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# MEMORANDUM

To: Groundwater Advisory Council
From: H. Bokuniewicz
Re: Minutes of the meeting of 19 September 2011
Date: September 28, 2011

**PRESENT**

H. Bokuniewicz
S. Colabufo
A. Orlov
K. Roberts
M. Scorca
W. Spitz

**REGRETS**

M. Alarcon
N. Bartilucci
C. Gallagher
L. Koppelman
R. Liebe
R. Mazza
M. Nofi
D. Paquette
A. Rapiejko
S. Terracciano

1. There were no comments on the minutes of the last meeting (6 June, 2011).

2. Dr. Alex Orlov discussed collaborative research in Materials Science and Engineering at Stony Brook focused on development of new membranes for water filtration based on nanostructured sustainable composites. This collaboration is driven by Chemistry Department (Prof. Ben Hisao and Prof. Ben Chu) to find "greener" filtering solutions using less energy and greener routes of membrane fabrication. Filtration can be micro-, ultra-, nano-, or even osmotic. One grant proposal to demonstrate the applicability of these new membranes microfor drinking water treatment has been submitted to the EPA. The primary focus of this funding opportunity was in "Research and Demonstration of Innovative Drinking Water Treatment Technologies in Small Systems". The demonstration experiments are intended to be conducted at a filtration plant in upstate Groton, NY, in White Plains, and in cooperation with the Suffolk County Water Authority. Interlocking fibers can be designed to provide filters with permeability up to ten times higher than the standard commercial filters. These membranes are currently being produced in Stony Brook's Chemistry Department. Some tests show that the new filters outperform millipore filters allowing twice the water volume flux and four-times better phage retention. Cr and I, which are not effectively removed by standard micro, ultra-filtration, are substantially reduced by the new filters. The surface properties and structure can be controlled to target other contaminants, such as radioactive Cs. The current capacity of cartridges produced at Stony Brook run on a "household" scale of 300 gal/day. There are several test underway concerning long-term stability, and scaling-up is, of course, an issue for future study. In addition, the needs of the SCWA challenge the technology with other contaminants which may require osmotic filtration.

Another project, which is lead by Stony Brook (Prof. Orlov is a PI) is collaboration between United States Department of Agriculture and Technion University (Israel). Biochar is created from cellulose by heating in the absence of oxygen refereed to as pyrolysis. Like activated charcoal, it has a strong absorption capacity. Its surface can be adjusted to optimize water and pesticide absorption. It can be produced from grass, yard waste cotton seed, chicken litter, or almost any vegetation waste. In Israel, biochar is used as a supplement in agriculture soils of low organic content. Biochar has the potential to reduce fertilizer and pesticide runoff. Its ability to adsorb a particular chemical (nitrogen, hydrogen, oxygen, carbon) can be adjusted, to some extent, by manipulating the source material and temperature. In the laboratory, pyrolysis is carried out in a nitrogen atmosphere but in commercial applications, the goal is just to minimize contact with oxygen. Biofuels can also be produced as a by-product of the process.

At Stony Brook, instrumentation is available to test the surface conditions; in collaboration with BNL, the use of x-ray tomography has been used to determine filter structure. With such instrumentation, changes in pore size can be documented; when exposed to water, pore expansion can occur altering the absorption characteristics.

In addition to biochar, Stony Brook is involved in other projects relevant to water treatment. New carbon-based or silica-base absorbents may prove surface areas of 2000 square meters per gram or about twice that of activated charcoal. At subnanometer sizes, nobel metals, like gold, have been found to become more reactive and to assume new configurations that change their reactivity. It may be that particle size and structure can be controlled to make new materials with, for example, power to oxidize nitrate.

Some industrial projects were mentioned by Alex. In some places surface coatings of titanium oxides are applied to control airborne contamination. One commercial product, a curtain, called "Pureti", is intended to remove organics like toluene from the air in a room.

3. The question was raised whether biochar just accumulates pesticides or holds these compounds that then degrade in place. In the former case, eventually a biochar layer would become a waste product itself.

   Biochar might be applied in areas where pesticides are applied by spraying to leaves. The overspray would be trapped in a biochar layer. Such a remedial activity might allow some pesticides currently banned from use on Long Island to be used. Eventually, however, the entire surface might be saturated and break though occurs.
   The technique might be helpful, for example, in vineyards which use foliar sprays.

   The creation of Biochar was also discussed. On Long Island, we have a policy of composting yard waste in the open air rather than in vessels. This gives us some problems with odors and other issues. If we want to in-vessel composting, biochar may be a valuable product line, including the creation of biofuel in the process.

4. Alex offers a class in "Environmental Materials Engineering". The course description is attached. Suggestions for guest lecturers and for possible field trips would be welcome. At Stony Brook, students are prepared to take the PE certifying exams and the EIT. Even though there is no Civil and Environmental Engineering program, this can be done through. Specializations in Engineering Science Major:
   http://www.matscieng.sunysb.edu/ugrad-specializations.html

5. The Groundwater Institute is an unfunded institute of the University. Specific projects are funded, as usual, through the Research Foundation. Recently, however, because of the budget situation, all institutes have come under increasing pressure to cover their own administrative costs. Unofficially, the Institute was considered as having a $60,000 short last year. The immediate problem was sidestepped by averaging income over several years. This year I expect to be seen as $80,000 in the red. A source a dedicated, administrative funding would resolve the issue. Even without funding, the Institute may be allowed to continue at the University, if it has been established in State law. Steve Englebright has introduced that bill in 1999, but we are not sure of its final fate. I'll check.

   Another outcome of the budget crisis has been the virtual elimination of adjunct positions. This has put the revisions of our Hydrogeology program on hold.

6. On Tuesday (27 September), Robert Sweeny is hosting a hearing on the SC Comprehensive Water Resources Management Plan. The meeting is by invitation only. The plan has been criticized for not providing implementable actions, although it does seem to recommend options, like eliminating half-acre zoning.

7. There will be some opening at the EPA technical support team in NYC to replace current professionals who are relocating. Hydrogeologists with 5-years experience, or retired professionals, will be recruited to join the Manhattan office concerning Superfund projects. Anyone interested might contact Michael Scorca (212-637-4316) or Diana Catt (212-637-4311).

8. The next meeting will be on Monday, October 17, 2011.

HB/ed
**GWminutessep2011.doc**

## ESM 212 Introduction to Environmental Materials Engineering

**Course Catalog description:**

Multidisciplinary, materials-oriented approach to environmental engineering, incorporating the concept of sustainable development: basic principles, including pollutant transport, water quality, waste and waste water treatment, energy systems and energy efficiency, use of sustainable materials, 'green' manufacturing and pollution prevention. Use of field and laboratory sensors and analytical tools will be discussed and demonstrated. Project and problem-based approach to product design incorporating environmental considerations.

*3 credits*

**Pre- or Corequisite(s):** Either ESG 100, ESG 201, ESG 198, General Chemistry I or permission of instructor

**Text(s) or other required material:** Michael Ashby: Materials and the Environment: Eco-Informed Choice (recommended text for courseproject).

**Course learning outcomes:**

Understanding impact of toxic chemicals on the environment
Understanding pollution control technologies
Understanding pollution prevention and use of environmentally friendly materials

**Topics Covered:**

Week 1. Introduction to environmental chemistry, engineering and sustainable development.
Week 2. Hazardous pollutants and environmental health.
Week 3. Basics of environmental chemistry.
Week 4. Environmental engineering: physicochemical principles for water treatment.
Week 5 Environmental engineering: physicochemical principles for air treatment.
Week 6 Field Trip, Guest Lecture
Week 7. Environmental engineering: physcochemical principal for solid waste treatment
Week 8. Environmental Engineering: Biological Principles for pollution treatment. **Midterm**
Week 9. Pollution transport in the environment Prevention and industrial ecology. Life Cycle Analysis. *Ashby: Ch. 3,4.*
Week 10. Industrial ecology: case examples of materials selection. Green chemistry and green engineering. *Ashby: Ch. 6, 7, 8.* Materials, Energy and Environment *Ashby: Ch. 10, 11*
Week 11. Class presentation on semester project.
Week 12. **Course final exam**

**Class/ Laboratory Schedule, i.e. number of sessions each week and duration of each session:**

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|---|---|---|---|---|---|---|---|
| ESM | 212 | Environmental materials Engineering | LEC | 1 | TU,TH | 5:20 PM | 6:40 PM |
| | | | Office Hours 216 Heavy Engineering | | W | 2:00 PM | 3:00 PM |