Arsenic Mitigation and Sustainable Behavior Change in Cambodia

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www.rdic.org

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Summary

- Resource Development International
- Approach to Arsenic Mitigation
  - Arsenic population impact assessment
  - Door-to-door surveying and education
  - Community assessment
  - Arsenic-safe water source interventions
- Arsenic mitigation research
  - Alternative arsenic-safe drinking water options
  - Assessing post-education behavior change
- Sustainable behavior change
Resource Development International (RDI)

- Non-profit NGO established in 2000
- Active in Cambodian water and sanitation sector
- Partner with MRD, UNICEF, WHO, others on arsenic issue

Departments:
- Community development
  - Arsenic education and mitigation
- Educational media studio
- Laboratory and research
  - Arsenic research and lab testing
- Household ceramic water filter factory
Approach to Arsenic Mitigation

1. Arsenic Population Impact Assessment
2. Prioritize Communities by Exposure
3. Target Door-to-Door Well Testing, Education, Surveying
4. Arsenic-safe Drinking Water Interventions (if necessary)
5. Community Assessment
6. Promote Alternative Arsenic-safe Water Sources (if available)
Step 1 - Approach to Arsenic Mitigation

1. **Arsenic Population Impact Assessment**
2. **Prioritize Communities by Exposure**
3. **Target Door-to-Door Well Testing, Education, Surveying**
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Arsenic Pop. Impact Assessment

- How many people exposed to GW arsenic?
- Nation-wide village-level data from 2008 National Census (NIS)
- National Well Database (WellMap), over 40,000 As well tests – www.cambodiawellmap.com

Data utilized:
- % wells in village with Arsenic ≥ 50ppb
- # households in village consuming tube well water
- Average household size
Example Calculation

- Stueng village, Samroang Thum commune, Kien Svay district, Kandal Province
- 43 As well tests $\Rightarrow 95\% \geq 50$ ppb
- 162 of 562 households drinking tube well water in March 2008
- Average 4.7 people per household in village

$$0.95 \times 162 \times 4.7 = 723$$ people
<table>
<thead>
<tr>
<th>Province</th>
<th>Arsenic Tests</th>
<th>Total Population (&gt;50ppb)</th>
<th>Total Population (&gt;250ppb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kampong Cham</td>
<td>7,739</td>
<td>19,355</td>
<td>4,221</td>
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<tr>
<td>Kampong Chhnang</td>
<td>1,083</td>
<td>2,531</td>
<td>38</td>
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<td>Kampong Thom</td>
<td>1,908</td>
<td>1,410</td>
<td>15</td>
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<tr>
<td>Kandal</td>
<td>17,663</td>
<td>56,177</td>
<td>26,986</td>
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<tr>
<td>Kracheh</td>
<td>804</td>
<td>774</td>
<td>61</td>
</tr>
<tr>
<td>Phnom Penh</td>
<td>452</td>
<td>1,030</td>
<td>111</td>
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<tr>
<td>Prey Veng</td>
<td>10,061</td>
<td>33,325</td>
<td>4,880</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>39,710</strong></td>
<td><strong>114,603</strong></td>
<td><strong>36,312</strong></td>
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</tbody>
</table>
Sources of Error

- Drinking water source changes since March 2008
  - New water source options available
  - More private wells drilled
- Only a few arsenic tests in some villages
  - Data from a few tests can impact estimations for an entire village
Summary

• Over 2 million living on arsenic contaminated groundwater aquifers
• Approximately 75,000 – 150,000 people consuming arsenic contaminated water in dry season
  • Increase in piped water systems
  • Historical arsenic education and awareness
  • Correlation with high iron and preference for other water sources
• Less exposure in rainy season
Step 2 - Approach to Arsenic Mitigation

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<table>
<thead>
<tr>
<th>Province</th>
<th>District</th>
<th>Commune</th>
<th>Commune pop’n</th>
<th>Population $\geq 50 , \mu g/L$</th>
<th>Population $\geq 250 , \mu g/L$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kandal</td>
<td>Kien Svay</td>
<td>Samraong Thum</td>
<td>20,195</td>
<td>5,033</td>
<td>3,240</td>
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<tr>
<td></td>
<td></td>
<td>Banteay Daek</td>
<td>14,593</td>
<td>4,798</td>
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<tr>
<td></td>
<td></td>
<td>Dei Edth</td>
<td>16,840</td>
<td>4,339</td>
<td>3,034</td>
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<td></td>
<td></td>
<td>Preaek Aeng</td>
<td>15,791</td>
<td>3,615</td>
<td>2,240</td>
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<td></td>
<td></td>
<td>Kokir</td>
<td>18,058</td>
<td>2,714</td>
<td>2,308</td>
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<td>Kandal</td>
<td>S’ang</td>
<td>Svay Prateal</td>
<td>14,531</td>
<td>3,467</td>
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<td>Kandal</td>
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<td>Sampov Lun</td>
<td>20,994</td>
<td>2,982</td>
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<td>Kampong Kong</td>
<td>11,450</td>
<td>2,958</td>
<td>1,636</td>
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<td>Prey Veng</td>
<td>Kampong Trabaek</td>
<td>Cham</td>
<td>11,179</td>
<td>2,782</td>
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<td>Pratheat</td>
<td>8,841</td>
<td>2,727</td>
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</tbody>
</table>
Step 3 - Approach to Arsenic Mitigation

1. **Arsenic Population Impact Assessment**
2. **Prioritize Communities by Exposure**
3. **Target Door-to-Door Well Testing, Education, Surveying**
4. **Arsenic-safe Drinking Water Interventions (if necessary)**
5. **Community Assessment**
6. **Promote Alternative Arsenic-safe Water Sources (if available)**
Door-to-door Arsenic Surveying and Education

- Surveyors ask each household if they drink water from tube wells at any time of year
  - If they do…
    - Well testing
      - Safe or not safe?
      - Give household well testing result card
    - Arsenic education
    - Alternative water source education
Door-to-door Arsenic Surveying and Education

- Household questionnaire
- Arsenic awareness,
- Drinking water practices
- Previous well testing
- Willingness-to-pay
- Arsenicosis screening

Over 6,500 households surveyed since December 2009
  - RDI
  - PDRD-Kandal, PDRD-Prey Veng
Step 4 - Approach to Arsenic Mitigation

1. Arsenic Population Impact Assessment
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6. Promote Alternative Arsenic-safe Water Sources (if available)
Promote Alternative Arsenic-safe Water Sources

- If available…
  - Clean “green” tube wells
  - Piped water supplies
  - Water vendor services
  - Increased rainwater storage
  - Dug wells
  - Surface water + HWTS

- Problems
  - Not always available
  - Financial limitations
  - Low willingness to pay
Step 5 - Approach to Arsenic Mitigation

- Arsenic Population Impact Assessment
- Prioritize Communities by Exposure
- Target Door-to-Door Well Testing, Education, Surveying
- Community Assessment
- Arsenic-safe Drinking Water Interventions (if necessary)
- Promote Alternative Arsenic-safe Water Sources (if available)
Community Assessment

- **Door-to-door household survey**
  - Month-by-month drinking water practices
    - What alternatives are available in community?
  - Arsenic awareness
  - Previous well testing results
  - Willingness-to-pay for alternative water supply
  - Density of arsenic impacted households

- **Meetings with local government**
  - Willingness to improve situation
Step 6 - Approach to Arsenic Mitigation

- Arsenic Population Impact Assessment
- Prioritize Communities by Exposure
- Target Door-to-Door Well Testing, Education, Surveying
- Arsenic-safe Drinking Water Interventions (if necessary)
- Community Assessment
- Promote Alternative Arsenic-safe Water Sources (if available)
Arsenic-safe Drinking Water Interventions

- If no alternatives available...
  - RDI
    - Microfinance rainwater harvesting tank program
    - Microfinance dug well program
  - GRET
    - Piped water supply systems
  - 1001 Fontaines
    - Surface water treatment and vendor systems
  - ITC/Lehigh Universities
    - Community-scale arsenic treatment and water vendor systems
  - Rainwater Cambodia
    - Subsidized rainwater tank program
  - UNICEF
    - Ceramic water filters for surface water
    - Rainwater harvesting systems at schools/households
Arsenic Mitigation Research

- World Bank WSP funded project
- Study on arsenic-safe water options
  - Small-scale piped water systems
  - Rainwater harvesting
  - Dug wells
  - Surface water + HWTS
  - Water vendors
Arsenic Mitigation Research

- Study themes
  - Advantages
  - Disadvantages
  - Cost analysis
  - Willingness-to-pay
  - Risk substitution

- Project timeframe June to November 2011
Arsenic Mitigation Research

- Follow-up assessment of Door-to-Door education program
  - Is behavior change occurring?
    - Why?
    - Why not?
    - Community factors that influence behavior change
      - Willingness to pay
      - Availability of alternative safe water options
  - Is the message remembered?
Sustainable Behavior Change

- Community participation in decision-making process
  - Ownership over the problem

- Community and door-to-door education
  - Increase awareness, increase willingness-to-pay
  - Message not lost over time

- User preferences
  - Rainwater, piped water, clean and treated water

- Subsidies to reach poorest of poor

- Simplicity in water options
Questions?