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THE MEMPHIS DEPOT
TENNESSEE

ADMINISTRATIVE RECORD
COVER SHEET

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Final

Memphis Depot

BRAC Cleanup Team

Meeting Minutes

28 September 2006

BRAC Cleanup Team	Organization	Phone/email
Michael Dobbs	Defense Logistics Agency (DLA)/Defense Distribution Center (DDC) DES-DDC-EE	717.770.6950
Turpin Ballard	Environmental Protection Agency, Region IV (EPA)	404.562.8553
Evan Spann	Tennessee Department of Environment and Conservation, Division of Remediation (TDEC-DoR)	901.368.7916
Project Team	**Organization**	**Phone**
Glen Turney	e^2M	210.348.6000
Tom Holmes	e^2M	404.237.3982
Angela McMath	e^2M	404.932.6222
Steven Herrera	e^2M	916.852.7792
Denise Cooper	e^2M	901.774.3681
David Price	MACTEC Engineering and Consulting	770.421.7022
Bruce Railey	Corps of Engineers - Huntsville	256.895.1463
Brett Frazer	Corps of Engineers - Huntsville	256.895.1874
David Nelson	CH2M Hill	770.604.9182 x394
Mike Perlmutter	CH2M Hill	770.604.9182 x645
Peter Lawson	CH2M Hill	
John Tunks	Mitretek Systems	303.779.2672

Previous Meeting Minutes

The BCT signed the final 27 June and 17 August 2006 BCT meeting minutes.

Dunn Field 90% Source Areas Remedial Design (SARD)

Mr. Perlmutter reported that CH2M Hill posted the 90% SARD on their FTP site for BCT review on 15 September 2006. He then highlighted important points from the data collected during the Dunn Field Remedial Design Investigation (RDI). The results from the two soil samples CH2M Hill collected to determine the edge of 1,1,2,2 Tetrachloroethane (PCA) in soil near Disposal

Site 10 were non-detect decreasing the size of that proposed soil treatment area. Mr. Perlmutter agreed to reevaluate the data based on Mr. Holmes comments regarding confirmation sample results collected after removing Disposal Site 10.

Sample results collected from outside of the original Treatment Area (TA) 3 near MW06 were below remedial goals (RGs) and the additional samples collected from within the original TA3 confirmed the size of proposed soil treatment area. Mr. Perlmutter indicated that there may be some additional sampling prior to the remedial action (RA) to confirm the best location for the thermal system within TA3.

Mr. Ballard asked if that meant a study was planned prior implementation of the RA and indicated the project team must take into consideration the time and effort to accomplish another study vs. the potential cost savings for a couple of heating points. Mr. Holmes responded that a few more samples would be collected to refine the in-situ thermal desorption (ISTD) points for use in the Source Areas RA Work Plan (RAWP). If sample results were below RGs as the team suspected, then the data would be used only for the Close Out Report and would not be presented to the BCT for discussion. Mr. Holmes anticipated the additional sampling would not delay the Source Areas RAWP.

Mr. Perlmutter reported that at TA4 most of the additional samples were collected from the perimeter of the area and that results were below the RGs. This was consistent with the membrane interface probe results and indicated that CH2M Hill had effectively delineated the RG boundary for TA4.

Mr. Ballard asked why the design indicated that the above ground soil vapor extraction (SVE) system for the fluvial aquifer would later be buried below grade. Mr. Perlmutter responded that since the fluvial SVE system would be running for 5 years, CH2M Hill preferred to bury the system buried allow the area to be reused without disturbing the system. He also mentioned freeze and thaw issues and said that burying the system would be better for the health of the system in the long run.

Mr. Nelson indicated that the Dunn Field RDI Technical Memorandum (TM) would be submitted with the next version of SARD. Mr. Spann requested that CH2M Hill distribute the RDI TM figures as soon as possible. Mr. Nelson agreed, after the figures had gone through the quality assurance/quality control procedure.

Mr. Holmes asked if Mr. Nelson knew what was in the soil pile located in TA3. Mr. Nelson did not know, but said the pile had been there for years. Mr. Holmes indicated that e2M would have to remove the pile before construction of the Source Areas RA. He will monitor the pile removal and, if it contains debris, will evaluate the need to sample the pile. Mr. Holmes then asked about the soil piles from the Permeable Reactive Barrier (PRB) Implementation Study. Mr. Nelson reported that the sample results indicated the piles could be spread, and he anticipated e2M would do that during construction of the Source Areas RA. EPA and TDEC concurred that e2M could spread the piles.

AI: CH2M Hill to distribute the RDI TM figures to the team as soon as possible upon completion of QA/QC procedures.

Land Use Control Implementation Plan (LUCIP)

Mr. Nelson reported that CH2M Hill received an email from EPA that indicated EPA would not be able to provide comments by the deadline due to changes made by the Department of Army

(DA). Mr. Ballard indicated that the revised LUCIP contained changes that EPA did not solicit in its comments. The revised LUCIP contained language pulled from the Main Installation LUCIP that no longer applied and that did not meet the EPA Land Use Control guidance. Mr. Ballard suggested that Mr. Dobbs provide DA with the original EPA comments on the original draft LUCIP and have the appropriate person within DA work with EPA to resolve these issues. Mr. Dobbs asked if EPA Region 4 or Headquarters would be able to resolve the issue. Mr. Ballard indicated that the EPA Region 4 Legal Office would review the document and would then send it up to Headquarters for their review. Mr. Dobbs will contact DA to determine who will be the single point of contact for DA on the Dunn Field LUCIP and provide that information to Mr. Ballard.

AI: Mr. Dobbs to determine the appropriate Department of Army point of contact to work with EPA to resolve issues regarding the Dunn Field LUCIP.

Dunn Field Off-Depot Groundwater Remedial Design (RD)

PRB Implementation Study

Mr. Nelson discussed the Zero-Valent Iron (ZVI) Permeable Reactive Barrier (PRB) Implementation Study and the confirmation data received by CH2M Hill to date. At end of August CH2M Hill installed 5 borings, 4 within the PRB, and one monitoring well down gradient of MW195. The information provided by these borings and well would help differentiate between theoretical conditions and actual conditions. The borings would also provide information regarding the influence of ZVI within the wall as well as down gradient of the wall. CH2M Hill also wanted to get better idea of what was happening at MW196 as it did not produce sufficient water to sample.

CH2M Hill found that within 5 feet of MW196 the top of clay dropped about 7 feet. MW196 sits in an area where the clay that forms the base of the fluvial aquifer is elevated and appears to be blocking water flow in that area. Monitoring wells down gradient of the PRB along the line of groundwater that flows through the low point in the clay have shown positive impacts from the PRB. Mr. Nelson indicated that the information helped explain the fluctuation in data between sampling points along a similar horizontal line within this area.

Mr. Perlmutter then further discussed the following findings from the PRB confirmation borings, associated issues and potential solutions.

1) Finding: Incomplete formation sediments removal during jetting process. Implications: Accumulation of formation materials at the bottom of the column; iron/sand mix does interface with the clay layer. Potential solution: During jetting process, use guar with higher specific gravity to facilitate removal of formation sediments. Larger formation materials will remain suspended during jetting process and will be removed when the iron/sand mix pumped in.

Mr. Ballard and Mr. Spann offered another solution – cut into the clay about 1 foot to provide a sump at the bottom of the column.

2) Finding: Sidewall sloughing. Implications: Periodic column sidewall sloughing resulted in stratification, particularly on column perimeter; resulted in formation of sand lenses within the iron/sand column. Potential solution: During jetting process use guar with higher specific gravity to minimize sidewall sloughing; remix column contents after iron/sand/guard pumped into column.

Mr. Perlmutter remarked that remixing the column contents was actually included in the work plan, but they did not apply it in the field. When asked how they would remix the contents, Mr. Perlmutter explained that they would use a much lower jet setting so as not to disturb the side walls.

3) Finding: Highly variable clay surface. Implications: Iron/sand columns are either above or below the top of clay; potential for contaminant plume to pass over or under the ZVI PRB; wastes iron that is below the top of clay. Potential solution: Improve the drilling technique so that the top of clay is consistently identified during the installation process; use geophysics to delineate top of clay before construction; use a series of lithologic borings to delineate top of clay before construction.

Mr. Ballard asked if the subcontractors cut down to a specific depth or to top of clay. Mr. Nelson responded that the columns were installed to a uniform, specific depth.

4) Iron/sand segregation: This was a concern voiced in work plan comments, but it was not seen during confirmation borings and CH2M Hill did not consider it an issue. Implications: Iron and sand separates during the tremie process. Potential solution: Since this was not observed, CH2M Hill determined no need to change to mix design.

5) Finding: Fingering on column perimeter. Implications: Iron and formation sand stratification is exacerbated on the column perimeter; potential for contaminant plume to pass through the PRB with insufficient contact time. Potential solution: During jetting process, use guar with higher specific gravity; adjust rotation and extraction rate and the jetting pressure to make cutting radius more consistent top to bottom; remix column contents after iron/sand/guar pumped into column.

Mr. Ballard asked how the subcontractors could determine that one portion of the column was eroding more another during jetting in order to form a clean column. Mr. Perlmutter indicated that significant fingering at the site was not evident from the confirmation borings, although it was a potential reason for differences in groundwater samples along similar horizontal lines and therefore was something they looked for during the confirmation boring. The results did indicate that the amount of ZVI called for in the work plan was in the ground.

Mr. Nelson then discussed the latest geochemical and volatile organic compound (VOC) groundwater sampling data. He indicated that geochemical results were similar to past results. VOC results appeared to follow the groundwater flow paths based on the new understanding of top of clay. MW195 produced good sampling results, which is in flow path. Mr. Perlmutter interjected that it would take time for the down gradient wells to reflect impact from the PRB.

Mr. Nelson reported that CH2M Hill was working the ZVI PRB Implementation Study Technical Memorandum and that it was scheduled to be submitted with the next version of the Off-Depot Groundwater RD.

Groundwater Modeling

Mr. Lawson presented results from the latest groundwater modeling. The model objectives were to develop vadose zone flow and transport models for each of the four treatment areas and to link modeling results to the mixing cell model to calculate groundwater concentrations. To accomplish this, the models simulated current conditions and were compared with observed groundwater concentrations. Modelers then performed analysis to determine contaminant concentrations in soil that would require cleanup.

Mr. Lawson reported that the individual models were constructed for each proposed soil treatment area with site specific stratigraphy, soil properties and contaminant concentrations. He used the Hydrus 1-D model to predict the water flux and contaminant concentrations in the pore water entering the aquifer over the simulation period. These quantities together defined the total contaminant mass flux to determine transport. The Mixing Cell model incorporates Hydrus 1-D water and contaminant mass flux estimates. Water flux was transient but averaged 11.4 inches per year. The model assumed a 4-meter mixing zone thickness based on observed stratigraphy found during sampling.

He then described the simulations used to recreate current conditions. The simulations were performed to predict the impact that would result from current contaminant levels in the soil source areas and assumed that the maximum observed total soil concentration extended throughout the loess and fluvial material. The higher organic content and moisture content of the loess resulted in greater contaminant mass in the loess.

Mr. Holmes asked if the contamination was moving out of loess slowly would it move quicker through fluvial and attenuate. Mr. Lawson responded that it would not because there was no water being added to the system as it moved through the loess into the fluvial. He continued that the conservative assumptions tended to provide for a maximum flux of contamination from the vadose zone, which would result in and assumed that there was maximum residence time in the fluvial aquifer.

Mr. Lawson reported that the modelers did not simulate every contaminant found in each treatment zone, but concentrated on the most important ones. The calculated conditions vs. actual conditions graphs showed that the calculated conditions were a bit higher than the actual conditions.

The simulation results indicated that soil contamination concentrations were much greater in the past, that soil sampling had not detected maximum concentration areas, that a dense non-aqueous phase liquid (DNAPL) had intruded the groundwater aquifer sustaining elevated groundwater concentrations, or a combination of the above. Basically, a DNAPL in the past made it to the groundwater and past concentrations were higher than today.

To determine soil cleanup levels that would be protective of groundwater, the modelers assumed a maximum groundwater impact of 50 ug/l. The mass flux estimates were then converted to uniform total soil concentrations that produced that flux. The modelers assumed similar concentrations throughout the soil column. Mr. Ballard remarked that the cleanup levels identified on the slides were not the approved cleanup levels even though the slide was entitled "soil cleanup levels."

To evaluate groundwater flow and contaminant transport at the site, the modelers developed a three dimensional flow and transport model. The modelers used MODFLOW as the flow model linked with MT3DM.

The assumed hydraulic conductivity of the model reflected the complex site stratigraphy and was from 2 to 4 feet per day. Mr. Lawson indicated that the modeling results supported the hypothesis that windows existed in the clay layer between Memphis Sands and intermediate aquifers.

Mr. Lawson reported that there was a high level of correspondence between the actual water level results and with those produced by the model. The model was able to reproduce actual

results, which should provide a higher level of confidence that the model of future effects would accurately represent what would happen.

The MT3DM model was linked with the groundwater flow system defined by the MODFLOW model to simulate contaminant movement from the source areas. The four primary groundwater contaminant plumes on Dunn Field were input as boundary conditions. Simulations were performed assuming persistent sources along with remedial scenarios with declining sources.

Remedial scenario simulations assumed concentrations in the ZVI injection areas were reduced instantaneously to 1000 ug/l. The simulations then assumed that contamination concentrations in the source areas including the ZVI treated areas were further reduced by 20% of the starting point concentrations per year for 5 years. After that fifth year, the modelers removed the boundary conditions and assumed all was clean in the flux. For the no-action simulations, the modelers assumed that current concentrations persisted into the future unchanged due to the DNAPL presence.

Mr. Ballard asked if the simulation assumptions corresponded to the 5000 ppb areas that would be treated down to 1000 ppb. Mr. Perlmutter responded that they did correspond. Mr. Ballard then asked who determined the 20% decline in concentrations. Mr. Lawson responded that he determined the decline based on information provided by Mr. Nelson about the proposed remedial actions.

Mr. Lawson then reviewed the Trichloroethylene (TCE) and 1,1,2,2 PCA transport simulations. After one year with the PRB in place, the model indicated that the contamination plume would bifurcate west of Dunn Field toward depressions in the clay that may be windows into the intermediate aquifer and the Memphis Sands aquifer. With the sources eliminated, the model indicated the plume in the fluvial aquifer degraded fairly rapidly but that it also bifurcated.

In the intermediate aquifer, the model indicated that the plume wanted to move toward the northern suspected window in the clay. Mr. Ballard and Mr. Spann voiced concern that the model showed a large amount of influx from the fluvial into the intermediate aquifer. Mr. Lawson reported that the model assumed a permeability of 10^{-6}, but that the modelers did not have a lot of data regarding the intermediate aquifer's hydraulic conductivity with fluvial. Mr. Ballard interjected that CH2M Hill should have transducer data for the intermediate aquifer collected by the U.S. Geological Survey (USGS). He also suggested that the modeling data indicated the need for a monitoring well in the intermediate aquifer west of TA2.

Mr. Lawson concluded his presentation saying that 1,1,2,2 PCA and TCE were the contaminants that posed the greatest threat to offsite groundwater quality; that groundwater with elevated contaminant concentrations currently existed down gradient of the proposed soil treatment areas; that despite treatment efforts and depending on transport and degradation properties, continued degradation of down gradient water quality may occur; that gaps in the aquitards at the site represented threats to deeper groundwater quality; that the vertical hydraulic conductivity of the aquitards was a key parameter that governed the transport of contaminants vertically downward into the deeper aquifers; and that additional field investigation may be warranted to obtain site specific vertical permeability estimates.

Mr. Ballard asked if there would be a drastic difference in the transport flow through to the intermediate aquifer if the modelers had better intermediate aquifer data based on the USGS transducer data. Mr. Lawson responded that the amount of mass the model predicted would move down to the intermediate was not huge, so if the model moved that mass laterally it would

not drastically change the amount of contamination moving into the intermediate aquifer. Mr. Lawson presented his recommendation that since vertical contamination migration in the source zones was a key issue; then multi-layer aquifer testing would significantly reduce uncertainty in the site modeling parameters.

Mr. Lawson also indicated that some process was occurring to reduce the contaminant mass west of Dunn Field at the Memphis Light, Gas and Water substation. He speculated that the mass was either being destroyed or it was going away by either leaking or moving in another direction. The team then discussed how the mass would reduce, other than chemical reduction because oxygen reduction potential (ORP) and dissolved oxygen (DO) did not indicate monitored natural attention (MNA) occurred in that area.

Mr. Holmes wondered if perhaps an influx of clean water from the west was diluting the mass. Mr. Spann questioned whether there could be a window within the plume path that was pulling it down. Mr. Holmes indicated that sampling results from the numerous monitoring wells installed in the plume pathway did not indicate a window, and that there would be some potentiometric difference if there was a window into the intermediate aquifer in that area.

The team discussed the reason for conducting the model and the need for a monitoring well in the intermediate aquifer under the source area to help the team understand where the mass was going since the current data indicated the mass was reducing much more so than the model predicted. Mr. Ballard indicated that unless there was no reduction in groundwater contamination 5 years after starting the Source Areas RA, then he did not see the need for an intermediate well at this time.

Mr. Holmes said that the benefit of the model was to show concentrations suitable for MNA. Mr. Lawson indicated that at another site, CH2M Hill used the model with a field attenuation rate that matched the field data to better replicate reality. Mr. Ballard commented that the team could take the current model and add a field attenuation rate based on existing data and compare that on a regular basis with post-RA sampling data. If in a number of years it is off by a certain amount, then the team can reevaluate the situation.

Mr. Dobbs asked if the BCT required any action to be taken regarding the model at this time. Both Mr. Ballard and Mr. Spann indicated no action needed at this time.

60% RD

The discussion then moved to the 60% Off-Depot Groundwater RD. Mr. Nelson reported that he had received BCT comments on the 60% RD and that the response to comments was on schedule to be distributed to the BCT on 12 October 2006.

Mr. Nelson then moved the discussion to the ZVI PRB Implementation Study. He reported that Hayward Baker, Inc. (HBI) felt that the PRB installation method could be made to work with a few changes. He requested the team's input on whether the PRB was still a viable option.

Mr. Spann felt that the team should evaluate the alignment of the PRB and better understand the clay surface elevation as well as how thick a wall was needed. He indicated that Mr. Ballard had suggested using more iron, keying everything into the clay to allow for a sump to accept any drop of suspended formation material, establishing a top of clay upper wall elevation that allowed the installer to meet a minimum saturated thickness even if water never moved through some areas. Mr. Spann also mentioned Mr. Perlmutter's concern of the DO and ORP levels in

the area. Mr. Perlmutter responded that he needed to further evaluate DO and ORP levels at other PRBs and the affect on contamination degradation as it took time to flush out the system.

Mr. Dobbs asked if the team felt the need for the PRB. Mr. Holmes was not convinced that the PRB was necessary based on several issues. One, the plume did not appear to be moving. Two, if the plume was not moving much it did not make sense to install a PRB at the proposed location when treatment of down gradient contamination levels would also be necessary.

Mr. Holmes indicated that the team would have some additional data soon regarding the impact of the PRB on levels and that there may be resolution of the issues with the current PRB. And the top of clay elevation issue was not surprising. But, constructing the PRB means a large investment of funds and the issue of evaluating potential action down gradient had not been resolved. He felt that it did not make sense to continue with the 90% RD until the team could evaluate the information from the ZVI PRB Implementation Study TM.

Mr. Ballard asked how much data was enough to make a decision. He indicated that if as the lead agency DLA wanted to propose an amendment to the Dunn Field Record of Decision, then they should do so. Or, Mr. Dobbs should formulate a letter that showed good cause for an extension to submit the 90% Off-Depot Groundwater RD. Mr. Ballard indicated that if DLA requested a document submittal extension, then the team should allow sufficient time in the revised submittal schedule so as not to delay the document submittal again.

Mr. Perlmutter suggested that the team would like to evaluate some other possibly more aggressive remedies such as enhanced reductive degradation. Mr. Ballard indicated that if the team wanted the ZVI PRB Implementation Study TM to become the basis for a design change, then EPA must receive the TM by the 90% RD deliverable date with sufficient information that provided the basis for good cause. Mr. Ballard said he would probably have a technical reviewer evaluate the TM and, if they did not see sufficient cause to change the remedy, then he would have to say there was no need for a delay.

Wabash Avenue Investigation

Mr. Spann reported that TDEC was preparing a report based on their investigation eliminating Wabash as the source of the contamination moving onto the northeast corner of Dunn Field. The report would also propose other sources to investigate as part of this preliminary assessment/site investigation. He was unsure of a schedule to proceed with the investigation, but would keep Mr. Dobbs informed.

Main Installation Remedial Action (RA)

Mr. Holmes reported that e2M had installed all the injection and monitoring wells. The first round of injections occurred without difficulty and delivered the appropriate amount of sodium lactate. E2M had started the second round of injections and would finish injecting into the last remaining well during the BCT demonstrations.

He reported that e2M had collected baseline groundwater samples from the new wells and the sampling results indicated no real changes from previous sampling results in TTA-1 and TTA-2. e2M had installed the additional wells for the MW39 plume, but the data would not be available until November. e2M was currently preparing the RA construction report, which would become an appendix to the Main Installation Interim Remedial Action Completion Report. e2M would prepare a TM describing the newly installed wells.

Dunn Field Groundwater Interim Remedial Action (IRA)

Mr. Price presented information from the draft Semi-Annual IRA Status Report for the period of January through June 2006. He reported that the average monthly effluent discharge rate was 51.1 gallons per minute with a total effluent discharge of 13.3 million gallons. Based on concentrations in the effluent water, approximately 16.8 pounds of TCE and 39.7 pounds of total VOCs were removed during the reporting period.

Mr. Holmes reported that e2M was preparing to collect the next round of semi-annual samples. Mr. Holmes indicated that e2M would distribute to the BCT recommendations for monitoring wells in which he wanted to reduce the number of passive diffusion bags from two to one.

AI: E2M to distribute recommendations of which monitoring wells to reduce the number of passive diffusion bags.

Dunn Field Property Sale

Mr. Price reported that two bids received by the Corps of Engineers - Mobile were below market value and were not accepted. The Department of Army will now offer the property through the General Services Administration.

Mr. Ballard asked that Mr. Dobbs make sure that only the Finding of Suitability to Transfer 4 area was included in sale based upon John De Back's LUCIP comments regarding a discrepancy between the LUCIP figure and a figure showing the property for sale.

RAB Meeting and Partnering Session

Ms. McMath distributed the draft RAB agenda for the 19 October 2006 meeting and requested input from the team.

Ms. McMath reported that a partnering session was scheduled for 17-18 October 2006 at the Double Tree Hotel. If participants would like to stay at the Double Tree, then they should call the hotel directly to obtain the government rate as she had reserved a block of rooms at the government rate.

Mr. Ballard suggested that a partnering session agenda item should be to review certain sections of the Federal Facilities Agreement (FFA). Mr. Ballard will email the team and Frontline his recommendations and asked that everyone read the sections prior to the partnering session.

AI: Mr. Ballard to email team FFA partnering session recommendation and applicable sections to review prior to session.

Deliverables schedule

Mr. Nelson confirmed that CH2M Hill was on schedule to distribute the 90% Off-Depot Groundwater Design?

Next Meeting

Ms. McMath reported that the next project team meeting was scheduled for the afternoon of 16 October 2006. The next BCT meeting was scheduled for 19 October 2006 to be conducted in Memphis, TN.

MICHAEL DOBBS — DATE
Defense Distribution Center
BRAC Environmental Coordinator
BRAC Cleanup Team Member

10/19/06
TURPIN BALLARD — DATE
Environmental Protection Agency
Federal Facilities Branch
Remedial Project Manager
BRAC Cleanup Team Member

10/19/06
EVAN SPANN — DATE
Tennessee Department of Environment and Conservation
Memphis Field Office
Division of Remediation
BRAC Cleanup Team Member

FINAL PAGE

ADMINISTRATIVE RECORD

FINAL PAGE