Permeable Reactive Barriers (PRB): Technology Update

John Doyon (NJ) and Kimberly Wilson (SC)

October 26, 2011
Denver, Colorado
Our Goal – Implement PRB-5 Technical and Regulatory Guidance Document

- Overview of PRB-5 (2011) Tech Reg
- Small groups by sector
  - Implementation Targets & Key Messages
- Report out
- Actions to take

We need your help to hit our implementation targets!
ITRC PRB Guidance – Over the Years

- 2011 - PRB-5 Permeable Reactive Barriers: Technology Update

- 2005 - PRB- 4 Permeable Reactive Barriers: Lessons Learned/New Directions

- 2000 - PBW- 2 Design Guidance for Application of Permeable Reactive Barriers for Groundwater Remediation

- 1999 - PRB- 3 Regulatory Guidance for Permeable Reactive Barriers Designed to Remediate Inorganic and Radionuclide Contamination

- 1999 - PBW- 1 Regulatory Guidance for Permeable Reactive Barriers Designed to Remediate Chlorinated Solvents
Permeable Reactive Barriers (PRBs): The Plume Stops Here!

- Continuous, in-situ permeable treatment zone
- Intercepts & remediates contaminant plume
- Treatment through physical, chemical, or biological processes
- Stand-alone technology to close sites or treatment train as part of overall site strategy
Example PRB Installation

Over 200 PRBs installed over past 15 years
Ideal Site Targets for PRBs

- Groundwater contaminated with:
  - Chlorinated solvents, energetics, radionuclides, dissolved metals, nitrates, perchlorates, phosphates, LNAPLs, and others (see Table 4-1 in PRB-5) – and combinations of contaminants

- Depth of contaminants down to 35-45 ft

- Desire for a “greener” and sustainable solution

- Unobtrusive / passive solution after installation
How Our Team Members Describe PRBs

- Adaptive
- Small Footprint
- For Range of Contaminants
- Low O&M
- Passive After Installed
- Green Solution
- Protective of Receptors
- Migration Prevention
- Sustainable
- Buys time for source treatment
- Depth to 35-45ft
- Longevity
- Plume Capture
PRB-5 Tech Reg: Easily Understood & Accessible Information for PRB Applications

- Regulatory considerations for:
  - Selection, installation, & monitoring of PRBs - streamline regulatory review

- Lessons learned - 15 years & over 200* PRB installations

- Site examples (broad range of contaminants and geologic settings)

- Contacts and references
PRB: Technology Update Tech Reg

- Guides decision process for PRBs
  - When, where, & applicability by contaminant type
  - PRB stand-alone remedy and/or treatment train

- What’s New:
  - New reactive & combined treatment media leads to expanded list of contaminants treated
  - Improved understanding of treatment mechanisms
  - Deeper installation techniques
  - More options for monitoring, optimization, rejuvenation, and sustainability
  - Growing confidence in reliability and longevity
What Can You Do to Promote the ITRC PRB-5 Tech Reg?

- Get PRB-5 Tech Reg to site level decision-makers dealing with contaminated groundwater

- Be open-minded - advancements in PRBs may now meet your site needs
  - Deeper than before – 35-45ft
  - New PRB media = new contaminant treatment
## Potential PRB Tech Reg Impacts

<table>
<thead>
<tr>
<th>EXPECTED USER GROUP</th>
<th>INTENDED USE</th>
<th>BENEFIT TO BE RECEIVED BY USERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regulators</td>
<td>Review PRB proposals / Technology Selection</td>
<td>Better site decisions / Protective Solutions</td>
</tr>
<tr>
<td>Consultants</td>
<td>Technology Selection / Design / Monitoring / Develop PRB proposals</td>
<td>Better site decisions / Better value for clients / regulatory partnership</td>
</tr>
<tr>
<td>Site Owners</td>
<td>Technology Selection / Design / Monitoring / Develop PRB proposals</td>
<td>Better site decisions / cost &amp; time savings / streamlined regulatory review</td>
</tr>
<tr>
<td>Academia</td>
<td>Providing students with latest information</td>
<td>Better equipped students</td>
</tr>
<tr>
<td>Community Stakeholders</td>
<td>Ensuring trusted resource for decision-makers</td>
<td>Getting to the best solution</td>
</tr>
</tbody>
</table>
Build Site Synergy – Use PRB-5

Regulators    Community Stakeholders    Site Owners    Consultants
Small Group Activity –
Implementation Targets & Key Messages

- Break into groups by sector
- Assign scribe and reporter
- Discuss / Document
  - List of Potential Projects/Sites
  - Target Users (be specific – names)
  - Key Messages
Build ITRC PRB Success by Taking Action

1) Identify target users
2) Use PRB-5 Info Sheets
3) Share key messages
4) Provide free PRB-5 documents
5) Promote free training
6) Report success

What action are you going to take?
**ITRC Permeable Reactive Barriers: Technology Update Implementation Session – October 26, 2011 in Denver, Colorado at the ITRC Fall Meeting**

The information below is a summary from the ITRC *Permeable Reactive Barriers: Technology Update* Implementation Session at the 2011 ITRC Fall Meeting in Denver, Colorado and includes:
- List of attendees / Participant Action Items
- Small Group Flip Chart Notes

**List of Attendees signing in:**

<table>
<thead>
<tr>
<th>First Name</th>
<th>Last Name</th>
<th>Organization</th>
<th>Participant Action Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>?</td>
<td>?</td>
<td>?</td>
<td>Other (with no name provided) educate / inform company staff of document and IBT</td>
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<tr>
<td>?</td>
<td>?</td>
<td>?</td>
<td>Other (with no name provided) share document with senior state staff</td>
</tr>
<tr>
<td>Ernest</td>
<td>Ashley</td>
<td>CDM (Camp, Dresser, &amp; McKee, Inc.)</td>
<td>Will host a tech transfer session and encourage taking the online training also post info on web portal</td>
</tr>
<tr>
<td>Rebecca</td>
<td>Bourdon</td>
<td>MPCA</td>
<td>Contact a specific site PM team to ask if PRBs have been considered.</td>
</tr>
<tr>
<td>Kathy</td>
<td>Brown</td>
<td>Wyoming DEQ</td>
<td>Present document at next staff meeting (bimonthly)</td>
</tr>
<tr>
<td>Mark</td>
<td>Bruce</td>
<td>Test America</td>
<td></td>
</tr>
<tr>
<td>Richard</td>
<td>Burnette</td>
<td>MacDill AFB FL</td>
<td>Attend next Internet-based training</td>
</tr>
<tr>
<td>Chris</td>
<td>Carleo</td>
<td>AECOM Environment</td>
<td></td>
</tr>
<tr>
<td>Kevin</td>
<td>Collins</td>
<td>GA EPD</td>
<td></td>
</tr>
<tr>
<td>Earl</td>
<td>Crapps</td>
<td>Alaska DEC</td>
<td>Attend the ITRC PRB IBT; Send Alaska forum on the Environment link to Mary Y. for ITRC presence.</td>
</tr>
<tr>
<td>Annette</td>
<td>Dietz</td>
<td>Department of Environmental Quality</td>
<td>Forward document to Erin M.; Send e-mail to cleanup PMs</td>
</tr>
<tr>
<td>John</td>
<td>Doyon</td>
<td>NJ Department of Environmental Protection</td>
<td>Team Member - Follow-up from Implementation Session</td>
</tr>
<tr>
<td>Jan</td>
<td>Dunker</td>
<td>U.S. Army Corps of Engineers</td>
<td>Promote free ITRC PRB Training</td>
</tr>
<tr>
<td>Jim</td>
<td>Fish</td>
<td>Alaska DEC</td>
<td>Recommend PRB to term c contractor for specific sites</td>
</tr>
<tr>
<td>Mike</td>
<td>Fitzpatrick</td>
<td>EPA Office of Resource Conservation and Recovery</td>
<td>Will advertise the document to EPA RCRA Staff in Regional Offices</td>
</tr>
<tr>
<td>Lindsay</td>
<td>Hall</td>
<td>DE Dept. of Natural Resources &amp; Environmental Control</td>
<td>Will attend PRB Internet training</td>
</tr>
<tr>
<td>Walsta</td>
<td>Jean-Baptiste</td>
<td>Florida Department of Environmental Protection</td>
<td>I will present it to my co-workers.</td>
</tr>
<tr>
<td>Michele</td>
<td>Johnson</td>
<td>Artemis</td>
<td>Tweeting re: PRB-5</td>
</tr>
<tr>
<td>Matt</td>
<td>Jones</td>
<td>ECOS</td>
<td></td>
</tr>
<tr>
<td>Ilsu</td>
<td>Lee</td>
<td>Freeport-McMoRan Mining Copper &amp; Gold Inc.</td>
<td>Share key messages</td>
</tr>
<tr>
<td>Mark</td>
<td>Malinowski</td>
<td>California Dept of Toxic Substances Control</td>
<td>Will discuss with Staff - PRB Guidance and website</td>
</tr>
<tr>
<td>First Name</td>
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<td>Participant Action Items</td>
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</tr>
<tr>
<td>Pat</td>
<td>McLoughlin</td>
<td>Microseeps, Inc.</td>
<td>Write up PRB summary for sales and marketing group.</td>
</tr>
<tr>
<td>Mark</td>
<td>Nielsen</td>
<td>ENVIRON</td>
<td>Post link to document for all remediation professionals in the firm (U.S. and International) with the Fact Sheet (Information Sheet)</td>
</tr>
<tr>
<td>Eric</td>
<td>Nuttall</td>
<td>University of New Mexico</td>
<td>Team Member - Follow-up from Implementation Session</td>
</tr>
<tr>
<td>Osaguona</td>
<td>Ogbebor</td>
<td>CH2M HILL</td>
<td>Post link to PRB document in my company tech page; talk to clients and other PMs about PRB; Present document to RL</td>
</tr>
<tr>
<td>Jim</td>
<td>Olsta</td>
<td>CETCO</td>
<td>Will post weblink to PRB document on our website</td>
</tr>
<tr>
<td>Tom</td>
<td>O’Neill</td>
<td>NJDEP</td>
<td>Will contact NJ DEP PF design group and present (or facilitate) presentation with design PMs, SCs, and BC.</td>
</tr>
<tr>
<td>Krishna</td>
<td>Reddy</td>
<td>University of Illinois</td>
<td>Inform National Guard Bureau Operational Range Assessment Program about PRB potential for off-site contamination migration control.</td>
</tr>
<tr>
<td>Hugh</td>
<td>Rieck</td>
<td>US Army Corps of Engineers</td>
<td></td>
</tr>
<tr>
<td>Randall</td>
<td>Ryti</td>
<td>Neptune and Company, Inc.</td>
<td>Team Member - Follow-up from Implementation Session</td>
</tr>
<tr>
<td>Cannon</td>
<td>Silver</td>
<td>CDM (Camp, Dresser, &amp; McKee, Inc.)</td>
<td></td>
</tr>
<tr>
<td>Michael</td>
<td>Stroh</td>
<td>Missouri Department of Natural Resources</td>
<td>Talk to dry cleaner site managers, superfund NPL site manger, voluntary cleanup program manager about PRB Tech Reg.</td>
</tr>
<tr>
<td>Ken</td>
<td>Vogler</td>
<td>Colorado Department of Public Health and Environment</td>
<td></td>
</tr>
<tr>
<td>Fred</td>
<td>Vreeman</td>
<td>Alaska DEC</td>
<td>Promote training internally to ADEC project managers; bring up guidance at meetings with AFCEE to recommend use in upcoming contract specifications</td>
</tr>
<tr>
<td>Valerie</td>
<td>Wilder</td>
<td>Missouri Department of Natural Resources</td>
<td>attend IBT and encourage co-workers to do the same -- organize a group from our unit to attend at the same time</td>
</tr>
<tr>
<td>Kimberly</td>
<td>Wilson</td>
<td>SC Dept. of Health and Environmental Control</td>
<td>Team Member - Follow-up from Implementation Session</td>
</tr>
<tr>
<td>Mary</td>
<td>Yelken</td>
<td>The Yelken Group, Inc.</td>
<td>Program Advisor - Follow-up from Implementation Session</td>
</tr>
<tr>
<td>Peter</td>
<td>Zawislanski</td>
<td>Terraphase</td>
<td>Presentation to company staff; send information to insurance clients; Team Member - Follow-up from Implementation Session</td>
</tr>
</tbody>
</table>

**Small Group Flip Chart Notes:**

**State/Local Government Group 1 & 2:**

Sites/Programs:

- Dry Cleaner Program Sites
- Voluntary Cleanup Program
- LUST Programs
- Green Remediation Managers
- Pump & Treat conversions
- Alaska – USAF
  - King Salmon
  - Galena
Eielson
- Alaska – dry cleaner (old/legacy/state lead)
  - Kenai
  - Anc
  - Fai
- Florida
  - Koppers – Gainesville
  - Dry Cleaners
  - Public funded CERCLA
    - Syncon Resins
    - Ellis Property
    - VI Chem
- Minnesota
  - St. Louis PK (Reilly Tar)

People/Users
- CO – Walter Avcamenko
- CO – Doug Jameson
- MO – Ken Koon
- CO – Erik Gessert
- AK – James Fish
- WY – Jerry Breed
- OR – Erin McDonnell
- DE – Jennifer Roushey
- CO – Barbara Nabors
- AFCEE / ACOE Project Managers
- NAVFAC – Locate specific PM names
- Alaska Tech Clearinghouse – Fred Vreeman
- Florida – Tech review section – Brian Dougherty; Jennifer Farrell – dry cleaners
- Missouri – Bob Hinkson – Remediation Project Management Supervisor; Jim Belcher
- New Jersey – Ken Petrone, Bruce Venner and site Project Managers

Messages
- It’s green
- Identify state conferences and present there or national (i.e., Brownfields)
- Track record
- It is cost effective
- Not just chlorinated solvents
- Perception issues – clogging, fouling
- Supply case study data
- Target optimization (rejuvenation) - (historic legacy)
- Option for long term
- Environmental Impact (Low energy)
Success Story Lead
- Kevin Collins – GA EPD

Federal Participants
People/Contacts:
- Navy Optimization Work Group
- USACE Environ. Community of Practice (Hugh Rieck)
- Army Environmental Command (Doris Anders)
- AFCEE – John Gillespie, Paul Jurena

Messages:
- New contaminants addressed
- New, better emplacement (deeper)
- Cost savings potential
- Green & Sustainable Remediation

Private Sector Participants Groups 1 & 2
Users
- Consultant reference
- Conferences (booth, poster, presentation, workshop)
  - Battelle Chlorinated
  - AEHS Amherst
  - Workshops with CEUs
    - Require state approval
- Linkedin

Sites/Projects
- 12 states not part (or minimally) of ITRC
- Consultant
  - Internal Knowledge Management
  - Tech Transfer
  - Webinars

Messages
- Case studies
  - Costs
  - Lessons Learned
- State regulators have reviewed document
- Sustainability Lifecycle Assessments
- Passive – final not initial
- Lot of $ for passive system
- Seems like secondary tech
- Matrix to show applicability
- Mass Flux
- Timeframes
- Credibility
- Insurance and banking
- Promote list of states concurring on document

**Academia Participants**

**Messages:**

- Both the guidance documents and internet training are used in environmental courses
- The archived IBT audio files need to be better advertised
- Request that POCs visit faculty/students and discuss ITRC and regulatory considerations
- Use PRBs to treat storm runoff and protect rivers and lakes
- Note that PRBs are green and sustainable