Marine Corps Base Camp Lejeune
Restoration Advisory Board Meeting Minutes

RAB Meeting: July 29, 2008

ATTENDEES:

Robert Lowder/Camp Lejeune
Andrew Smith/Camp Lejeune
Gary Tysor/NAVFAC Mid-Atlantic
Randy McElveen/NCDENR
Matt Louth/CH2M HILL
Chris Bozzini/CH2M HILL
Kim Henderson/CH2M HILL
Keri Hallberg/CH2M HILL
Joe Colella/Shaw Group
Laura Bader/RAB Co-Chair
Thomas Mattison/RAB Member
Leonard McAdams/RAB Member
Jerome Ensminger/RAB Member
Cynthia Rester/RAB Member
Marvin Powers/RAB Member

FROM: Kim Henderson/CH2M HILL

DATE: September 17, 2008

LOCATION

Coastal Carolina Community College, Business Technology Building, Room 102 in Jacksonville, North Carolina

MINUTES

6:00 PM

I. Welcome and Introductions

II. IR Site 89 Zero-Valent Iron (ZVI) Soil Mixing Update

Objective: The purpose of this agenda item was to provide an update on the status of the non-time critical removal action (NTCRA) currently being conducted at Site 89. This discussion was led by CH2M HILL representative, Mr. Chris Bozzini.

Overview: Mr. Bozzini reviewed the history of Site 89 which was the former defense reutilization management office (DRMO). There are high concentrations of chlorinated solvents in groundwater at Site 89. The contaminants of concern (COCs), which are volatile organic compounds (VOCs), are primarily 1,1,2,2-tetrachloroethane (PCA) and its breakdown products. The NTCRA is being conducted to address source areas and the estimated treatment volume is 30,000 cubic yards (yd^3), the area is 32,000 square feet (ft^2), and the depth is 25 feet (ft). Soil mixing with ZVI-clay addition was the selected treatment. The soil mixing is conducted in 15 10-ft diameter overlapping columns. The optimal mix

consists of 2% ZVI and 3% bentonite based on results of a bench-scale study conducted prior to the NTCRA. This same technology was used and was successful at Site 88 in 2005.

There have been several actions taken at Site 89 to treat VOC contamination. In 2000, the Navy removed the top 5 ft of soil and backfilled. In 2005, one large source area was treated with electrical resistance heating (ERH). In 2007, the team decided to conduct treatability studies in the remaining source areas and dissolved plume to determine the effectiveness of treatment technologies for evaluation in the Feasibility Study following completion of this NTCRA.

Mr. Ensminger questioned whether a liquid form of the ZVI treatment is available because it seems it would be more effective and provide better distribution to treat larger areas. Mr. Bozzini responded that in situ injection was conducted during the treatability study and because iron is a solid there were some delivery issues for distribution. Mr. Bozzini indicated that there is ongoing research on nanoscale iron.

Soil mixing with ZVI-clay is conducted in situ. ZVI treats chlorinated contaminants and the clay provides contaminant migration control. The clay also acts as a lubricant during mixing and creates a lower permeable zone of soil to reduce contaminant mass flux. This is a patented technology developed by DuPont (1998) and was donated to Colorado State University (2003). The RAB reviewed a 3D figure of a conceptual model of the soil mixing process before and after mixing.

The implementation steps for the NTCRA include site preparation, mixing and backfilling, and monitoring. Site preparation activities included clearing trees from the southwest corner of the site, sampling and abandonment of existing monitoring wells in the treatment area, excavation of the top 3 feet of overburden and berm construction, and installation of high visibility fencing around the mixing area. Photos of the site preparation and storage area for the ZVI and bentonite were shown. The ZVI and bentonite are stored in an adjacent warehouse in 1 ton supersacks. The mixing is conducted from south to north which is downgradient to upgradient. Field testing for ZVI content to confirm mixing quality is being conducted. Excess water and stormwater and vapor is collected and treated. Photos and videos of the soil mixing and photos of the quality control sampling and treatment systems were shown. Site restoration includes placing geotextile and backfill south to north as soon as possible, while not interfering with subsequent mixing areas.

Mr. Ensminger asked how wide the blades on the auger are and what is the horizontal and vertical extent of the area to be treated. Mr. Bozzini responded that the augers are 10 ft in diameter and are conducted in overlapping columns to cover the area; approximately 32,000 ft^2 will be treated down to 25 ft below ground surface. Mr. Ensminger questioned whether we knew the source of the PCA. Mr. Bozzini answered that the source is unknown but there is some speculation that there was some paint solvent (described as anti-infrared radioactive resistant paint) disposal during the 1st Desert Storm but there is no record that the paint solvent contained PCA. The only other known activity was bladder storage.

Baseline monitoring was conducted at 10 soil locations, 9 existing monitoring well locations, and 4 surface water locations. Surface water will be monitored monthly during treatment to confirm there are no impacts to the creek. The RAB reviewed the results of the baseline monitoring and first round of surface water monitoring conducted during treatment.

Mr. Ensminger asked which direction the adjacent creek flowed. Mr. Bozzini indicated that the creek flow was to the south. The RAB discussed the surface water results were there was a 50% reduction in concentrations between the baseline sampling and round 1 sampling, conducted 4 weeks apart. Mr. Ensminger was impressed with the results.

Mr. Ensminger asked the locations of the monitoring wells and whether monitoring is being conducted downgradient to ensure that the plume is not mobilizing. Mr. Bozzini explained that the plume is bounded by monitoring wells and the groundwater flow is radial toward the creek. The existing wells in the treatment area were abandoned but monitoring wells will be installed following treatment. Mr. Ensminger questioned whether the contamination extended into the deeper aquifers. Mr. Bozzini responded that there are VOCs present in the intermediate aquifer at concentrations orders of magnitude lower that the shallow aquifer and that the deep aquifer is clean.

Follow-up monitoring will be conducted at 10 soil locations at 1, 2, 3, 6, 9, and 12 months after treatment; 10 new monitoring well locations quarterly for 1 year after treatment; and 4 surface water locations quarterly for 1 year after treatment. Slug tests will also be conducted.

The soil mixing will be completed in August 2008 followed by site restoration in September 2008. Follow-up monitoring of soil, groundwater and surface water will continue through fall 2009 and a summary report will be submitted in 2010.

III. IR Site 73 Pilot Study Update

Objective: The purpose of this agenda item was to provide an update on the status of the Site 73 pilot study results. This discussion was led by CH2M HILL representative, Mr. Chris Bozzini.

Overview: Mr. Bozzini reviewed the history of Operable Unit 21, Site 73, located in the Courthouse Bay area. Vehicle maintenance was conducted at the site from 1946 and waste oil and battery acid were disposed of. The primary COCs are trichloroethylene (TCE) and its breakdown products. The RAB reviewed a figure of the target treatment area where an air sparging pilot study was conducted using the existing horizontal well from a former hydrogen gas sparging pilot study at Site 73 and existing air sparging equipment from a former pilot study at Site 86. The air sparging system operated for one year.

Monitoring included sampling of 15 existing monitoring wells and 4 soil vapor locations. The frequency included baseline, 1, 3, 6, 9, and 12 month monitoring for VOCs, dissolved oxygen (DO), and oxidation reduction potential (ORP). The RAB reviewed a figure of the treatment area and graphs showing the reduction of TCE concentrations over time. The radius of influence was at least 125 ft from the horizontal well. In summary, average TCE concentrations were reduced by 75% in the target zone, by 93% in the intermediate zone, and 97% in the deep zone. There was some increase in TCE concentrations in shallow, distant wells. No vapor issues were created in the adjacent buildings.

Mr. Ensminger asked how deep the contamination is and how deep the horizontal well is. Mr. Bozzini indicated that the contamination is to a depth of approximately 75 ft below ground surface (bgs) and there is a well installed at the site to a depth of 100 ft bgs that is clean. The horizontal well extends to a depth of 88 feet bgs to extend beneath the

contamination and strip VOCs above it. Mr. Ensminger questioned where the VOCs are going. Mr. Bozzini indicated that they are volatilizing into air and converted to innocuous by-products (e.g., CO_2). Soil vapor monitoring was conducted outside the adjacent buildings and although there was a spike in concentration after the system startup, there was no risk identified and concentrations decreased overtime. Mr. Ensminger questioned whether there is an exhaust or system for air collection at the end of the well. Mr. Bozzini responded that the well end is capped and there is a screen at depth where the air is directed from the compressor through the formation and the air mixes with the water and strips VOCs into the atmosphere. Mr. Ensminger asked how we know that this process does not cause soil contamination if the VOCs don't make it to the surface. Mr. Bozzini explained that it is basically a mass transfer equation where the VOCs in water become vapor and the transfer time is fast so that there is not enough time for the VOCs to come out of solution and sorb to soil. This technology would not be as effective if used in an area with a confining layer.

IV. Basewide Vapor Intrusion Investigation Approach Presentation

Objective: The purpose of this agenda item was to provide a summary of the investigation approach for a basewide vapor intrusion evaluation o. This discussion was led by CH2M HILL representative, Mr. Matt Louth.

Overview: It was planned to show a video produced by the Navy and Marine Corps Public Health Center (NMCPHC) that provides an understanding of the key concepts and principles to the vapor intrusion pathway; however, the video was not shown due to technical difficulties. The video can be downloaded from http://www-nmcphc.med.navy.mil/ep/index.htm under "Risk Communication".

Mr. Louth reviewed the definition of vapor intrusion which is the migration of volatile chemicals from the subsurface into overlying buildings (Interstate Technology and Regulatory Council [ITRC], 2007). Vapor intrusion is a pathway of potential concern because there is a potential for human health risks as people spend > 90% of their time indoors, VOCs often cannot be seen, smelled, or tasted, there is potentially both acute and chronic effects, and risks may greatly exceed those due to other direct-contact pathways (e.g., ingestion of groundwater and ingestion and/or dermal contact with soil). There can also be safety hazards (e.g., acute, explosion) associated with vapor intrusion.

Vapor intrusion is a hot topic based on increased attention by regulatory agencies on the affects of vapor intrusion of VOCs in groundwater into occupied buildings. Recent DoD policy and guidance have been issued for assessment of this pathway. Therefore, a basewide evaluation is currently being conducted.

Mr. Louth reviewed the current guidance and policy documents that include:

- Navy/Marine Corps (April 2008) *Final Policy on Vapor Intrusion*
- DoD (Air Force, Navy, and Army) (February 2008) *Final Draft Tri-Services Handbook for the Assessment of the Vapor Intrusion Pathway*
- ITRC (January 2007) *Vapor Intrusion Pathway: A Practical Guideline*

- EPA (February 2004) *User's Guide for Evaluating Subsurface Vapor Intrusion into Buildings*
- EPA (November 2002) *Draft Subsurface Vapor Intrusion Guidance*

All these documents indicate that vapor intrusion is a rapidly evolving field, reflecting the state of science at the time. They also present a tiered approach for assessing the vapor intrusion pathway with Mr. Louth reviewed the general steps including identification of VOCs within 100 ft of buildings, determining whether immediate action is needed, assessing whether soil gas or groundwater concentrations exceed generic risk-based criteria and site-specific risk-based criteria, and assessing whether sub-slab soil gas or indoor air exceed site-specific risk-based criteria.

The objectives of the basewide evaluation were to follow recent DoD guidance and policy to identify whether complete exposure pathways exist for vapor intrusion. The basewide evaluation was conducted in 6 areas of the base: Hadnot Point, Mainside, Air Station, Courthouse Bay, Camp Geiger, and Tarawa Terrace.

Step 1 was the initial screening. A literature search was conducted to identify active Installation Restoration (IR); Resource, Conservation, and Recovery Act (RCRA); and underground storage tank (UST) sites including site use, the type of contamination present, geology, the presence of a remediation system, and regulatory status. Groundwater VOC data collected from 2002-2007 was then screened against the North Carolina Groundwater Quality Standards (NCGWQS) and generic vapor intrusion screening levels (EPA, 2002). Approximately 170 buildings of interest were identified within 100 ft of a groundwater plume. The RAB reviewed figures of the buildings of interest by area.

Step 2 was the refined screening. Preliminary building surveys were conducted to develop the conceptual site model (CSM), including width, length, ceiling height; building use (e.g. industrial); occupancy; and the number of doors, windows, and loading docks. Site-specific screening levels were then modeled based on building use for the residential, small building, and large building scenarios. Groundwater VOC data was then screened against site-specific screening levels. Based on this screening, only 50 out of the initial 170 buildings of interest were identified. The RAB reviewed figures of the refined buildings of interest by area.

Step 3 included sampling and analysis. Co-located groundwater and soil gas samples were collected adjacent to buildings. Groundwater samples were collected from the top 5 ft of the shallow aquifer and soil gas samples were collected from 1 ft above the shallow water table. In buildings adjacent to remediation systems (less than 5% of buildings), sub-slab soil gas and indoor air samples were collected to monitor for direct impacts. At these locations, a building survey was conducted to determine sample locations and document potential indoor sources of VOCs and ambient air samples were collected for comparison purposes. The field sampling event was conducted from June 16 through 25, 2008 and validated data is expected back in August 2008.

Step 4 will include building-specific risk evaluations. Multiple lines of evidence (ambient concentrations, internal and external source locations, building construction and use, trends between groundwater, soil gas, sub-slab, and indoor air sampling data, and vertical

hydrogeologic conditions) will be evaluated to determine whether vapor intrusion pathway is present.

Next steps will be to determine if buildings may require further investigation or mitigation. Further investigation may include collection of additional sub-slab and indoor air samples. Common mitigation measures include sealing all cracks, sumps, and preferential pathways, installation of vapor barrier, land use (or building use) controls, and installation of sub-slab depressurization or pressurization devices. Preliminary results will be presented at a future RAB meeting. Mr. Lowder indicated that this evaluation is being conducted to provide a baseline, decisions will be based on guidance and policy for how often the evaluation will need to updated.

Mr. Ensminger asked if handouts of the presentation were available. Mr. Lowder responded that the presentation could be provided.

V. Next RAB Meeting

Mr. Lowder requested agenda topics for the October RAB meeting, an update on Range Environmental Vulnerability Assessment (REVA) was identified. Mr. Lowder identified other potential topics including the results of the vapor intrusion investigation, Site 69 groundwater data, Military Munitions Response Program (MMRP) preliminary assessment/site investigation (PA/SI) data, Site 89 data, and the 5-Year Review. The RAB voted to hold the next meeting on **Tuesday, October 21**, **2008 6:00 PM – 8:00 PM**. Mr. Lowder will secure a location for the meeting and send the information to the RAB members.