THE NEED FOR R&D IN THE U.S.

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TRADITIONAL LIFE CYCLE OF A U.S. ONSITE SYSTEM

- Permitting: prescribed systems on acceptable sites; list of approved alternatives; prescribed system designs
- Installation: minimal construction oversight; most states have installer, site evaluator licensing/registration
- O & M: homeowner responsible - booklets and brochures provided
- Corrective actions: repair/replacement based upon verified complaints

WHAT THIS MEANS

- Little expertise needed by regulators, designers, and homeowners
- Homeowners MUST PAY for any &all mistakes thru cost of repairs/ replacements
- Previously developed property values can be severely impacted owing to poorly performing O/S systems

WHAT IS NEEDED TO FACILITATE A PERFORMANCE PARADIGM?

All stakeholders but owner must understand basic hydraulics, pretreatment principles, and soil treatment capabilities under variable site conditions

Each practitioner category should have specific responsibilities and be accountable for their performance to managers and regulators

What Drove EPA's Involvement?

- Congress directed EPA in 1996 to report on onsite and of onsite and decentralized systems
- 1997 EPA Response to Congress noted:
  - "***Adequately managed*** decentralized systems are a cost-effective and long-term option for meeting public health and water quality goals"
- Report identified some barriers to full/proper use
  - Lack of awareness of O&M needs and misperception about the potential for modern septic systems
  - Existing regulatory and legal constraints that prevent proper applications
  - Lack of responsible management programs
  - Fear of liability & financial disincentive for engineers

WHAT WAS CONGRESS' RESPONSE TO USEPA?

- It was clear to Congress that EPA was only going to address management issues
- Congress authorized $16 million over the next decade to have done what EPA would not/could not do
- These research programs were run through Washington U. of St. Louis (National Decentralized Water Resources Capacity Development Project) and then the Water Environment Research Foundation (Decentralized Water Resources Collaborative)

CATAGORIES OF PROJECTS

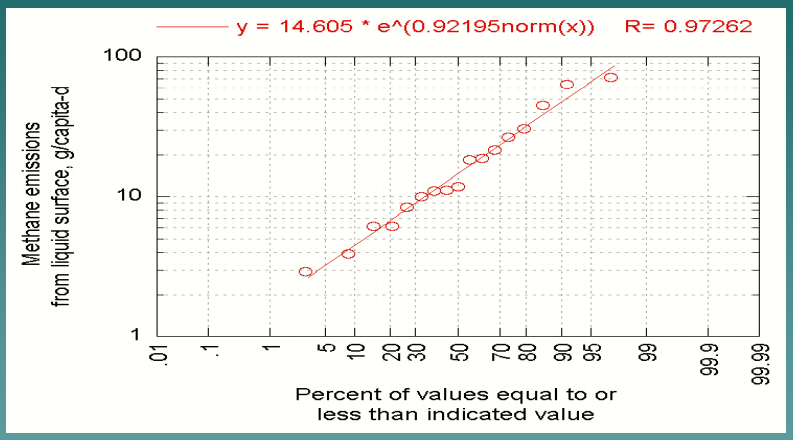
- Environmental science & engineering
- Management, economics, and policy
- Training and education
- Strategic planning

These projects were chosen and overseen by advisory/steering committees made up of people with varied backgrounds*

SOME NOTEWORTHY SCIENCE & ENGINEERING PROJECTS

- Residential wastewater characterization, septic & other preliminary systems' performance, and GHG production
- USEPA had estimated that septic tanks produced 79% of the methane generated from wastewater systems
- DWRC Project measurements found methane production to be less than 60% of EPA estimate, thus reducing ST methane to <50% of wastewater total

SEPTIC TANK METHANE (UC DAVIS, 2009)



ADDITIONAL DWRC TOPICS IMPORTANT TO ONSITE SYSTEM UNDERSTANDING

- Pretreatment impacts on soil treatment performance for numerous contaminants (including PPCPs), groundwater mounding design approaches, natural systems design, specific pollutant removals by soil systems, hydrogeological impacts, and cost documentation
- Studies of natural systems performance
- College-level and practitioner curricula developed for use by educational institutions and training centers

WERF WEBSITE

Temporary: http://www.werf.org/AM/Template.cfm?Section=Decentralized_Systems&CONTENTID=15544&TEMPLATE=/CM/HTMLDisplay.cfm

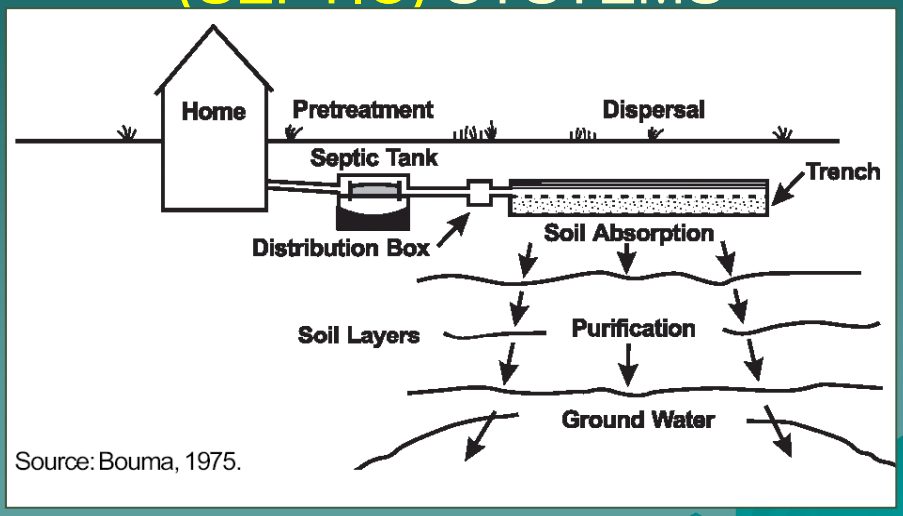
Soon: www.decentralizedwater.org

- The website contains tools for reviewing the entire body of work funded by the Congressional earmarks

NORDIC CONFERENCE KEY ISSUE IS PHOSPHORUS

- In US, nitrogen is a more dominant issue given the large coastal area population (30-40%)
- There are concerns over loss of phosphorus (P) reserves, but not yet perceived at crisis stage
- Areas of industrialized agriculture have supersaturated soils from overloading with manure and excess P in fertilizer resulting high P concentrations in runoff and eutrophication of inland waterways (agricultural runoff =the biggest source of P in US waterways)

TRADITIONAL SOIL-BASED (SEPTIC) SYSTEMS



SOURCES OF RESIDENTIAL PHOSPHORUS

Toilet (organics)	60%
Bathing and Kitchen Appliances (polyphosphates)	35%
Garbage Grinders (organics)	5%

65 to 85% of the septic tank effluent P is in the ortho form (~10-20% rem'l)

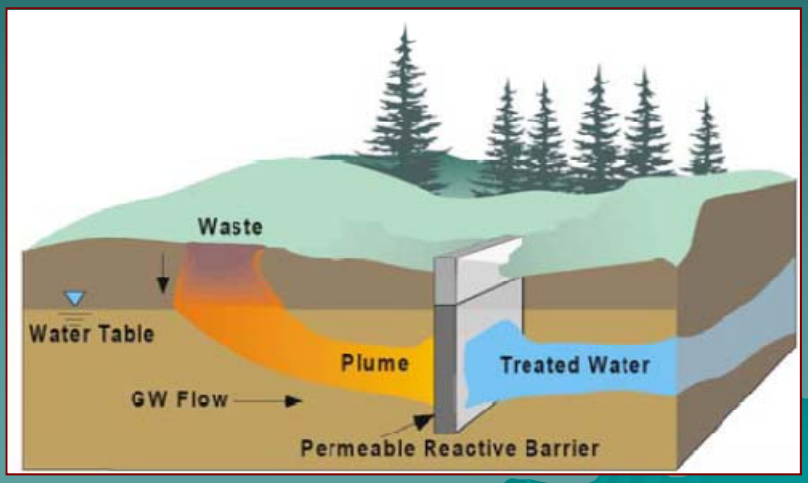
PHOSPHORUS SOURCE REDUCTION

- Several states (>15) require P-content of detergents to be no more than 0.5% by weight.
- Those states have claimed a daily P per person loading drop of 59% (our characterization data would predict <40%)
- There has been about a 30% reduction in total household wastewater P content over the past few decades

PHOSPHORUS TREATMENT

- Phosphorus removal can be accomplished by precipitation or adsorption
- Chemical, chemical/biological, or chemical/physical treatment produces excess sludge and must be managed frequently with trained/skilled operators
- A most promising technology "permeable, reactive barrier (PRB)" trenches that intercept groundwater near shoreline, filled with specially designed media (eg, aluminates, sands with high iron oxide content, power plant air scrubber byproducts) have been successfully demonstrated for short durations.
- The only O&M demand is to replace media every 10+ years, and the excess P problem is quickly solved without a long lag time.

PERMEABLE, REACTIVE BARRIERS (PRBs)

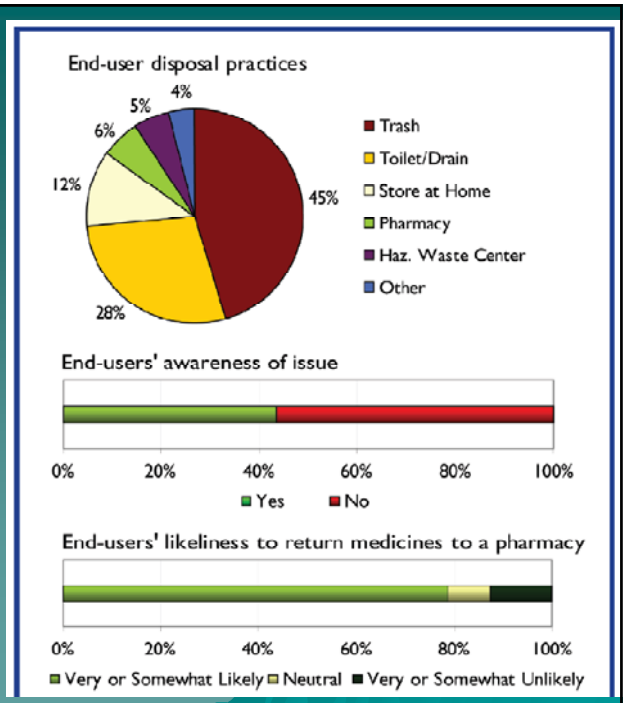


PHARMACEUTICALS AND PERSONAL CARE PRODUCTS

- $250 billion spent in U.S. annually
- Use is rising among all age groups
- One in six Americans takes 3 or more drugs
- More than half of the drugs ingested are excreted
- 75,000 chemical compounds in use

WHERE DO UNUSED PPCPs GO?

End-user results from Santa Barbara CA Survey



PPCP TREATMENT

- Activated carbon & MBRs are very effective
- Chlorine disinfection can remove some compounds, ozone removes most, as does high energy UV
- Soil treatment removes many of these organic compounds, especially when uniform dosing/ resting are employed at lower loading rates

US RESEARCH NEEDS

- Soils must continue to be studied to become a predictable treatment unit for use in models that have an acceptable margin of error for predicting performance on both site and watershed bases
- The major pollutant category of interest will be PPCPs
- Research should be initiated on the efficiency and duration of various phosphorus-retention materials that can be used in passive (PRB) groundwater treatment systems
- Given the direction of federal and state funding, small R&D studies related to local problems & conditions are likely to be the norm in the near future

THANKS FOR YOUR ATTENTION

Any Questions?

GENERAL PHOSPHORUS REMOVAL CONTROLS IN SOILS

- Iron, aluminum, and calcareous content of soil
- Alkalinity, pH, NH_4 –N content & redox status of influent
- System age and uniformity of distribution & dosing

PHOSPHORUS REDUCTION NEEDS

- Minimize phosphorus concentration in wastewater by product substitution
- Maximize soil contact volume and time to optimize soil adsorption and precipitation capabilities through uniform dosing and resting (LPP or drip) high in the soil profile
- Add P-removal assessment to site evaluation procedures
- Conduct field studies of simple, practical P removal concepts like PRBs and enhanced ground/surface water interfaces should be undertaken to simplify management demands and shorten impact lag times