NAVAL BASE CHARLESTON
RESTORATION ADVISORY BOARD (RAB) MEETING
Minutes of 13 November 1998

Live Oak Community Center
2012 Success Street, North Charleston, SC

RAB Members Attending
Mr. Ben Addison
Mr. Reese Batten (for Tony Hunt)
Ms. Ann Clark
Mr. Bobby Dearhart
Mr. Tom Fressilli
Mr. Wilburn Gilliard
Mr. Don Harbert
Mr. Louis Mintz
Mr. Henry Shepard
Ms. Fouche'na Sheppard
Mr. Dann Spariosu

Guests Attending

Mr. Paul M. Bergstrand	SCDHEC
Mr. Johnny Tapia	SCDHEC
Mr. Scott Glass	U.S. Navy
Ms. June Mirecki	College of Charleston
Mr. Joseph M. Land, Sr.	Galileo Quality Institute
Mr. Mike Reubish	CEERD
Ms. Susan Dunn	Redevelopment Authority
Mr. Ted Blahnik	EnSafe Inc.
Mr. Larry Bowers	EnSafe Inc.
Ms. Kris Collins	EnSafe Inc.
Mr. Fred Erdmann	EnSafe Inc.
Mr. Keith Johns	EnSafe Inc.
Mr. Ed Mears	EnSafe Inc.

Introduction of the RAB members and Guests

Mr. Louis Mintz, Community Co-Chair, brought the meeting to order at 6:00 p.m. Member and audience introductions were made.

Administrative Remarks and Discussion of Last Meeting Minutes

Mr. Mintz invited Ms. June Mirecki, College of Charleston, to comment on her concerns and interests. Ms. Mirecki offered her support, and the support of her graduate students for the Technical Assistance Program funds. Ms. Mirecki stated her qualifications and her familiarity with the environmental problems in the area, including the Navy base and some of the adjacent neighborhoods.

In response to questioning by RAB members, Ms. Mirecki expanded on her discussion of the Technical Assistance in Public Participation (TAPP) program, explaining that one must apply for technical assistance monies from the Navy. She stated that she was only one of several that would apply for the funds, up to $25,000 per year for technical assistance.

She stated that the technical assistance funds would not be for analysis or investigations, but would be used more for developing a dialogue or continuing and enhancing a dialogue about technical issues related to groundwater, surface water, soil, and air quality between the RAB and the communities that are involved, and also nearby industries.

Mr. Mintz clarified that the RAB itself must first decide if it wants or needs the technical assistance provided under the TAPP program, in addition to the support presently provided by the Navy, USEPA and SCDHEC. If so, there is $25,000 a year available.

Mr. Mintz called for discussion on the need for technical assistance, and asked if the RAB would like the full board or a subcommittee to develop a list of questions toward that end. Ms. Sheppard moved for the subcommittee to develop the list. The motion was seconded by Mr. Fressilli.

Mr. Mintz then brought up the fact sheet, drafted but now tabled, summarizing the radiological cleanup of the base. The fact sheet stated that the investigation was done in a timely and efficient manner, and that very little contamination was found. Whatever radiological contamination found was remediated.

Regarding the radiological fact sheet, Mr. Dearhart commented that Naval Sea Systems Command feels they have put out adequate information, along with the EPA and State of South Carolina, that Naval Base Charleston was released for unrestricted use from radiologic controls. All of this information is presently located in the Information Repository. Their feeling was that further information released would needlessly bring up more questions.

Mr. Addison suggested publishing a fact sheet stating the information can be found in the Repository. Mr. Dearhart said that this probably would be acceptable.

Mr. Mintz asked for comments on the minutes from the last meeting. There were no comments.

Subcommittee Reports

Community Relations Subcommittee
Mr. Mintz volunteered to contact the media to see if the RAB meetings could be mentioned in the newspaper and on Monday or Tuesday daytime local programs.

There were no other subcommittee reports.

Mr. Dearhart suggested putting information about Charleston Naval Complex cleanup in a Department of Defense publication entitled "BRAC Talk." Discussion was supportive.

Environmental Cleanup Progress Report

Mr. Batten summarized the environmental cleanup progress since the last RAB meeting.
- Zones B, C, and D: Work has been completed under the RCRA Facility Investigation (RFI).
- Zones B and D: Corrective Measures Studies (CMS) reports were completed and accepted.
- Zone A: Additional work at SWMU 39 is on schedule.
- Zones E, F, and G: By the next RAB meeting, the Navy expects to have this RFI report under regulatory review.
- Zone H: RFI completed February 1998.
- Zones I and K: RFI completion scheduled for December 1998.

Mr. Dearhart provided an update on the recent activities by the Environmental Detachment.
- They have received approval to backfill SWMU 38, the site of a pesticide spill. It will be backfilled within a week.
- Approximately 30,000 gallons of oil have been recovered at SWMU 8.
- Excavations in Zone G will be finished by the end of next week.
- At SWMU 11, soil is being excavated and a barrier is being installed to prevent runoff into drainage ditches.
- At SWMU 166, the site of a past trichloroethene (TCE) release, excavations have been done in accordance with the work plan. Sampling has been done. Additional excavation may be required to meet the remedial end points defined by SCDHEC.

Mr. Dearhart reported that the first tank at the Chicora Tank Farm has been demolished and the cap has been installed. Dirt was put back on top of the cap and the site will be seeded this week. Cleaning has been started on the pump rooms of the second and third tanks in preparation for demolition, if it is determined demolition will happen.

Mr. Mintz discussed the conveyance of the Chicora Tank Farm property to City of North Charleston or the school district. He referred to an October 12 letter from Ray Anderson, City of North Charleston. In the letter, the City of North Charleston asked the Charleston County School District if they would take the rest of the property if the City of North Charleston took five acres. At this point, no agreement had been reached. It was noted by Mr. Dearhart that if nobody wanted the property for reuse, the tanks would probably be left in place and filled with inert material.

Mr. Mintz suggested someone speak to the Officer of the Land Property Management at the School District in order to seek a resolution. There were no volunteers.

Ms. Mirecki commented on the possibility of the Chicora Tank Farm property as a Brownfield redevelopment site. She stated that Brownfield is an EPA program whose purpose is to enable development of under-utilized sites primarily for industrial or redevelopment purposes.

Treatability Study Presentation

Larry Bowers, an engineer with EnSafe, made a presentation on the chemical and physical properties of chlorinated solvents. Mr. Bowers spoke specifically of two sites at the Navy base. At Area of Concern (AOC) 607 - Building 1189, the former dry cleaning building - both groundwater and soil are impacted by chlorinated solvents. SWMU 166, the Naval Annex, also is impacted by chlorinated solvents in the groundwater and soil.

Mr. Bowers reported that there are four types of compounds located at AOC 607 and SWMU 166: PCE (tetrachloroethylene, also known as "perk "), TCE (trichloroethylene), DCE (dichloroethylene), and VC (vinyl chloride). These are halogenated compounds or halogenated hydrocarbons (also called chlorinated compounds), and considered to be known carcinogens. They can target the kidney and the liver, mucus membranes, eyes, and the upper respiratory tract of exposed individuals.

Mr. Bowers explained some basic chemical physical properties of these solvents using six parameters. Each parameter has a critical value. Engineers can plan remedies and cleanup techniques depending on whether the chemical concentrations are above or below that critical value.

1) First is molecular weight, with a critical value of 400 grams per mole. All four compounds are under 400. This means the behavior of these compounds can be predicted fairly accurately.

2) Vapor pressure has a critical value of 0.001 millimeters of mercury. All four compounds have vapor pressures higher than this number. This means these compounds have the tendency to be volatile or "evaporate" into the air. An engineered solution can take advantage of the volatility of the compounds.

3) Solubility has critical value range of 0 to 100 milligrams per liter. All four compounds are greater than 100, and the highest is 5500. These compounds are extremely soluble. They have the tendency to "dissolve" in water, moving from a solid to a liquid phase. This can be more of a disadvantage than an advantage in environmental assessment and remediation work. However, engineered solutions are being proposed at the two impacted sites that will take advantage of the high solubility of the chlorinated compounds.

4) Henry's Law Constant is a measurement of how easily the compounds move from a liquid state to a gaseous state, or the other way around. All four compounds are well above this parameter's very low critical value (0.000005 atmosphere cubic meter per mole). This means that these compounds would prefer to exist as a gas, and are therefore "strippable." In engineering terms, ex-situ stripping is extracting groundwater from the aquifer and running it through a system that creates the proper conditions for the compound to leave the water and enter the air. Stripping can also be done in-situ (where the contaminant lies - in the ground or subsurface) by directing air into the groundwater. This can strip volatile compounds from the groundwater.

5) Organic Carbon Water Partition Coefficient, OCWPC. The critical value is 10 to 10,000 kilograms per liter. This is the measurement of how readily the compound sorbs (attaches) to organic particles in the soil. A high OCWPC indicates a compound that has a tendency to sorb to organic parts of the soil. Because all four compounds have OCWPC values in between those numbers, it is hard to come to a conclusion about these compounds. Mr. Bowers noted that it can be difficult to design remedial systems for highly sorbed compounds in soil.

6) Density has a critical value of 1 gram per cubic centimeter, which is the density of water. All four compounds have a density greater than 1, so they are denser than water and have a tendency to sink. An item that's denser than water is called a dense non-aqueous phase liquid or DNAPL. Chlorinated solvents, which are the contaminants at these sites, have a tendency to move down through the soil, then sink through groundwater until they run into something that stops them. This is usually a clay or rock layer. At these clay or rock layers, dense materials like DNAPLs will accumulate, where they will act as continued sources of contamination.

Additionally, engineers must consider biodegradation and temperature when looking at remedies. These four compounds are biodegradable, which means they degrade naturally in the environment under certain conditions. Also, when the temperature is increased, these compounds mix more easily with water, mobilizing them. This makes the compounds easier to remove from the environment.

Ted Blahnik, an EnSafe engineer, spoke on potential remediation technologies for the base, and these two sites in particular. First, he reported that the investigations are coming to a close, and they are now moving on to remediation of the two sites, AOC 607 and SWMU 166. Although some contaminated soil (sources of groundwater contamination) were successfully removed, there is still a groundwater problem at SWMU 166.

Mr. Mintz had a question concerning planting poplar trees as a method of removing contaminated groundwater. Mr. Blahnik explained that using trees or other plants is a technique called phytoremediation. Where groundwater is relatively shallow, plants can be used to soak up the groundwater. Poplar trees are sometimes used because they use a lot of water. The plant takes up the contaminated water, then breathes it into the atmosphere. Some contaminants will inhibit the growth of the tree if concentrations are too high. Mr. Blahnik mentioned that this method is a possibility at some sites at the Naval Base.

Mr. Blahnik's presentation concentrated on two categories of corrective measures for groundwater:

1) ex-situ: where groundwater is pumped out of the ground and treated above ground, and
2) in-situ: where things are injected into the ground to break the chemicals down, or things are added to make the chemicals easier to get out of the groundwater.

Mr. Blahnik noted that sometimes the best remedy is to incorporate both ex-situ and in-situ treatment technologies.

Ex-situ solutions

- Pump and treat is a method where a well is used to pump water out of the aquifer, where it is treated above ground. At these sites at the Naval Base, there is contamination in the soil and groundwater, and DNAPL contaminants at the bottom of the groundwater, where they sink to. A typical pump and treat system would not help the soil contamination or the DNAPL conditions.

- Vacuum extraction is a similar concept, *but slightly more efficient*. A vacuum is applied to the well to pull contaminated water into the well, but it also pulls air through the soil and into the well. The vacuum improves groundwater flow to the well, so more water is extracted and DNAPL removal is improved. In addition, air moves through the soil more quickly than normal, stripping the volatile contaminants from the soil. This removes some of the source material that continues to contribute to groundwater contamination.

- Monitored natural attenuation. Natural attenuation can occur if there are not toxic levels of contamination, such as exist with a DNAPL. Monitoring the process adds assurances that the natural breakdown is actually working. With monitored natural attenuation, heat and biochemical additives can be used to enhance the process. This method counts on natural microorganisms to break down the contamination. This works well if the contamination concentration is at a level where the bugs will eat the contamination. Mr. Blahnik stated it works well with gasoline, but not as well with chlorinated solvents. It does not work where there is DNAPL because the contaminants are in a concentrated state.

- Heat is a method to be considered. Injecting steam works well in sandy aquifers because it moves through the sand, heats the water, and everything moves faster towards an extraction well. Electrical heating works better in soils that conduct electricity better than sand, such as clay. Integrated heating uses steam and electricity which would move through a combination soil, like sand and clay.

Using steam, one or two central extraction wells are used, and a vacuum is applied. On the perimeter of the zone to be cleaned, steam is injected at several points. Where the steam is injected, steam moves through the unsaturated zone and the water gradually heats up. The steam and heated water gradually move through the zone of contamination toward the extraction wells. As it moves, the volatile compounds become more volatile and more mobile. They are less "stuck" to the soil and more likely to move to the extraction well. This method has been shown to reduce contaminant levels by 90 to 95 percent in six to eight months.

Electrical heating is a high-intensity, short-term, more expensive solution. It typically costs a quarter million dollars to get it started, and then for every quarter acre to an acre, depending on soil type, it can be another quarter million dollars. However, this is a good solution for removing DNAPL, provided you know where it is. This method is similar to steam injection wells, but the steam injectors are replaced with electric heating probes. Near the vacuum extraction well, you place a neutral probe to draw the electric charge and, essentially, the aquifer in between is boiled. Ideally, when this process is turned off, everything is clean.

There are less intensive and longer term in-situ solutions. These include biochemical enhancements or other methods that make the contaminant degrade faster where it sits, underground.

Anaerobic enhancements are methods where nutrients and substrate (food for the microorganisms) are added to the contaminated zone. The microorganisms that break down chlorinated solvents require an oxygen-poor environment. Other catalysts include iron and methane, or anything that will drive down the amount of oxygen in the groundwater. This process breaks down the PCE to TCE, TCE to DCE, and DCE to Vinyl Chloride. However, anaerobic breakdown is slow for DCE and even slower for Vinyl Chloride. Therefore, pumping air into the ground with an injection well or putting oxygen release compounds in the water through groundwater wells downgradient ("downstream") of the anaerobic zone can improve the breakdown of these compounds.

Mr. Blahnik reported that the Navy's current planning calls for anaerobic/aerobic sequencing. This involves injecting - into the groundwater - nitrate and phosphate in the form of fertilizer to increase microbial growth and drive the oxygen content down. The microorganisms multiply and use up more oxygen. When the oxygen is gone or reaches very low concentrations, microorganisms begin using other compounds to survive. Some of these compounds include PCE, TCE, DCE and, to a limited extent, Vinyl Chloride.

Next, air is injected, creating aerobic conditions. In this oxygen-rich condition, some of the solvents volatilize, and some degrade aerobically. Downgradient of the aerobic zone, low-flow groundwater extraction wells remove some groundwater and circulate it back to the beginning of the anaerobic area for additional treatment. The down side to this method is that the DNAPL is not affected. Nothing can be done biologically to get rid of DNAPL because it is too concentrated and toxic to microorganisms.

Mr. Blahnik commented on how the Navy is proposing to test some of these methods on actual contamination at SWMU 166 and AOC 607.

AOC 607 sits over a sandy aquifer 10 to 12 feet below ground surface. The location of the contaminants is well defined. It's a small area. There is steam nearby. The Navy is proposing to run steam to the site, inject it in a circle around what is thought to be the highest concentration, and put a vacuum on the middle for three to six months. The Navy hopes to see an 80 to 99 percent reduction in volatile organic compounds at that site.

SWMU 166 is different in that it has very deep contamination, 40 to 60 feet below ground. A lot of the contamination has soaked into the silty clays. Some of the contamination exists as a DNAPL. Steam won't work in this area by itself. There are two options. If the DNAPL can be removed, we can use biochemical enhancements to treat a very large area. To use steam alone, as many as 40 wells would have to be put in, and it would not be cost effective. Six-phase electrical heating is another option. Ensafe is looking for the DNAPL now, and Mr. Blahnik believes they will find it. If the DNAPL is accurately located, EnSafe proposes using a short run of six-phase electrical heating, expecting to see 95 to 99 percent of the contamination removed from selected zones.

In a separate study, the Navy is going to test anaerobic/aerobic sequencing either in an area of the SWMU 166 plume which is not suspected to contain acutely toxic concentrations of solvents, or in an area which will be treated first using the six-phase heating process.

Mr. Blahnik asked for questions. Ms. Mirecki questioned what would be done when nitrate was added to their system and the nitrate level rises above 10 milligrams per liter. Mr. Blahnik responded that they would not inject greater than 10 milligrams per liter. Ms. Mirecki and Mr. Blahnik discussed spatial control on the biodegradation reactions and other technical aspects of this solution.

Comments and Questions

Ms. Sheppard asked Ms. Mirecki to elaborate on her discussion with Mr. Blahnik. Ms. Mirecki stated that these bioremediation strategies are largely experimental and show varying degrees of success.

Ms. Sheppard asked if the process had been successful elsewhere. Mr. Blahnik replied affirmatively. Ms. Mirecki disagreed concerning the DCE (aerobic) degradation. Mr. Blahnik said that they would have the work plan done in November.

A question was raised about whether to continue having the meetings every two months, the concern being the loss of community members because of the infrequency of the meetings. Mr. Mintz asked for comment from the board members. The general agreement was to continue meeting every two months, but to increase the frequency if the need arises.

The next RAB meeting will be December 8, 1998, at 6:00 p.m. at the Live Oak Community Center, 2012 Success Street, N. Charleston, SC.

Meeting Adjourned

Minutes approved by:

Tony Hunt
SOUTHDIVNAVFACENGCOM

Louis Mintz
Community Co-Chair