

## Research Review and Advisory Committee for the Bureau of Onsite Sewage Programs

Approved Minutes of the Meeting held at the Orange County Health Department, Orlando, FL

May 29, 2008

Approved by RRAC July 30, 2008

### In attendance:

- **Committee Membership and Alternates:** David C. Carter (Chairman, member, Home Building Industry); Paul Davis (member, DOH-Environmental Health); Anthony Gaudio (member, Septic Tank Industry); Marc Hawes (alternate, Home Building Industry); Bill Melton (member, Consumer); Eanix Poole (alternate, Consumer); Jim Rashley (alternate, DOH-Environmental Health); Patti Sanzone (alternate, Environmental Interest Group); Clay Tappan (member, Professional Engineer); Pam Tucker (member, Real Estate Profession); and Ellen Vause (alternate, Septic Tank Industry)
  - **Not represented:** Restaurant Industry, State University System
  - **Visitors:** Damann Anderson (Hazen & Sawyer); Rick Baird (Orange County Environmental Protection Division); Quentin Beitel (Markham Woods Association); Alice Berkley (State Representative Bryan Nelson's Office); Dominic Buhot (Greens Environmental Services); John Byrd (Aide to Orange County Commissioner Brummer); Blaine Carter (Florida Home Builders Association); Ron Davenport (Infiltrator Systems); Lindsay Faloh (E-2 Tanks); Francisco Gonzalez (Seminole County Environmental Health); Roxanne Groover (Florida Onsite Wastewater Association); Karl Henry (Seminole County Environmental Health); John Higgins (Markham Woods Association); Mary Howard (Orange County Environmental Health); Dan Meeroff (Florida Atlantic University); Harley Pattee (E-2 Tanks); Daniel Smith (Applied Environmental Technology); Gary Smith (Orange County Environmental Health)
  - **Department of Health (DOH), Bureau of Onsite Sewage Programs:** Paul Booher; Sonia Cruz; Kim Duffek; Eberhard Roeder; and Elke Ursin
1. **Introductions:** Seven out of nine groups were present, representing a quorum. Chairman David Carter calls the meeting to order at 9:40 am. James H. Peters is the new alternate for the Professional Engineer's and was added to the committee as of the last meeting. Elke Ursin asked a procedural question on whether the RRAC members would be interested in having a CD-ROM mailed to them with the meeting material, as opposed to hard paper copies, in order to save resources, time, and money. The RRAC indicated that they prefer to have the paper copies so that they do not have to print out the materials themselves.
  2. **Review of Previous Meeting Minutes:** Motion by Clay Tappan, seconded by Paul Davis:  
**The minutes were approved as submitted.**  
The members voted and all were in favor with none opposed, the motion passed. Later in the meeting John Byrd mentioned that the location information on the first page was incorrect, and this change will be made to reflect the correct information.
  3. **Discussion on Legislative Session:**
    - a. **Senate Bill 1318:** Appoints a local government representative to RRAC and TRAP and eliminates certification requirement for individuals working under an engineer. Those working under an engineer would still need to go through the soil certification requirements with the Department of Health. Bill Melton asks what the intent was to eliminate the certification requirements. Clay Tappan stated that the Florida

Engineering Society took exception to the requirement for those individuals working under the direct responsible charge of an engineer to be a Certified Environmental Health Professional. This was seen as an encroachment into the engineer's profession. The local government representative would be knowledgeable about domestic wastewater treatment and is to be recommended by the Florida Association of Counties and the Florida League of Cities.

- b. **Special Appropriation 1682:** \$1,000,000 study on passive nitrogen, \$150,000 inventory of onsite systems, and a report by October 1, 2008 identifying costs for 5-year inspection program. This item was introduced to the RRAC for consideration and will be discussed at future meetings if/when the appropriation has been signed into law. The million-dollars would come from DEP, and the \$150,000 would come from the research trust fund. Patti Sanzone states that she has concerns that the amount of money specified in this appropriation is not very much. David Carter stated that he understands this inventory to be more of a records review type project. Elke Ursin states that some of the initial concepts on how to approach this are similar to how the Wekiva numbers were generated: get a list of developed properties from the county property appraisers and subtracting those that have a sewer bill. Patti Sanzone states that this inventory will help with the inspection program mentioned in the last part of the appropriation. Paul Davis states that it will be easier to do this inventory with the large utilities, but much harder for the small ones. Anthony Gaudio mentioned that an inventory was previously done in Leon County and that there may be good information available to help develop this project. There was a question from the audience whether RRAC is in favor of this and the general consensus is that RRAC carries forward with whatever charge is given to them. This appropriation is much broader than just the Wekiva issue, the focus is more statewide.
  - c. Both are waiting to be signed into law.
4. **Wekiva Update:** There is no new information on rulemaking; options are still being discussed with the governor's office. At the last RRAC meeting Dr. Eberhard Roeder presented revised the input and loading estimates. The RRAC was given an opportunity to provide comments, the report has been finalized, and is available on the DOH website:

<http://www.doh.state.fl.us/environment/ostds/wekiva/WekivaEstimateFinal.pdf>

There was a discussion on how this report could be final without RRAC having approved the report. Any report generated by or for the department is presented to the RRAC for review and comment, per the statute requirement. The RRAC was allowed to comment at the last meeting. The RRAC does not generally vote on a report. The RRAC is an evolving study group where if new information comes to light it can be considered at that time.

A brief overview of the Total Maximum Daily Loads (TMDL) process was given by Dr. Eberhard Roeder. Elke Ursin provided a brief update of the TMDL for the Wekiwa Spring, Rock Spring, Wekiva River, Rock Springs Run, Little Wekiva Canal & River, and seven lakes. The reports were released in April. DEP did not receive objections and is going forward to final adoption. Surface loading and springs contribute the majority of nutrient load into Wekiva River/Rock Springs Run. Septic tanks are one source of nutrient loading in surface runoff and springs. Implementation of TMDLs will require a close look at septic tank loadings along with

all other watershed sources. TMDL implementation plan (Basin Management Action Plan, or BMAP) development will begin this summer. The reports are available here:

[http://www.dep.state.fl.us/water/tmdl/final\\_tmdl.htm](http://www.dep.state.fl.us/water/tmdl/final_tmdl.htm)

An update was presented on the FDEP Phase II study looking at what impacts fertilizer use has on water quality in residential areas in the Wekiva Basin. DEP has contracted with SJRWMD and there is an anticipated start date for sampling sometime in June.

## 5. Brief updates on other projects

### a. Ongoing projects

- i. **University of Central Florida Research Facility** – UCF has a grant with FDEP to look at nutrient reducing onsite systems and to develop a research facility with test beds. Dr. Ni-Bin Chang presented to the RRAC the current status of the project.
- ii. **Passive Nitrogen Removal Assessment** – Elke Ursin presented a quick overview of the progress since the last RRAC meeting in January. The final laboratory experiment report has been received. The draft economic analysis of passive systems report and the recommendations for the passive nitrogen system report have both been received. Dr. Smith presented a paper on the preliminary results of the laboratory experiments at the National Onsite Wastewater Recycling Association (NOWRA) Nitrogen Symposium in April. The laboratory experiment sampling has been extended for five additional sampling events over a five month period due to the interesting preliminary results. At the end of the sampling, the station will be disassembled and the treatment media will be evaluated. The draft final project report was received two days before the meeting, the full report, including the appendices, was emailed to the RRAC, and printed copies of the report, excluding the appendices, were passed out with some extras for the audience.

Dr. Smith presented on the final report. He worked on this with collaboration from Dr. Dick Otis with Otis Environmental Consultants, LLC and Mark Flint with Watermark Engineering Group, Inc. Dr. Otis was much help on the literature review and the recommendations portions of the project, and Mr. Flint was central to the economic analysis and other components of the overall project. He acknowledged FDOH staff, the RRAC, Damann Anderson, and Hillsborough County for allowing use of the site. The objectives of the study were to evaluate enhanced nitrogen removal from on-site wastewater using passive systems. The influent for the laboratory experiment came from the effluent of a septic tank. The overall goal is to reduce total nitrogen. The presentation will cover the literature review and database portion of the contract, the experimental evaluation (which is now completed), the economic analysis, and the recommendations.

The definition of passive was defined as “A type of onsite sewage treatment and disposal system that excludes the use of aerator pumps and includes no more than one effluent dosing pump in mechanical and moving parts and uses a reactive media to assist in nitrogen removal.” These are the restraints that form the basis of the project. The literature review portion of the project looked

at several references and what has been done in the field, to come up with some constraints to formulate an approach for the laboratory experiments. Some of the technology constraints are that there are no aerators, which would require an unsaturated filter for Stage 1. Stage 1 is to accomplish the first stages of nitrogen removal which is ammonification and nitrification. There was a constraint of having only one pump, and the question was where to put the pump. A reactive media was required, which would require an electron donor for denitrification, to provide alkalinity, and to possibly provide ion exchange in the whole process.

The two stage filter concept was developed in response to the constraints. There are two filters in series: Stage 1 is unsaturated and aerobic to get organic nitrogen and ammonia removal and to produce a low amount of TKN in the effluent, Stage 2 is a saturated anoxic filter to convert to oxidized nitrogen, provide an electron donor for denitrification and produce a low nitrogen oxide effluent. The electron donor is provided by passive aeration through the media. The next step is to decide where the pump should go. It was decided to put it prior to the Stage 1 filter as nitrification/ammonia removal is one of the most sensitive processes. This allows time dosing to the media, the potential for recycling of the effluent, allowing for flow equalization to the entire treatment train, and gravity flow after the pressure dosing of the effluent through the rest of the system. Septic tank effluent was pumped to the top of the unsaturated media in Stage 1 by a peristaltic pump. This runs through trickle flow into the Stage 2 horizontal saturated anoxic filter with reactive media. One could think that this is a good small scale representation of what would happen in a full size system. Dr. Smith sees these as different modules that could handle different flow rates and influent concentrations that could be plugged into different systems. He sees these working for onsite and as well as for management of sanitary water onsite in an urban environment. Anthony Gaudio asks what a peristaltic pump is and Dr. Smith states that it is a pump that provides positive displacement and does well with low flow rates. The systems were dosed with wastewater once every 30-minutes. Dr. Roeder asked how the air gets into the top of the unsaturated filter and whether it comes into the bottom as well and Dr. Smith stated that there are air holes in the top and no air holes at the bottom. The water is dosed to the top and trickles down. During normal operation all the effluent is put back into the septic tank, and when a sample is taken it was collected as it came out of the Stage 1 or 2 filters. He developed a method to measure the effluent volume as it comes out. Two of the filters (clinoptilolite and the expanded clay) had a constant flow rate but the tire crumb filter varied. The dissolved oxygen was high as it came out of Stage 1, which shows that the media has a high aeration capacity, better than sand.

An important factor for the media is particle size, specific surface area, external porosity, air filled porosity, water retention capacity, and cation exchange capacity (CEC). These were all researched in the literature review portion of the project and the information gathered was used to select the media. There are three two stage systems in parallel. The first used Zeo-Pure clinoptilolite which is an ion exchange zeolite, a naturally mined mineral from the Death

Valley area. Zeolites are used in some industrial water treatment processes to take different ions out, were once used in water softeners, found in aquarium filters, and are used in cat litter boxes to keep the ammonia down. It was also used at one secondary wastewater treatment facility for ammonia removal. Paul Davis stated that a byproduct of the mining is silicate which can be harmful if inhaled and Dr. Smith stated that when he received the material it had a little dust and that when placing the material precautions should be taken. The second is an expanded clay which comes from Georgia. You take clay and you put it in a cement kiln, it opens up and is called a lightweight aggregate. It's lighter than concrete and is great for biofilm reactors like this one. The expanded clay is sold for construction purposes, and is used for drinking water treatment filtration processes. When Dr. Smith spoke with the manufacturers they stated that if the demand was there someone would set up a distribution center. Paul Booher asked whether this is the same type of material used in the Keys Demonstration Project and Damann Anderson said it was a different brand but basically the same process. The LECA (Lightweight Expanded Clay Aggregate) comes from Norway and is now called Filtralite P for phosphorus removal that includes calcium carbonate to aid in phosphorus sorption. The third media used was tire-crumbs which is a recycled product available from many places here in Florida. It is used as an aggregate substitution in drainfields. The first two media have a high capillarity; they are able to retain a lot of water vs. the tire crumb. The three media each have different characteristics. Hauling the media for one system would be more costly, but for more than one it becomes more cost effective. This will be discussed later in the cost analysis section.

Paul Booher stated that this process could be seen as the Culligan Man system where there is ion exchange. You come in and backflush and there was no residue to dispose of later. Dr. Smith said that one way of looking at this is that the material is being regenerated onsite through biological regeneration. Mr. Booher said there can be a factory that makes modules of these systems, which is closer to the Culligan Man system. Dr. Smith said that this is similar to how cars are designed and manufactured. Every time someone wants to design a new car, mass production is always the end goal. These are mass produced depending on what model you want and they come with a user's manual that says that you change the oil every 5,000 miles, and at 10,000 miles you have to look at and replace certain components. He sees this as a modular thing that can be built, where you know that it can perform, and then you can plug it in to different designs. He stated that this study is creating a space for innovation and where we go with it is up to us.

The Stage 2 media was selected based on it being reactive, having a specific electron donor release rate (not too fast (used up too quickly) and not too slow (greater potential for a breakthrough of nitrogen)), a media with longevity, having a supply of alkalinity, and a high anion exchange capacity (a media that would also remove phosphorus). One of the selected media is expanded shale, which comes from Utah and is also called utilite. The expanded shale is similar to the LECA but came out on top for phosphorus sorption in one specific study, and would probably be cheaper as it comes from Utah as opposed to

Norway. Elemental sulfur is another media which provides an electron donor. Oyster shell is the third media and it provides alkalinity. The Stage 2 media is a mixed media. The process for nitrogen reduction is totally autotrophic. There is nitrification in the first stage and autotrophic denitrification in the second stage.

There were three two-stage systems shown in the diagram below. The first stage is unsaturated aerobic that had three columns (one with each media type: zeolite, expanded clay, and tire crumb) that have a three-inch diameter and 24-inch depth. Each were stratified in similar ways with larger particle sizes on top going to smaller sizes and ending with some larger particles so that the smaller particles do not get flushed out. The reason for this was because septic tank effluent may not be completely filtered, and to handle some of the larger solids that may come through. There is a possibility that the 24-inch depth may not be needed, but this will need to be evaluated after future study. The second stage is saturated anoxic that had three columns (each with different combinations of non-stratified sulfur, oyster shell, and expanded shale) that have a 1.5-inch diameter and 24-inch depth. There is an interpretation problem with each Stage 1 filter feeding into another State 2 filter and that was understood.

Stage	Filter	Column ID, inch.	Media depth, inch	Media placement	Media														
Stage 1 unsaturated aerobic	1A	3.0	24.0	Stratified	<p><b>Clinoptilolite</b></p> <table border="1"> <thead> <tr> <th>depth (in.)</th> <th>diameter (mm)</th> <th>top</th> </tr> </thead> <tbody> <tr> <td>8</td> <td>3 - 5</td> <td rowspan="5">↓ bottom</td> </tr> <tr> <td>8</td> <td>0.8-2.3</td> </tr> <tr> <td>6</td> <td>0.5-1.1</td> </tr> <tr> <td>1</td> <td>0.8-2.3</td> </tr> <tr> <td>1</td> <td>3 - 5</td> </tr> </tbody> </table>	depth (in.)	diameter (mm)	top	8	3 - 5	↓ bottom	8	0.8-2.3	6	0.5-1.1	1	0.8-2.3	1	3 - 5
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Stage 2 saturated anoxic	2A	1.5	24.0	Nonstratified	75% elemental sulfur 25% oyster shell														
	2B				60% elemental sulfur 20% oyster shell 20% expanded shale														
	2C				45% elemental sulfur 15% oyster shell 40% expanded shale														

Pam Tucker asked where the septic tank effluent came from and Dr. Smith stated that it came from Flatwoods Park in Hillsborough County. The wastewater was mixed from a single family ranger residence with four people and a day-use bathroom. There was one power failure which was after the initial sampling events.

This system operated as a one pass design, which means there was no recirculation. There were 48 doses per day, and a chart was presented outlining several other features. The average residence time was 9 hours in Stage 1 and 12 hours in Stage 2. This experiment was run for 60 days. The first 21 days were start-up to allow the system to stabilize. The nitrogen loading (how much nitrogen per area of filter per time) was reasonably consistent for purposes of the study and was around 7 and 11 grams/square meters/day. The total nitrogen from the septic tank was an average of 77.4 mg/L, which was mostly ammonia. The total nitrogen coming out of the final stage was around 2 mg/L for the clinoptilolite and expanded clay; and the tire crumb went through a progression of decrease through the study ending around 15 mg/L but averaging around 44 mg/L. The effluent was dominated by organic nitrogen, which shows that nitrification has occurred. The tire crumb Stage 1 system did not do a good job at getting rid of the ammonia, so the total nitrogen in the final effluent after Stage 2 is much higher than the others. Ammonia in an anoxic filter is going to behave conservatively, and not be removed. David Carter pointed out that column 1A had an average total nitrogen much lower than column 1B, but the average total nitrogen coming out of 2A and 2B are about the same. This would seem to show that column 2B was more efficient than 2A. Damann Anderson stated that the clinoptilolite is a good ion-exchanger with ammonia, so the ammonia is being held there and is perhaps held long enough to nitrify and then denitrify in that first stage. Dr. Smith stated that he expects that the expanded clay would accept less loading than the clinoptilolite. David Carter asked whether Dr. Smith expects the tire crumb to stay around 15 mg/L and if so taking an average would not be a good representation of this media. The tire crumb could have had a longer stabilizing time than the others. Damann Anderson stated that this is why the experiment is going to run longer. Dr. Smith stated that these systems do have start-up phase and it appears the tire crumb did take longer to acclimate. Paul Booher made a point that the loading at 3 pounds per square foot per day could be a biological overloading and not a nutrient overloading. Damann Anderson did not agree completely and thinks the loading could be higher and still work because of the coarser material on top. Dr. Roeder stated that column 2C (receiving the effluent from the tire crumb column) did not seem to remove the nitrate even though it gets very little and Dr. Smith stated that this was an interesting result. Pam Tucker asked whether the tire crumbs would be more repellant than the other two media and Dr. Smith agreed that there is less residence time with the tire crumb.

The removal efficiency average after Stage 1 showed ammonia nitrogen being removed at 99.9% for the clinoptilolite and the expanded clay; and the tire crumb was 60.5%. The removal efficiency average for total nitrogen after

Stage 2 for the clinoptilolite and the expanded clay was around 97%; and the tire crumb was 33%. This could be considered start-up data.

The results of the field parameters were discussed next. The influent dissolved oxygen (DO) was low, as expected. The Stage 1 (aerobic) results were much higher showing that aeration occurred. Stage 2 was low. The pH was maintained at neutral. Alkalinity is very important for nitrification/denitrification and is an important parameter to measure. Alkalinity was high in the septic tank effluent and very low as it left the Stage 1 filter and went up in Stage 2 due to the oyster shells.

The theoretical longevity of the sulfur is an important question. This can be calculated and was presented on a graph showing the results for different levels of pre-denitrification. The range for some of the scenarios he presented was between 30 – 50 years. This needs to be tested.

Some of the conclusions from the laboratory experiment were:

- Proof of the two stage filter concept for passive nitrogen removal, comparable to wastewater treatment plants
- Single pass loading at 3 gallons per square feet per day
- Total nitrogen removal of 97%
- Total nitrogen reduced from 77 to 2 mg/L
- Longer term operation needed

Anthony Gaudio asked whether the high 77 mg/L influent had any impact on what the results are and Dr. Smith stated that even at such a high level the system brought it down to very low levels. He stated that in the future with more water conservation, that number can go up. In doing these types of studies you are looking to find out the resilience and get a design envelope for how much you can push the system. John Byrd asked at the end when there is a total cost, would this be marketable at this point in time, is there anyone out there that can do this. Dr. Smith stated that Damann Anderson could do it. Damann Anderson said that this is why we need studies, to develop this into a marketable product. Paul Davis stated that none of this is patented at this point. Dr. Smith stated that this is public domain information.

The next part of the project was to provide an economic analysis and develop some examples of how to configure this on site. Dr. Smith showed a diagram with a septic tank (primary treatment) with a pump going to the unsaturated Stage 1 and saturated Stage 2 filters and then to soil dispersal. His objective is to do a life cycle cost analysis and to provide an equitable comparison of alternatives. The life cycle costs look at installation costs, what needs to be done every year (maintenance), etc. All of the costs are split up by unit costs (making things comparable to 2008 dollars), uniform annual cost (take the life cycle cost and break it into a uniform cost over the years), and present worth. He acknowledged Mark Flint for his work on this task. This estimate includes costs for equipment, materials, installation, energy, maintenance, monitoring, media replacement, and residuals. The base case used for these calculations

is a 300 gallon per day system. He used existing tanks and materials to come up with these estimates, but if this is to be mass produced specific designed modules could be created that optimize some of the design factors.

There were multiple scenarios considered varying the Stage 1 filter plan area (varying loading rate), the media, and the Stage 2 filter volume/media replacement intervals. A total of 12 different systems were analyzed by varying the different scenarios.

A table was shown with the operation and maintenance costs. David Carter asked what monitoring will be done annually for \$100. Dr. Smith states that nitrogen, that is TKN and NO<sub>x</sub>, are what should be measured, perhaps CBOD too. Samples would be pulled from the final effluent from the Stage 2 filter. He stated that you could take septic tank influent samples too, but if you are designing a resilient system the end of the treatment train is what you need to know. You would probably monitor more things initially and then as the system stabilizes only monitor for specific parameters. David Carter asked whether there are any other systems in the state that have regular chemical monitoring. Dr. Roeder stated that it depends, but that in most cases there is no sampling. Dr. Roeder noticed that the operating permit is not on the list and that generally takes the place of sampling. David Carter stated that he wants to compare apples to apples and while it is a good thing to do, if we are not sampling anything now maybe that number should not be part of a direct comparison. Damann Anderson stated that the operating permit is missing so it is a wash. Ellen Vause stated that because there is a media that needs to be replaced, you have to do some sort of monitoring of the constituents coming out of the filter media to know when to replace it. Dr. Smith stated that there are three media replacement options: a large system with infrequent replacement, an intermediate, and a small system with frequent replacement (Culligan Man model). David Carter stated that at the end of all this, these numbers need to compare with other types of systems. He wants to find what things are in common with other systems and which are additional things special for this system. David Carter asked whether there were any other studies that Dr. Smith looked at that went over this type of cost estimate. Damann Anderson stated that this was done for the Keys Study. The uniform annual cost for all the alternatives range from around \$2,100 to about \$2,500 per year. The present worth, including the primary treatment and drainfield, ranges around \$36,000 - \$44,000. The nitrogen-removing (nitrification-denitrification) processes take approximately 80% of the total cost. O & M overall is about 35% of the total. The cost per gallon treated is around \$0.21 and the cost per pound of nitrogen removed is between \$22 to \$29.

A breakdown of the cost distribution for one of the 12 scenarios was presented as an example, was the focus of much of the discussion, and is presented here:

	<b>2008\$</b>	<b>% of Total</b>
<b>Primary Treatment / Pumping</b>		
<b>Installation</b>	<b>2,800</b>	<b>7.0</b>
<b>O&amp;M</b>	<b>1,284</b>	<b>3.2</b>
<b>Total</b>	<b>4,084</b>	<b>10.2</b>
<b>PNRS Stage 1</b>		
<b>Installation</b>	<b>3,770</b>	<b>9.4</b>
<b>O&amp;M</b>	<b>6,801</b>	<b>16.9</b>
<b>Total</b>	<b>10,571</b>	<b>26.3</b>
<b>PNRS Stage 2</b>		
<b>Installation</b>	<b>3,417</b>	<b>8.5</b>
<b>O&amp;M</b>	<b>6,801</b>	<b>16.9</b>
<b>Media replacement</b>	<b>10,844</b>	<b>27.0</b>
<b>Total</b>	<b>21,062</b>	<b>52.4</b>
<b>Total PNRs Component</b>	<b>31,633</b>	<b>78.7</b>
<b>Drainfield</b>	<b>4,500</b>	<b>11.2</b>
<b>Total Installation</b>	<b>14,487</b>	<b>36.0</b>
<b>Total O&amp;M</b>	<b>14,886</b>	<b>37.0</b>
<b>Total System Life Cycle Cost</b>	<b>40,217</b>	<b>100.0</b>

The total system life cycle cost consists of the total O & M (37%) + the total installation (36%) + the media replacement for Stage 2 (27%) = 100%.

There are many unknowns in this cost estimate. One of the questions would be the cost for the media replacement in Stage 2. John Higgins stated that he understood that the time dosing was important. Would this mean having to install a larger septic tank to handle the peak flows? The answer was no. Damann Anderson stated that this is similar to a mound system which is dosed. There are overrides within these systems to handle times when there are parties with lots of flow. John Higgins asked whether the system would be degraded if it is being overused and Damann Anderson said for the long term probably not, but for a day or two it may be. Dr. Smith said that instead of getting 99% removal, a couple of times a year you may get less than that, but over the year it may not be important.

Dr. Roeder stated that the costs presented here are much lower per pound of nitrogen removed than when he tried to do the analysis for Wekiva. Part of the reason for this may be because this system is more effective (2 mg/L from 77 mg/L) than what Dr. Roeder was looking at (10 mg/L from 40mg/L).

Paul Davis stated that the electrical costs for a system recently installed in his county was over \$1,000/year which does not compare to the number presented here (\$124). Dr. Smith stated that this system only has one pump running, and no aerators. There is also the option of powering this off the grid with solar panels if needed.

Anthony Gaudio asked how the installation costs were calculated. Dr. Smith stated that the primary treatment costs were estimates from Mark Flint who has designed and installed systems. The costs for Stage 1 include the media costs gathered from various vendors and shipping. If there are enough of these systems there needs to be a distribution center that receives the media and prepares it. Anthony Gaudio stated that he is excluding the costs for Stage 1 and 2 but the installation and drainfield costs are a knowable amount and the cost seems high. Ellen Vause stated that \$6,500 for a standard septic tank and drainfield is a little high. Damann Anderson stated that it depends on what part of the state you are in.

David Carter asks for clarification on the media replacement and whether the entire media is used up at the end. Dr. Smith stated that the Stage 1 media would not need to be replaced but Stage 2 would. Most of the sulfur would still be there but it might have some sort of coating on it, or flow is not moving through as it should, performance is deteriorating and the media needs to be replaced. Dr. Smith clarified that the media replacement cost is a conservative estimate to replace all of the media. The questions are: how to design the system (either large with infrequent replacement, or small with frequent replacement) and how do you manage the media (possible reuse)? David Carter pointed out that the replacement frequency costs were not very different between the different scenarios and suggested to design a system that makes the most sense from a consumer standpoint. Clay Tappan asked whether Dr. Smith sees the media becoming dirty as the bacteria grow, die, and slough off. Dr. Smith stated that so far this has not been seen in the laboratory experiments and there is no evidence of hydraulic overload. Ellen Vause asked what the disposal method would be for the sulfur removed from the system and Dr. Smith stated that there are several options. One possibility could be to regenerate and reuse it in the process; another could be land application as a crop soil amendment; as a last resort it could be put in the landfill. David Carter stated that much of what has been considered lately is how much does it cost to buy and operate, and Dr. Smith stated that that would be around \$14,500. If the media was not going to be replaced, the total installation and O & M would be around \$29,200. David Carter asked whether the O & M cost would be common among other performance based treatment systems and Dr. Smith said that it would be. John Higgins asked whether the installation costs include the first order of media and Dr. Smith said that it does

include the media. David Carter stated that the media replacement cost is an annualized value over the life of the system. Pam Tucker asked whether the costs were only for a 5-year period, and David Carter clarified that if you wanted to have a system for the next 30-years you would need to write a check for \$40,217. David Carter asked whether the sampling results would dictate when the media should be replaced, and Dr. Smith said that the annual monitoring would be a way to trigger the need for media replacement. There is uncertainty as to how long the media would last. Dr. Smith stated that if you design a system that you know is going to last a certain number of years, then you would not need to test it and instead replace it at 70% of the lifetime. David Carter related this to pumping out a tank, some can go longer before a pump out and some will go less. Dr. Smith stated if you have a conservative estimate on the expected life of the system, perhaps a simple checkup prior to this date would be sufficient.

John Higgins asked that the tables and the report make it clearer, add a footnote, that there is a cost escalation factor of 3.75% per year.

Anthony Gaudio stated that there is current technology available that can get the effluent to a 70% reduction, as opposed to the 97% with this media, but there is a drip irrigation drainfield added on to the end of the system which would give an even greater reduction. He asked whether development costs are included in the cost estimates. He also brought up Dr. Roeder's Wekiva cost estimate for \$140 per pound of nitrogen removed, and how he thought that number was too high. He stated that to think that a system could get 97% reduction based on the results of a small scale controlled study might not be realistic. Dr. Smith stated that this is a start, and he firmly believes that these systems adequately represent the performance factors that would occur in a larger system. This would need to be tested in a full-scale setting, attached to a single family home. Anthony Gaudio stated that it would be good to have a discussion with Mark Flint to sharpen up these numbers to make it more realistic. Damann Anderson stated that these answers are unknown until this has been scaled up and studied, which would be the next phase. Dr. Smith stated that this is all experimental, and the next step is to see how this would operate under real life conditions.

David Carter asked where Dr. Smith expects this system to break down; where will it fail first? Dr. Smith stated that the mechanical items would be the first to break: the pump, electronic control system, and electrical supply. One of the advantages of passive systems is that the bugs grow on the surface and don't do much. If it is designed right so that it does not clog up, and you maintain the water moving through, it will work fine as long as the mechanical parts are working. Dr. Smith is fairly confident that Stage 1 will work fine; Stage 2 is more unknown and would need to be tested.

Paul Booher compared the system with a sewer system. He said his sewer bill runs around \$35 per month and asked whether it would be a fair statement to say that this system would be about twice as high a sewer system. David Carter stated that the \$35 does not include the impact fees and installation

costs so it may not be comparable. Paul Booher stated that the life cycle cost of a conventional system would be around \$8,600 and the nutrient reducing system would be \$40,217. Anthony Gaudio stated that the \$8,600 might not be accurate as the drainfield on the nutrient reducing system would last much longer than one on a conventional system due to the change in the quality of the influent, and it may be more around \$20,000 for a conventional system. Dr. Smith stated that an estimate of the costs for sewer as compared to upgrading the existing systems was done for Marco Island and the costs were comparable. Dr. Smith stated that it is important to compare life-cycle costs and that for centralized sewer that would include construction, O&M, and energy costs, and also include any federal grant funding received.

Jim Rashley asked what code changes would need to be made: do we need a 2-year permit, or can we go to a 5-year permit, do we need to do a dig-out, what would the water separation requirement need to be, etc. He is very interested in this study and where it could go. Dr. Smith thinks the loading could be higher too and maybe there does not need to be as much drainfield.

Anthony Gaudio stated that the cost analysis part of this study would be great to look at again after the larger scale study, and that it is important to understand that costs go down with demand.

Dr. Smith showed a cost comparison between the passive system and a recirculating sand filter. Sand filters are not used much in Florida, but are common nationally. The numbers he presented for the passive nitrogen system are not too far off from currently available numbers for other similar systems.

He went over some of the design recommendations. He recommended having a tank with a built in pump chamber, having screened septic tank effluent, measure the daily flow, pressure dosing to Stage 1, and install sampling ports. Some of the installation recommendations are to develop a complete hydraulic profile, pay attention to the media preparation and placement, and perform watertightness testing. Some of the permitting recommendations are to perform some full scale evaluations which could lead to NSF certification. There is also the additives rule that would need to be considered to make sure what is leaving the system will not harm the environment. Dr. Roeder stated that one of the byproducts might be sulfuric acid. Some of the maintenance and monitoring recommendations are to check the counters and meters every 6-months, and once a year inspect all electrical/mechanical parts, flush, and test the flow distribution to the system. Monitoring would be done once a year for Stage 1 and Stage 2 effluent for TKN, NO<sub>x</sub>, CBOD<sub>5</sub>, and DO.

Dr. Smith went over some of the recommended next steps. One would be to continue the operation of the small scale columns to verify continued performance, which is currently being done. Another would be to do a full scale demonstration which would test various process configurations and media configurations. Some other next steps would be to look at the longevity of the denitrification process, refine the design and the cost analysis, and

examine other water quality parameters such as phosphorus, pathogens, and emerging contaminants.

Paul Davis stated that the budget for the Phase II of the Passive Nitrogen Removal Study is currently \$200,000 coming from the research funds, and the research is important and exciting. John Higgins applauded Dr. Smith for using a present value approach and he urged RRAC to set a standard to require all vendors to submit costs using this approach. David Carter stated that this is a good point. Most people look at what it costs to buy the system, not what it costs to maintain and operate. There seemed to be consensus that the work Dr. Smith has done was very impressive and he was thanked for doing a thorough job.

- iii. **Optical Wastewater Tracers Study (old Remote Sensing of Optical Brighteners Study)** – Contract executed between DOH and DEP in May. Grant extension received from EPA to extend to end December. The purpose of this study is to test the feasibility of detecting wastewater inputs to Florida surface waters using optical characteristics such as optical brighteners from laundry detergents as tracers. Project budget: \$66,680.
  - iv. **Manatee Springs, Performance of Onsite Systems Phase II Karst Study** – The immediate task is to complete the upgrades of the systems to include nitrogen reduction. A new research collecting permit has been received from DEP. The tanks were pumped and certified and site evaluations were performed. DOH is currently working on repair permit applications. The budget for upgrades and some sampling is \$34,000. A new agreement will need to be prepared to perform the sampling once the systems have been installed. FSU expressed interest in being the provider with an anticipated budget of \$24,000.
  - v. **Taylor County Source Tracking Study** – Draft report on Phase I submitted for comments from RRAC. Final report from Florida Atlantic University submitted and distributed to RRAC members. Grant ends 6/30/2008. The tasks that are remaining are developing a tri-fold brochure and write the final grant report. FAMU MPH intern currently working on designing tri-fold, creating a mailing list, and developing any policy change recommendations. Some of the main points in the tri-fold:
    - Beaches were all about the same regardless of development
    - Going upstream (creeks and canals) generally worse water quality than beaches
    - Environmental factors like rainfall and temperature effect the numbers
    - No big difference between OSTDS and sewer, use whatever is appropriate for the desired density and existing OSTDS conditions
  - vi. **Monroe County Performance Based Treatment System Performance Assessment** – The revised sampling protocol is to be reviewed by the RRAC for the remaining work.
- b. Projects coming up
- i. **2008 Research Priorities** - Top 5 ranked projects presented to TRAP. All were approved by TRAP at 1/24/2008 meeting.

1. **Restoration of the University of South Florida (USF) Lysimeter Station** - \$20,000 - \$50,000 approximate cost. If restored, several projects that RRAC wanted to pursue could potentially be conducted at the station. USF faculty has expressed interest in partnering on this, could be linked with Kiran C. Patel Center for Global Solutions which has ranked potable water and sanitation as a top priority in their research agenda. The restoration is dependant on updating the memorandum of understanding between USF and FDOH which is currently being routed internally.
  2. **Phase II of the Florida Passive Nitrogen Removal Project** - \$200,000 approximate cost. Build on the results of the Phase I study to go from a lab scale project to a prototype scale project. Could be accomplished under special appropriation 1682
  3. **Wekiva Onsite Sewage Treatment and Disposal System (OSTDS) Seasonal Variability Assessment** - \$200,000 approximate cost. Investigate if there is a seasonal variability of nitrogen concentrations from OSTDS in the Wekiva Study Area of Central Florida. Could be accomplished under special appropriation 1682.
  4. **Alternative Drainfield Product Assessment** - \$200,000 - \$300,000 approximate cost. Compare the functioning of alternative drainfield materials to standard aggregate. This project may need to wait until the next budget cycle.
  5. **Long-term deformation of tanks of different materials** - \$20,000 approximate cost. Draft request for proposal submitted for RRAC review. Current draft proposal emphasizes less on other tank materials, but the intent is to include these. Proposing two phases:
    - a. Phase I: literature review on plastic tanks with assessment protocol to include different tank materials (fiberglass, concrete)
    - b. Phase II: field sampling numerous tanks of different materials based on the Phase I protocol
- ii. **319 Project on Performance and Management of Advanced Onsite Systems** – Grant is still in review process with DEP. Task 1 is the Monroe County project discussed previously. Task 2 is the statewide database of advanced systems based on permit records. Draft Request for Proposal submitted to RRAC for review for a vendor to provide an electronic database of all advanced OSTDS in Florida with permit information. Cost \$6,000.
  - iii. **Coastal Management Program Grant Funding Opportunity** – Grant to resample the Town of Suwannee to see what effects sewerage has had on water quality. DEP has included the project with the state's application to NOAA in the amount of \$68,000. DEP is currently working on the grant agreement. NOAA will decide around July 1, 2008, if they approve we will begin solicitation for a contract provider. Draft Invitation to Negotiate scope of work submitted for RRAC's consideration.

**6. Budget Discussion** – A draft budget for the 2008 – 2009 fiscal year has been suggested:

<u>Operating Budget</u>	<u>\$90,000</u>
<u>Phase II Manatee Springs</u>	<u>\$34,000</u>
<u>Columbia County River Front Survey</u>	<u>\$5,000</u>
<u>Lysimeter Station Restoration</u>	<u>\$50,000</u>
<u>Passive Nitrogen Phase II</u>	<u>\$100,000</u>
<u>Deformation of Tanks Study</u>	<u>\$20,000</u>
<u>Wekiva Seasonal Variability Study</u>	<u>\$100,000</u>
<u>Alternative Drainfield Product Assessment</u>	<u>\$100,000</u>
<u>Other</u>	<u>\$30,000</u>
<b>Total</b>	<b>\$529,000</b>

FY 07-08 Budget was \$242,475

7. **Other Business** – There was no other business discussed.
8. **Public Comment** - The public was allowed to comment throughout the meeting.
9. **Closing Comments, Next Meeting, and Adjournment**
10. **Next Meeting:** No date was set for the next meeting. Next meeting anticipated to be some time in July 2008 at a location to be determined with a preference for the Gainesville area. Some of the items for the next meeting are to select a provider for Suwannee Study, and to respond to Special Appropriation 1682 if/when signed by the Governor. Motion by Clay Tappan, seconded by Anthony Gaudio to adjourn. The meeting adjourned at 3:55 pm.