

MEMORANDUM

To: Groundwater Advisory Council
From: H. Bokuniewicz
Re: Minutes of the meeting 20 September 2010
Date: September 21, 2010

PRESENT

R. Alvey
N. Bartilucci
H. Bokuniewicz
S. Colabufo
G. Hanson
S. Jones
D. Paquette
W. Spitz
C. Young

REGRETS

M. Alarcon
L. Koppelman
R. Liebe
R. Mazza
M. Nofi
A. Rapiejko
K. Roberts
J. Szabo
S. Terracciano
K. Willis

1. There were no corrections on the minutes of the last meeting (June 7, 2010). Item 2, on VOCs, was discussed further. Rob and Jack Monti (USGS) have been working on a 3-D GIS of VOC plumes in Nassau County. Sidira Robles who was working as an EPA intern on the project is now in a one-year probation position in EPA Region II (brown fields). Jack also had a computer intern working on the project. A test demonstration had been done earlier at the USGS in Coram.

SWAP output from three water districts were examined as part of this effort. On another project, WESTON is sampling wells under contract with the EPA in the Hicksville area. CDM and the Corps of Engineers are also involved.

Item 3 concerning drought conditions was discussed informally. Over the summer the SCWA hit their all-time highest pumpage rate at 514,000 gpm. In Nassau County a district that would run on four wells over the winter needed 24 wells in operation to keep up with demand, even with restrictions in place.

2. We (LIGRI) had worked on a white paper concerning the fate of nitrogen in Port Jefferson Harbor in support of the County's request to increase discharge. The county will not be resorting to leaching pits but will instead, study the fate of nitrogen released into the harbor by modeling. As part of the requirements for the modification of the SBU STP, Suffolk County is planning to model the hydrography of Port Jefferson Harbor with respect to the fate of nitrogen. I have had discussions with them; they plan to use the services of a consulting firm. We had submitted a proposal to the LISS to model the harbor but it was not funded.

3. Gil Hanson, Caitlin Young and colleagues are preparing a proposal to the Long Island Sound Study (LISS through the NY Sea Grant Institute to document the ground-water sources and fate of nitrogen to both Stony Brook and Port Jefferson Harbor). Cornell Cooperative Extension and the Suffolk County Department of Health Services are cooperating agencies. The assumption of LISS has been that any nitrogen introduced into the north shore harbors ends up in Long Island Sound. The proposed research focuses on the transformations undergone by groundwater nitrogen on its route to the open water of embayments. Measurements will concentrate on the freshwater-saltwater transition, on transformations in the sediment pore water and on the resulting concentrations in the open waters of the embayment. Stony Brook Harbor is an area of high natural resources, while Port Jefferson Harbor is seen as a complex area of involved, management efforts. Parts of Port Jefferson Harbor, like Conscious Bay and Setauket Harbor essentially drain to mud flats each tide. This condition might be used to advantage in constructing a nitrogen budget. Stony Brook Harbor would be done first.

The Long Island Sound Nitrogen Influx Reduction Model incorporates a 50% loss of nitrogen from terrestrial sources to the Sound. 61% of that has been attributed to denitrification in the vadose zone and 35% to further denitrification in the groundwater. However, in Northport, Hanson and Bleifuss found no evidence of denitrification in the vadose zone and less than 10% in the groundwater. The proposed objectives are (1) to estimate the groundwater discharge into the harbors, (2) to document the seasonal and tidal variations, (3) to map the groundwater saltwater/freshwater transition zone, (4) to measure dissolved oxygen levels which control the fate of nitrate, ammonia and denitrification and (5) to document any remineralization of ammonia, phosphate attenuation in association with iron-oxides, and the ratios of C:N:P. Electrical resistivity surveys, TRIDENT probes, seepage meters (ULTRASEEPs), and monitoring wells will be used. The monitoring wells from the study of Lawrence Aviation may be helpful although there is some concern over the complications due to the VOC's. (Fred Stumm at the USGS may be able to help if needed).

The budget will allow for the analysis of perhaps 100 samples per year for two years. The nitrogen compounds will be measured as well as N_2O . N_2O will be done in collaboration with Dr. Peter Groffman at the Cary Institute, Millbrook, NY. It may be that denitrification stops at N_2O gas, short of N_2 , in which case the extent of denitrification might be underestimated. Concentrations of dissolved organic nitrogen, dissolved organic carbon, sulfur, phosphate will also be determined as well as the $N_2: Ar$ ratio. (Carbon is needed to fuel anaerobic bacteria in the denitrification process). Nitrogen isotopes may be examined as well on a limited number of samples.

The study will not include the fate of nitrogen in the open water. (As mentioned earlier, the proposed study of this using geochemical tracers and hydrodynamic modeling was turned down), nor can it differentiate various sources of nitrogen in detail. Preliminary results as well as earlier consideration, suggest that the embayments may be importing nitrogen rather than exporting nitrogen to the Sound.

The proposed work would have been most helpful 20 years ago before large investments were made to upgrading STPs. Although it might reduce the nitrogen load to the harbor to include the development north of the Port Jefferson STP, it cannot be done because the amount of nitrate that the STP can discharge is capped. The technique, however, were not available then, even now, the proposed study might provide a template for the study of other embayments.

4. Nathan Epler, a Stony Brook alumnus and principal in Roux Associates, supported research on the use of zero-valent iron (ZVI) for nitrate remediation. Caitlin Young began experiments on the denitrification of ion-exchange brine using ZVI micro particle. The 5-micron particles were supplied by BASF, a German company. The brines were from the Suffolk County Water Authority treatment plant in Northport.

Batch tests were run using both powder and a composite of Ca-alginate beads. The five-micron powder had a fast reaction time reducing nitrate levels from above 50 ppm to between 15 and 2 ppm in 30 minutes with the greatest reductions being in anaerobic environments. The powder, however, was too fine for use in a flow-through column. Ca-alginate (a food-grade porous gel) beads were tried. The iron is incorporated into beads of this gel 0.5 to 1mm in diameter. Because the beads are porous the full surface area of the powder can be used while the column is still permeable enough for rapid flow. The reaction time, however, was much slower. Concentrations of nitrate went from 50 ppm to about 28 ppm in 60 minutes. If column-reactors are problematic it may be that fluidized-bed technology would be useful. There is experience with this technology at Dvirka and Bartilucci. High-pressure columns may also be a solution.

The reaction also elevates the pH. As denitrification proceeded pH went from 3 to 8 while the concentrations of nitrate approached zero. The higher pH slows the reaction. While denitrification proceeds nitrate seems to be converted mostly to ammonia; about 80% of the produce seems to be ammonia and only 20% nitrogen gas. Further test are planned to see if the production of ammonia can be controlled by adjusting the pH. Other ZVI products and other encapsulation techniques may also be tried.

It was pointed out that another problem with the brine waste was due to sulfate. The brine from Northport is sent to the Bergen Point Wastewater treatment plant which used secondary treatments. There is also a denitrification treatment facility in Nassau County and four others are planned. It's possible that sulfate could produce odor problems (H₂S) at the plants and that large volumes of brine may not be able to be handled by existing wastewater plants. ZVI ability to reduce contaminants, like MTBE, has been known for a long time. Tests might be able to be run to include the fate of sulfate.

5. The Massapequa Water District has requested that the EPA undertake clean-up of contaminate plumes resulting from Navy and NASA projects at the Northrop-Grumman facility in Bethpage. Senator Schumer has become involved in the request. Remediation has been ongoing at this site, however, while the sources were active, other groundwater pumpage was underway, like that for geothermal systems, so any "plumes" are dispersed and diffused. It seems unlikely, therefore, that the occurrence can be remediated by pump-and-treat, almost certainly not down to drinking water standards. Although Massapequa's wells are not yet impacted they may be in the future and treatment at the well-head would be required. Federal (EPA) money cannot be designated for this although the Navy had provided the South Farmingdale Water District funds for treatment. At the state level, the SCWA had received \$10 million from the imposed Natural Resource Damage Assessment for possible future treatment of supply wells in harm's way. Even in remediating well-defined plumes it is just not practical to get down to drinking water standards, 5 ppb, for example although reductions to 50 ppb are possible. Well-head treatment would still be required at any public supply wells that might be affected. This brings into question whether or not effective remediation is

worth the cost of the resources to implement it. The PUREX point-source required \$23 million in treatment for ten years and ten to fifteen years are still needed.

6. The next meeting will be Monday, October 25, 2010 at the office of Dvirka and Bartilucci in Woodbury, 9:30 – 11 AM.

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