  
THE TRI-SERVICE ENVIRONMENTAL RISK ASSESSMENT WORKGROUP



## DoD Vapor Intrusion Handbook

- Site-specific Assessment
  - Sampling and analysis considerations
  - Soil, groundwater, soil gas, indoor air
    - Issues and techniques
- Risk Assessment for VI
  - Preference for actual data in lieu of modeled
  - Military exposure parameters
  - Toxicity value selection
- Risk Management
- Risk Communication

Figure 3-1: Example of the Decision-Making Process for a Site-specific Vapor Intrusion Study  
(after ITRC 2007a)





## Multiple Lines of Evidence

- Soil gas data
- Groundwater data
- Fate and transport modeling
- Building construction and current conditions
- Comparison of constituent ratios of chemicals in soil gas and indoor air
- Impact of site geology
- Indoor air data
- Outdoor (background) air samples
- Results of the risk assessment
- Site or building use, ownership and control.



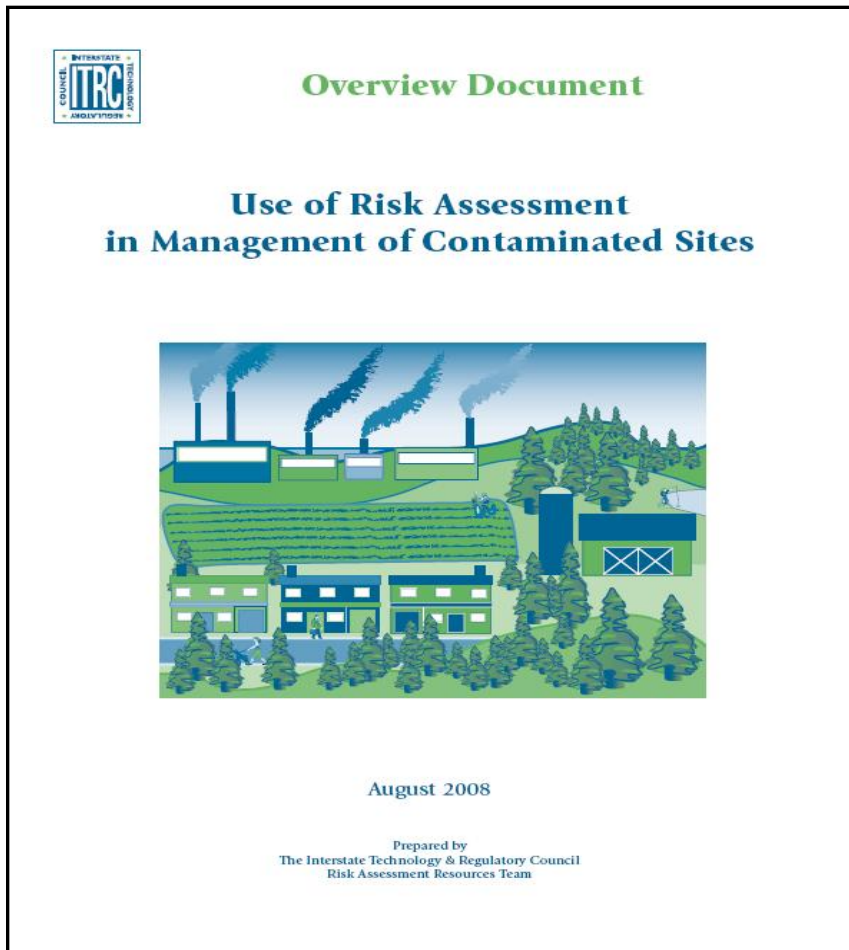
## VI Handbook Appendices

- Sampling & Analysis Methods
  - Pros/Cons, Costs
- Occupied Dwelling Questionnaire
- Background Assessment
- Evaluating building envelope
  - Pressure differences
  - Stack Effect
- Mitigation measures



## Other Activities

- Multi-Incremental Sampling ITRC team





## Other Issues

- RAGS Part F
- Regional Screening Levels
- TCE in; then out again draft due next fall
  - Region 7 position
  - Region 10 position
- EPA Framework for Toxicity Assessments