The Impacts of education and public outreach on on-site wastewater treatment systems’ use in Texas

BAEN OSSF Team

National Onsite Wastewater Association NOWRA Annual Conference, October 14, 2019
Loveland, CO
Outline

• On-site wastewater systems (OSSFs) in Texas
• BAEN OSSF Education/Outreach Program
• Impacts of Education & Outreach on:
  – Students
  – Homeowners
  – Professionals
• Where are we headed now?
• Conclusions & Discussion

Question: How many in the room are in education/outreach business?
Onsite / Decentralized wastewater treatment systems are here to stay....

- Integral part of our nation’s wastewater infrastructure (EPA Report to Congress…)
- Public Health and Water Quality Protection are a must
- 20% to >40% of dwellings use them
- They are known as.....
  - Septic Systems (most commonly)
  - OWTS: Onsite Wastewater Treatment Systems; Nationally
  - OSSF: On-Site Sewage Facility; Texas
“Adequately managed decentralized wastewater systems are a cost-effective and long-term option for meeting public health and water quality goals, particularly in less densely populated areas” (p. i)
Voluntary National Guidelines for Management of Onsite and Clustered (Decentralized) Wastewater Treatment Systems

Management Models

1. Homeowner awareness
2. Maintenance contract
3. Operating permit
4. RME operation & maintenance
5. RME ownership

Public Education and Participation is IMPORTANT
Number of OSSFs in TX then and now...

1990: 1,318,449
2016: 2,224,875 (2,297,783 in 2018)

This information was compiled from 1990 Census data and OARS data.
• On-Line Trial Map: https://ossf.tamu.edu/test-map/
OSSF Education/Outreach Programs @ TAMU

1. Publications *(PDF available for download)*

2. Home and Business Owners *(2-Hr and 6-Hr Programs)*

3. Professionals *(8-Hr and 16-Hr Programs for OSSF license holders who need continues education)*

4. Students *(4-H Students, REEU Program, Capstone Projects, and Graduate Research)*

5. Others *(presentations at local, regional, state, national, international events)*
Education & outreach: 
Publications
- Operation & Maintenance
- Siting requirements
- Various OSSF technologies
- 20 publications available in Spanish
On-site wastewater treatment systems

Selecting and permitting

About 50,000 on-site wastewater treatment systems are installed annually in Texas to treat wastewater from rural and suburban homes as well as from small businesses. An on-site wastewater treatment system collects, treats and applies wastewater to the soil.

Selecting the appropriate system for the site conditions is critical to the system’s success. If you select the wrong system or design, or install, operate or maintain the system improperly, it can fail, which could result in pollution of your property and that of others. You could also be fined.

Because homeowners are responsible for conducting or contracting for the installation and maintenance of an on-site wastewater treatment system, it is wise for homeowners to be involved in the planning and construction of the system.

Table XIII. Disposal and Treatment Selection Criteria.

<table>
<thead>
<tr>
<th>On-Site Sewage Facility(9) (OSSF)</th>
<th>Soil Texture Or Fractured Rock(10) (Most Restrictive Class Along Media(1) or 2 Feet Below Excavation)</th>
<th>Minimum Depth To Groundwater</th>
<th>Minimum Depth To Restrictive Horizon(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disposal Method (section)</td>
<td>Class Ia, Ib, IIb, IIIb(6)</td>
<td>MEASURED FROM BOTTOM OF MEDIA(7)</td>
<td>MEASURED FROM BOTTOM OF MEDIA(7)</td>
</tr>
<tr>
<td>Absorptive drainfield(2) (285.33(b)(1))Septic tank</td>
<td>U S U U</td>
<td>2 feet</td>
<td>2 feet</td>
</tr>
<tr>
<td>Absorptive drainfield(2) Secondary treatment</td>
<td>S(5) S U S(5)</td>
<td>2 feet</td>
<td>2 feet</td>
</tr>
<tr>
<td>Lined E-T(2) Septic tank</td>
<td>S S S S</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Lined E-T(2) Secondary treatment</td>
<td>S S S S</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Unlined E-T(2) Septic tank</td>
<td>U S U U</td>
<td>2 feet</td>
<td>2 feet</td>
</tr>
<tr>
<td>Unlined E-T(2) Secondary treatment</td>
<td>S(5) S S S(5)</td>
<td>2 feet</td>
<td>2 feet</td>
</tr>
<tr>
<td>Pumped Effluent Drainfield(2) Septic tank</td>
<td>U S S U</td>
<td>2 feet</td>
<td>1 foot</td>
</tr>
<tr>
<td>Leaching chamber(2) Septic tank</td>
<td>U S U U</td>
<td>2 feet</td>
<td>2 feet</td>
</tr>
<tr>
<td>Leaching chamber(2) Secondary treatment</td>
<td>S(5) S U S(5)</td>
<td>2 feet</td>
<td>2 feet</td>
</tr>
<tr>
<td>Gravelless pipe(2) Septic tank</td>
<td>U S U U</td>
<td>2 feet</td>
<td>2 feet</td>
</tr>
<tr>
<td>Gravelless pipe(2) Secondary treatment</td>
<td>S(5) S U S(5)</td>
<td>2 feet</td>
<td>2 feet</td>
</tr>
<tr>
<td>Drip Irrigation Septic tank/ filter</td>
<td>U S S U</td>
<td>2 feet</td>
<td>1 foot</td>
</tr>
<tr>
<td>Drip Irrigation Secondary treatment/ filter</td>
<td>S(5) S S S(5)</td>
<td>1 foot</td>
<td>6 inches</td>
</tr>
</tbody>
</table>
### TABLE XIII: DISPOSAL AND TREATMENT SELECTION CRITERIA

<table>
<thead>
<tr>
<th>ON-SITE SEWAGE FACILITY(9) (OSSF)</th>
<th>SOIL TEXTURE OR FRACTURED ROCK(10) (MOST RESTRICTIVE CLASS ALONG MEDIA(1) or 2 FEET BELOW EXCAVATION)</th>
<th>MINIMUM DEPTH TO GROUNDWATER</th>
<th>MINIMUM DEPTH TO RESTRICTIVE HORIZON(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Disposal Method (section) Treatment</strong></td>
<td><strong>Class Ia</strong></td>
<td><strong>Class Ib, II(8) or III(3)</strong></td>
<td><strong>Class IV</strong></td>
</tr>
<tr>
<td>Absorptive drainfield(2) (285.33(b)(1)) Septic tank</td>
<td>U</td>
<td>S</td>
<td>U</td>
</tr>
<tr>
<td>Absorptive drainfield(2) Secondary treatment</td>
<td>S(3)</td>
<td>S</td>
<td>U</td>
</tr>
<tr>
<td>Lined E-T(3) Septic tank</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Lined E-T(3) Secondary treatment</td>
<td>S</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Unlined E-T(2) Septic tank</td>
<td>U</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Unlined E-T(2) Secondary treatment</td>
<td>S(3)</td>
<td>S</td>
<td>S</td>
</tr>
<tr>
<td>Pumped Effluent Drainfield(3)</td>
<td>U</td>
<td>S</td>
<td>S</td>
</tr>
</tbody>
</table>
### TCEQ Chapter 285

#### TABLE XIII: DISPOSAL AND TREATMENT SELECTION CRITERIA

<table>
<thead>
<tr>
<th>ON-SITE SEWAGE FACILITY (OSSF)</th>
<th>SOIL TEXTURE OR FRACUTRED ROCK (MOST RESTRICTIVE CLASS ALONG MEDIA OR 2 FEET BELOW EXCAVATION)</th>
<th>MINIMUM DEPTH TO GROUNDWATER</th>
<th>MINIMUM DEPTH TO RESTRICTIVE HORIZON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disposal Method (section) Treatment</td>
<td>Class Ia</td>
<td>Class Ib, II or III</td>
<td>Class IV</td>
</tr>
<tr>
<td>Surface application Secondary treatment</td>
<td>S(6)</td>
<td>S(6)</td>
<td>S(6)</td>
</tr>
<tr>
<td>Surface application Non-standard treatment</td>
<td>S(6)</td>
<td>S(6)</td>
<td>S(6)</td>
</tr>
</tbody>
</table>

(2) If the slope in the drainfield area is greater than 30% or is complex, the area is unsuitable for the disposal method.

(6) Requires vegetation cover and disinfection.

**Surface application; Secondary treatment i.e., ATU & Spray System is a popular option.**
Trend in Types of OSSFs...

~ 50% of the permits are issued for ATU & Spray Option

Information compiled from OARS database (On-Site Activity Reporting System, TCEQ)
# TCEQ Chapter 285

## Table XII. OSSF Maintenance Contracts, Affidavit, and Testing/Reporting Requirements.

<table>
<thead>
<tr>
<th>SYSTEM DESCRIPTION</th>
<th>Maintenance /Affidavit Required</th>
<th>Maintenance Activities Required</th>
<th>Testing and Reporting Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Septic Tank &amp; Absorptive Drainfield</td>
<td>No</td>
<td>See §285.39</td>
<td>No</td>
</tr>
<tr>
<td>Septic Tank &amp; ET Drainfield (Unlined)</td>
<td>No (3)</td>
<td>See §285.39</td>
<td>No</td>
</tr>
<tr>
<td>Septic Tank &amp; ET Drainfield (Lined)</td>
<td>No (3)</td>
<td>See §285.39</td>
<td>No</td>
</tr>
<tr>
<td>Septic Tank &amp; Pumped Drainfield</td>
<td>No</td>
<td>See §285.39</td>
<td>No</td>
</tr>
<tr>
<td>Septic Tank &amp; Leaching Chamber</td>
<td>No</td>
<td>See §285.39</td>
<td>No</td>
</tr>
<tr>
<td>Septic Tank, Secondary Treatment, Filter &amp; Surface Application</td>
<td>Yes</td>
<td>Entire OSSF</td>
<td>Test &amp; Report</td>
</tr>
<tr>
<td>Secondary Treatment &amp; Standard Absorptive Drainfields</td>
<td>Yes</td>
<td>Treatment System</td>
<td>Report</td>
</tr>
<tr>
<td>Secondary Treatment &amp; ET Drainfield</td>
<td>Yes</td>
<td>Treatment System</td>
<td>Report</td>
</tr>
<tr>
<td>Secondary Treatment &amp; Leaching Chamber</td>
<td>Yes</td>
<td>Treatment System</td>
<td>Report</td>
</tr>
<tr>
<td>Secondary Treatment &amp; Gravelless Pipe</td>
<td>Yes</td>
<td>Treatment System</td>
<td>Report</td>
</tr>
<tr>
<td>Secondary Treatment, Filter &amp; Drip Emitter</td>
<td>Yes</td>
<td>Entire OSSF</td>
<td>Report</td>
</tr>
<tr>
<td>Secondary Treatment &amp; Low Pressure Dosing</td>
<td>Yes</td>
<td>Treatment System</td>
<td>Report</td>
</tr>
<tr>
<td>Secondary Treatment &amp; Absorptive Mounds</td>
<td>Yes</td>
<td>Treatment System</td>
<td>Report</td>
</tr>
<tr>
<td>Secondary Treatment &amp; Surface Application</td>
<td>Yes</td>
<td>Entire OSSF</td>
<td>Test and Report</td>
</tr>
</tbody>
</table>

**Maintenance required for all Secondary Treatment systems...**

**Test & Report required only for Surface Application (spray)....**
Homeowner maintenance exemption 285.7(d)(4)

- At the end of the initial two-year service policy period, the owner of an OSSF for a single-family residence shall either maintain the system personally or obtain a new maintenance contract.

- Limitation: An owner may not maintain an OSSF under the provisions of this section for commercial, speculative residential, or multifamily property.

- Local permitting authority can opt-in or opt-out of this exemption!
Homeowner maintaining their ATU and Spray System

• We estimate about 70 counties allow homeowners to do the maintenance after completing “approved” education program;
• We also estimate that the number of ATU permits issued in these counties account for about 50% of the total permits issued!
• TAMU education program is not approved in all the counties....
What do these items have in common?

- Yeast
- Buttermilk
- Dog food
- Cow manure
- Road kill
- Chicken
- Ground beef
Homeowner education

- Address homeowners’ FAQs
  - How do you live with an OSSF?
  - 1st home with an OSSF?
  - Maintenance requirements
  - The definition of working extends beyond a flushing toilet

- Education and outreach
  - Workshops
  - Website
  - Publications, & manuals
  - Demonstration sites
  - Surveys
  - Inspections
Homeowner education

- **Intro to Septic Systems**
  - 1 – 2 hour program
  - Provides a basic understanding of technologies
  - Often at the request of County Extension Agents or Watershed Coordinators

- **Homeowner Maintenance of ATUs**
  - Six hour program
  - Operation & maintenance
  - Tools
  - Reporting
  - How to live with an ATU
Course Evaluation Tool: Pre- and Post-Survey Form

1. For each item listed below, mark the ONE number in the left column that best describes your level of understanding BEFORE the program, and then mark the ONE number in the right column that best describes your level of understanding AFTER the program.

   Poor 1  Fair 2  Good 3  Excellent 4

   BEFORE Program
   AFTER Program

   Your understanding of...
   How septic systems are a part of our wastewater infrastructure.
   How practices in the home affect sewage characteristics.
   How changes in water quality impact sewage treatment plants.
   Safety issues associated with maintenance of anaerobic treatment units (ATU).
   How anaerobic treatment units remove waste from sewage.
   Anaerobic treatment plant operation and maintenance criteria.
   How a malfunctioning septic system can impact water quality.
   Importance of proper septic system operation for protection of public health.
   Tools and practices for maintaining an ATU.
   Importance of keeping biological components operating properly.

2. Please indicate your intentions to adopt each item listed below or indicate if you have already adopted the item listed or if it does not apply to your situation.

   Practice or technology that could be adopted...

<table>
<thead>
<tr>
<th>Before Adopted</th>
<th>Probability to be Adopted</th>
<th>Probability to be Understood</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 2 3 4</td>
<td>0 0 0 0</td>
<td>0 0 0 0</td>
</tr>
</tbody>
</table>

Please continue on the other side.
Course Evaluation Results

- Intro to Septic Systems
  - 76% will perform operation and maintenance activities on their septic system
  - 75% will pump out their septic tanks as needed
    - 20% had already adopted this practice

- Homeowner Maintenance of ATUs
  - 20% of participants indicated a willingness to hire a professional to maintain their system

6. Would you recommend this particular activity to others?  
   - Yes  
   - No

7. Your thoughts on the program (perhaps what you liked most, liked least, additional information you would like, etc.).
   
   Informative but I don’t feel competent to do this on my own. Will be better able to communicate with contractor.
Percent Change = ((Post-Mean - Pre-Mean) / 3) * 100

For example, for the question “How practices in the home affect sewage characteristics?” the value of Pre-Mean = 1.6 and Post-Mean = 3.6 then % Change = ((3.6 – 1.6)/3) * 100 = 66%
## Ten questions asked...

<table>
<thead>
<tr>
<th>Your understanding of...</th>
<th>BEFORE Program</th>
<th></th>
<th>AFTER Program</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>How septic systems are a part of our wastewater infrastructure.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>How practices in the home affect sewage characteristics.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>How changing water quality goals impact sewage treatment regs.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Safety issues associated with maintenance of aerobic treatment unit (ATU).</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>How aerobic treatment units remove waste from sewage.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Aerobic treatment unit operation and maintenance criteria.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>How a malfunctioning septic system can impact water quality.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Importance of proper septic system operation for protection of public health.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Tools and practices for maintaining an ATU.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Importance of keeping disinfection component operating properly.</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>
Example of a response...

<table>
<thead>
<tr>
<th>Your understanding of…</th>
<th>BEFORE Program</th>
<th>AFTER Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>How septic systems are a part of our wastewater infrastructure.</td>
<td>● ○ ○ ○</td>
<td>○ ○ ○ ○ ●</td>
</tr>
<tr>
<td>How practices in the home affect sewage characteristics.</td>
<td>○ ● ○ ○</td>
<td>○ ○ ○ ○ ●</td>
</tr>
<tr>
<td>How changing water quality goals impact sewage treatment regs.</td>
<td>○ ● ○ ○</td>
<td>○ ○ ○ ○ ●</td>
</tr>
<tr>
<td>Safety issues associated with maintenance of aerobic treatment unit (ATU).</td>
<td>○ ● ○ ○</td>
<td>○ ○ ○ ○ ●</td>
</tr>
<tr>
<td>How aerobic treatment units remove waste from sewage.</td>
<td>○ ● ○ ○</td>
<td>○ ○ ○ ○ ●</td>
</tr>
<tr>
<td>Aerobic treatment unit operation and maintenance criteria.</td>
<td>○ ● ○ ○</td>
<td>○ ○ ○ ○ ●</td>
</tr>
<tr>
<td>How a malfunctioning septic system can impact water quality</td>
<td>○ ● ○ ○</td>
<td>○ ○ ○ ○ ●</td>
</tr>
<tr>
<td>Importance of proper septic system operation for protection of public health.</td>
<td>○ ● ○ ○</td>
<td>○ ○ ○ ○ ●</td>
</tr>
<tr>
<td>Tools and practices for maintaining an ATU.</td>
<td>● ○ ○ ○</td>
<td>○ ○ ○ ○ ●</td>
</tr>
<tr>
<td>Importance of keeping disinfection component operating properly.</td>
<td>○ ● ○ ○</td>
<td>○ ○ ○ ○ ●</td>
</tr>
</tbody>
</table>

All responses are analyzed to determine two things:
• % of respondents who increased their understanding of….
• % change in the level of understanding…..
Example of a score card \((n=17)\)... 

\% of respondents who **increased their understanding of:**

- How septic systems are a part of our wastewater infrastructure? 94\%
- How practices in the home affect sewage characteristics? 71\%
- How changing water quality goals impact sewage treatment regs? 94\%
- Safety issues associated with maintenance of aerobic treatment unit 88\%
- How aerobic treatment units remove waste from sewage? 100\%
- Aerobic treatment unit operation and maintenance criteria. 94\%
- How a malfunctioning septic system can impact water quality? 94\%
- Importance of proper septic system operation for protection of public health. 82\%
- Tools and practices for maintaining an aerobic treatment unit. 88\%
- Importance of keeping disinfection component operating properly. 82\%
Example of a score card \((n=17)\)...

### Pre-Means, Post-Means & Percent Change

<table>
<thead>
<tr>
<th>Your understanding of . . .</th>
<th>Mean Before</th>
<th>Mean After</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 How septic systems are a part of our wastewater infrastructure.</td>
<td>2.35</td>
<td>3.82</td>
<td>49.0%</td>
</tr>
<tr>
<td>2 How practices in the home affect sewage characteristics.</td>
<td>2.65</td>
<td>3.88</td>
<td>41.0%</td>
</tr>
<tr>
<td>3 How changing water quality goals impact sewage treatment regs.</td>
<td>2.06</td>
<td>3.65</td>
<td>53.0%</td>
</tr>
<tr>
<td>4 Safety issues associated with maintenance of aerobic treatment unit (ATU).</td>
<td>2.12</td>
<td>3.76</td>
<td>54.7%</td>
</tr>
<tr>
<td>5 How aerobic treatment units remove waste from sewage.</td>
<td>2.18</td>
<td>3.88</td>
<td>56.7%</td>
</tr>
</tbody>
</table>
Example of a score card \((n=17)\)...

Pre-Means, Post-Means & Percent Change

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Pre-Mean</th>
<th>Post-Mean</th>
<th>Percent Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Aerobic treatment unit operation and maintenance criteria.</td>
<td>1.94</td>
<td>3.82</td>
<td>62.7%</td>
</tr>
<tr>
<td>7</td>
<td>How a malfunctioning septic system can impact water quality.</td>
<td>2.12</td>
<td>3.82</td>
<td>56.7%</td>
</tr>
<tr>
<td>8</td>
<td>Importance of proper septic system operation for protection of public health.</td>
<td>2.35</td>
<td>3.82</td>
<td>49.0%</td>
</tr>
<tr>
<td>9</td>
<td>Tools and practices for maintaining an ATU.</td>
<td>1.81</td>
<td>3.81</td>
<td>66.7%</td>
</tr>
<tr>
<td>10</td>
<td>Importance of keeping disinfection component operating properly.</td>
<td>2.18</td>
<td>3.88</td>
<td>56.7%</td>
</tr>
</tbody>
</table>

Percent Change = \(((\text{Post Mean} - \text{Pre Mean}) / 3) * 100\)
'Well Educated' Training

'Well Educated' Day Session is a free, one-day educational training for Texas residents who depend on household wells for their water needs. Well Educated is for private well owners who want to become familiar with groundwater resources, septic system maintenance, well maintenance, water conservation, water quality and water treatment.

As part of the Well Educated Program participants can bring their well water samples to be screened for common contaminants including fecal coliform bacteria, nitrates, arsenic and high salinity.

Please read the Water Sample Collection Instructions or watch an instructional video if you are unsure how to correctly collect your water sample.

Join the TWON Network

Sign up to occasionally receive helpful information for private water well owners.
The online survey link is emailed to past participants 6 months after attending the training.

- 75% shared the resources/materials with others who were not at the training.
- 90% of those needing to clean out hazards from their well house had done so.

For participants with septic tanks that needed pumping, 58% had pumped their septic tanks within 6 months following the program. An additional 25% were planning to have their tanks pumped soon.

- 49% of participants who needed to had plugged or capped their unused/deteriorated wells following the program. An additional 30% were planning to have their wells plugged soon.

- 81% of participants who had wells near contamination sources (pet shelters, livestock yards, etc.) moved the sources following the program, and another 14% had plans to move sources soon.
Texas Well Owner Network (TWON)

- Intentions to adopt behavior change measured at the close of the TWON presentation:
  - 88% of participants will test their well annually.
  - **82% of participants will pump their septic system regularly.**
  - 94% of participants will remove hazards from their well house.
  - 85% of participants with a deteriorated or open well will plug or cap the well.
Continuing Education Units (CEUs) Programs for TCEQ License Holders...

- Designated Representative;
- Site Evaluator;
- Installer I;
- Installer II; and
- Maintenance Providers.

- License renewal every 3 years; need 24 CEUs and a fee...
- [https://www.tceq.texas.gov/licensing/licenses/ossflic](https://www.tceq.texas.gov/licensing/licenses/ossflic)
Continuing Education Units (CEUs) Programs by TAMU...

- Overview of Advanced WW Treatment Systems
  - 8 hour workshop
  - Treatment, Disposal, and Reuse Technologies
  - PowerPoint with video and other visual aids
  - Tour of Training Center

- “High Strength” Class
  - 16 hour class
Measuring impact of CEU Programs using pre- and post- quizzes....
Pop-Quiz Time

- Air is composed mainly of which gas?
  a) Oxygen
  b) Carbon dioxide
  c) Nitrogen
Measuring impact of CEU Programs using pre- and post- quizzes….

Pre-Program

7. Air is composed mainly of which gas?
   a. Oxygen
   b. Carbon dioxide
   c. Nitrogen
   R/W
   2/10

Post-Program

7. Air is composed mainly of which gas?
   a. Oxygen
   b. Carbon dioxide
   c. Nitrogen
   11/1
Measuring impact of CEU Programs using pre- and post- quizzes....
Interactions with Students – From High School to Grad School……

- 4-H2O Youth Leadership
- REEU Program
- Capstone Program
- Work Study Program
- Graduate Research
The REEU Summer Program is a residential 5 week program open to Freshman and Sophomore undergraduates in agriculture science or environmental/agricultural engineering. The goals of the fellowship program are to: 1) provide hands-on learning experiences in water quality, 2) Expose students to careers in agricultural extension; and 3) provide a pathway to graduate school.

Fellowship students will receive:
- Hands-on education and research training in the area of water quality
- Internships with agricultural extension specialists
- 3-hours of college credit
- $2,500 stipend
- Free housing at Texas A&M University
- Meal allowance of $150 per week
- $250 travel allowance to participate in a water quality conference
- Opportunity to go on the Belgium Environmental Science and Engineering Study Abroad program

A multidisciplinary team of extension specialists, agricultural engineers, soil and water microbiologist, or( soil physicist from Texas A&M University (TAMU) and Prairie View A&M University (PVAMU) will support this program.

May 30 — June 30, 2018
Students selected for 2018 program

https://reeu.baen.tamu.edu/
Hands-on Experience in Reuse Water Quality...

Texas A&M Onsite Wastewater Training and Demonstration Center on the RELLIS Campus, about 20 minutes drive from the Classroom.... Ten days during the month-long program, students spent about two to three hours learning about Onsite Systems and sample collection/analysis...
Hands-on Experience in Reuse Water Quality...
BIOLOGICAL AND AGRICULTURAL ENGINEERING
Onsite Water Reuse (OWR) Research Capacity @ RELLIS campus
On-Site Water Reuse Research Capacity @ RELLIS campus

• Focusing on Onsite Direct Potable Reuse....

• Following well water treatment technologies are *getting* installed to treat MBR effluent:
  • Reverse Osmosis (RO)
  • UV Disinfection (UV)
  • Ozone Disinfection (OZ)
  • Chlorine Disinfection (Cl)
  • Activated Carbon Filter (AC)
  • Capacitive Deionization (CapDI)
  • High-Efficiency Distillation

• Also, meeting with TCEQ Wastewater Reuse & Drinking Water Supply teams to understand current rules and regulations.
Research project for 2018-REEU Fellows

Tank #1: Raw Sewage
Tank #2: Biomicrobics membrane bioreactor aerobic treatment unit
Tank #3: Ozone
Tank #4: Low-Tech Options
Tank #5: CapDI™
Subsurface drip field
Findings by 2019-REEEU Fellows

Overall Treatment Levels vs Energy

Significant additional energy required to go from MBR Effluent to almost DW...

2019 REEU Student Video
Performance of Different Technologies

Final product NOT yet ready for DPR... More studies and data needed....

2019 REEU Student Video
Measuring impact of REEU Programs using pre- and post- quizzes....

**Pre-Program Quiz**

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<th>Name:</th>
<th>Class Result Summary</th>
<th>Date: June 23</th>
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1. Which of the following is/are soil cations?
   a. Calcium (Ca++)
   b. Chloride (Cl–)
   c. Phosphate (PO₄³⁻)
   d. b. and c.

   **3 / 5**

2. Draw or list the components of the Nitrogen Cycle

   **4 / 4**

3. Cities like El Paso, Texas that receive less than 10 inches of rain a year will eventually run out of water.
   a. True
   b. False

   **2 / 6**

4. Air is composed mainly of which gas?
   a. Oxygen
   b. Carbon dioxide
   c. Nitrogen

   **2 / 6**

**Post-Program Quiz**

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<th>Name:</th>
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1. Which of the following is/are soil cations?
   a. Calcium (Ca++)
   b. Chloride (Cl–)
   c. Hydrogen (H+)
   d. Phosphate (PO₄³⁻)
   e. A + C
   f. B + D
   g. All the above

   **7 / 1**

2. Draw or list the components of the Nitrogen Cycle

   **4 / 4**

3. Cities like El Paso, Texas that receive less than 10 inches of rain a year will eventually run out of water.
   a. True
   b. False

   **7 / 1**

4. Air is composed mainly of which gas?
   a. Oxygen
   b. Carbon dioxide
   c. Nitrogen

   **8 / 0**

5. How much does a gallon of water weigh?
   a. 3.84 lb
   b. 4.93 lb
   c. 8.34 lb

   **8 / 0**
Measuring impact of REEU Programs using pre- and post- quizzes....

Pre-Program Quiz
4. Air is composed mainly of which gas?
   a. Oxygen
   b. Carbon dioxide
   c. Nitrogen

Post-Program Quiz
4. Air is composed mainly of which gas?
   a. Oxygen
   b. Carbon dioxide
   c. Nitrogen
Measuring impact of REEU Programs using pre- and post-quizzes....

2019-REEU Class Impact Analysis

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Measuring impact of REEU Programs using pre- and post- quizzes....

2019 REEU Students Change in % Right Answeres

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BAEN Capstone Projects...
BAEN Capstone Projects…

Wastewater Treatment Facility Amendments

Achayacu, Cuenca, Ecuador
Universidad de Cuenca
ETAPA

FINAL REPORT: WASTEWATER TREATMENT FACILITY AMENDMENTS IN ACCHAYACU, CUENCA, ECUADOR

PREPARED FOR ETAPA
Texas A&M University
University of Cuenca
Project Manager: Dr. Zivko Nikolov
Faculty Advisor: Dr. Anish Jairamia

HLM WATER SOLUTIONS
LAUREN KENNEDY | LEAH KOCIAN
HANNAH RIETVELD | MIKAELA VARA
Current Projects and Future Plans

• 319 grant projects:
  – OSSF outreach, inspections, pump-outs, repairs (RG);
  – OSSF inventory and mapping (GB).

• Water seed grant projects:
  – Investigation and Demonstration of a Novel Physical/Chemical Treatment Process for Removing Aqueous Ammonia from Wastewater;
  – Novel Nanostructured membrane for scalable and energy-efficient water desalination.

• Assess NPS Nitrogen Contribution to the Texas Coastal Zone from Septic Systems (Dr. Lin Zhang);

• Preliminary approval for the TCEQ-OSSF Research Grant Program (4 Questions – 3 Projects);

• Plans for establishing One-Water Center on the RELLIS Campus.
4 Research Topics Identified by TCEQ’s TOGP Committee

2.3.1 Adequacy of Current Aerobic Treatment Unit (ATU) Designs with Higher Strength Wastewater

2.3.2 Dosing vs. Non-Dosing of Aerobic Treatment Unit (ATU)

2.3.3 Implementation of Low Pressure Dose Systems (LPD) with Various Configurations

2.3.4 Black Water Non-Potable Reuse for Toilet Flushing

Research Projects Proposed by BAEN OSSF Team

#1

#2

#3
Research Question:
Using currently available technologies, can a homeowner reliably treat wastewater to meet indirect or direct potable reuse water quality?
Moving from a *single-use* to a *multi-use* water infrastructure at a building-scale....

**Single-Use Water Infrastructure (Decentralized): Depleting Fresh Water Sources ...**

- Fresh Water
- $\chi$ Gallons of Waste Water
- Septic System / OSSF / Decentralized System

**Re-Use Integrated Water Infrastructure (Decentralized): Sustained Fresh Water Sources ...**

- Source Water
- 80% - 0% Reclaimed water without environmental buffer to supplement Source Water Supply
- Multi-Use Water Treatment Appliance (treats wastewater for reuse locally and centrally)
- 20% - 100% Return to Environment
THANK YOU

TAMU OSSRF TEAM

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