Comments on
Panacea, Inc., 'Preliminary Fate and Transport Modeling – Final, Brown & Bryant Superfund Site, Arvin, CA,' Prepared for US Army Corps of Engineers, Los Angeles, CA, prepared by Panacea, Inc., LaMirada, CA, June (2004).

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Panacea, Inc. prepared its "Preliminary Fate and Transport Modeling – Final, Brown & Bryant Superfund Site, Arvin, CA," for the US Army Corps of Engineers, Los Angeles, CA, in June 2004. A copy of that report is available at:
http://yosemite.epa.gov/r9/sfund/r9sfdocw.nsf/3dc283e6c5d6056f88257426007417a2/11f476d4d68ae10d882579990001820d/$FILE/F&T%20-%20BB%20OU2%20-%20RIFS%209_05.pdf

The Executive Summary of that report states (page viii):
*"The purpose of this study is to assess and understand the fate and transport process of some of the chemicals of concern (COCs) in the vadose and saturated zones at the Brown & Bryant Superfund site (site). Based on analyses of existing borehole data, two conceptual hydrogeologic models were developed to simulate subsurface flow. This report describes the preliminary fate and transport modeling of seven COCs in the groundwater beneath the site that may be used to assess the potential risk of COCs reaching the City of Arvin water well supply."*

*Geology beneath the site is comprised of an alluvial deposit of alternating layers and mixtures of unconsolidated sands, silts, and clay. Soil underlying the site to a depth of 80 feet (24.4 m) generally consists of silty fine sand to fine sandy silt. Clean, well-graded sand lenses and thin seams of silty clay occur locally within these soils. The soils are thinly interbedded, with textural changes occurring every few vertical inches. These textural changes are also believed to occur laterally.*

*Due to varying conditions such as precipitation and soil properties that could affect the fate and transport of fluids and movement of chemicals into the groundwater, different assumptions and variables were used to develop the Alternative Conceptual Hydrogeologic Models 1 and 2. Based on these conceptual models, two numerical models were created using data from existing borehole logs, sampling data, and literature research. The main difference between the hydrogeological conceptual models is the northern extent of the existing clay layer in the saturated B-zone aquifer. In Conceptual Model 1, the saturated B-zone is assumed to consist entirely of sand. In Conceptual Model 2, the B-zone is assumed to consist of a continuous clay layer overlying the sand zone. Subsurface groundwater flow and the potential paths of the spread of the COCs were evaluated using the numerical models.*

*The preliminary fate and transport modeling results suggest that the COCs in the unsaturated zone persist longer than in the saturated zone. The conservative scenario modeling results show* *that transport of the COCs occurs primarily in the vertical direction in the unsaturated zone. This is despite the heterogeneous layering of the hydrogeologic units. Very little lateral flow and transport occurs in the unsaturated zone. In the saturated zone, flow and transport are mainly southwesterly toward the city well. This direction of flow and transport is partly due to assumptions made based on available information. These modeling results also show that the COCs in the saturated zone may persist for a maximum of 10 years in the absence of vertical leakage from the unsaturated zone. However, leakage from the unsaturated zone is predicted by these results to persist for more than 100 years. The concentrations of chemicals reaching the city well are estimated to be below their respective maximum contaminant levels (MCLs) with or without contribution from the unsaturated zone. This conclusion is reached based on several assumptions that should be validated by future investigations."*

Section 1.2 "Site Geology and Hydrogeology" states (page 2):
"*The site geology has been divided into two zones: the A-zone and the B-zone. The A-zone includes unsaturated soil to 65 to 75 feet (19.8 to 22.9 meters) below ground surface (bgs) and includes the first waterbearing unit, the A-zone groundwater. The depth to the saturated zone has varied between 65 and 85 feet (19.8 and 25.9 meters) bgs in recent groundwater depth measurements. The base of the A-zone is a thin sandy clay layer from 75 to 85 feet (22.9 to 25.9 meters) bgs. The clay layer and the A-zone groundwater occur beneath the entire site but disappear within 900 feet (274 m) south of the site.*

*The B-zone includes unsaturated soil beneath the A-zone and the second-lowest water-bearing unit (B-zone groundwater) at 150 to 165 feet (45.7 to 50.3 meters) bgs. The B-zone extends to at least 250 feet (76.2 m) bgs and ends at a clay layer known as the Corcoran Clay that confines the drinking water aquifer (the C-zone aquifer) beneath it. The thickness of this clay layer beneath the site is unknown. Specific data regarding the alluvial soil types within the B-zone were not encountered in previous reports prepared for the site or the adjoining properties. These materials probably comprise mixtures and layers of clay, silt, sand, and gravel.*

*Groundwater in the A-zone flows in a generally southerly direction, with some mounding of the water table observed extending south from the southwest corner of the site. The saturated thickness of the A-zone groundwater ranges from 0 to 10 feet (0 to 3.05 meters). The groundwater velocity in the A-zone has been estimated at 53 feet (16.2 m) per year. Slug test results suggest that a yield of less than 100 gallons (455 liters [1]) per day can be expected for wells in the A-zone. Aquifer testing of three of the onsite extraction wells showed a groundwater yield of approximately 1/4 gallon per minute (gpm) (1.14 l/min) (Morrison Knudson [MK], 1999b). It is the opinion of Panacea, Inc. (Panacea), however, that the wells tested were in a portion of the site that typically yields low water quantities. Wells south of the site, within the A-zone, have significantly greater yield.*

*The B-zone groundwater comprises a series of water-bearing units. All of the wells in the B-zone were installed in the water-bearing unit located at approximately 170 feet (51.8 m) bgs. The direction of flow in this unit is to the south, and the gradient is flat (0.0004). Permeabilities are much higher than for the A-zone groundwater. Past pump tests indicated that wells screened in the B-zone could be pumped at 7 gpm (MK, 1999b) for an extended period."*

Section 1.3 “Previous Agency Inspections and Findings” states (page 3):
*“Subsurface investigations conducted onsite to date (Panacea, 2002) have confirmed the presence of a number of potentially hazardous substances in the groundwater. Fifty-six organic compounds were found within the A-zone groundwater samples and 11 were found in the B-zone groundwater samples. The primary chemicals of concern (COCs) include:*

- *Chloroform;*
- *1,2-dibromo-3-chloropropane (DBCP);*
- *1,2-dichloropropane (1,2-DCP);*
- *1,3-dichloropropane (1,3-DCP);*
- *1,2,3-trichloropropane (1,2,3-TCP);*
- *Ethylene dibromide (EDB); and*
- *Dinoseb.*

*These chemicals were detected during the Operable Unit No. 1 (OU1) investigation. The contamination in the perched aquifer poses a potential threat to the underlying unconfined regional aquifer (B-zone) and the confined C-zone aquifer that is used for municipal drinking water. Public and private wells within 3 miles (4.8 km) of the site provide drinking water to 7,200 people and irrigate 19,600 acres (79.3 $km^2$) of cropland. City of Arvin Well #1 (Appendix A, A-5) is 1,500 feet (457 m) downgradient from the site (labeled as CW-1 in Figure 1-3). None of these supply wells are known to produce water from A- or B-zones.”*

No further mention seems to be made in the report of the other organic compounds found in the A-zone and B-zone groundwater, or the basis upon which the seven named chemicals were deemed to be the “primary” COCs worthy of mention. We have sent the following note to the US EPA B. Davila of the US EPA on March 29, 2012.
“*Bruni, As part of reviewing the Panacea report on transport and fate modeling we found the following statement on Page 3, paragraph 2:*
*“Subsurface investigations conducted onsite to date (Panacea, 2002) have confirmed the presence of a number of potentially hazardous substances in the groundwater. Fifty-six organic compounds were found within the A-zone groundwater samples and 11 were found in the B-zone groundwater samples*.”
The cited report is:
Panacea, Inc., 2002, Monitoring Well Installation Report, Draft, Operable Unit No. 2, Brown & Bryant Superfund Site, Arvin, California, prepared for U.S. Army Corps of Engineers, Los Angeles District, Los Angeles, California, dated October 2002.

“*We do not find that report to be available on the US EPA B&B Superfund site website. The potential for other COCs at the B&B site, in light of new/updated information is an important issue that we need to review; we would therefore like to receive a copy of the Panacea 2002 report referenced above.*

*Also, are there any other reports that contain data on the composition of the groundwaters in the A- and B- zones? If so, I would like to receive a copy of any reports and or data generated in the studies.”*

"*Based on new analytical data, more sensitive analytical procedures, and better understanding of the hazards of chemicals being developed, there is need to periodically (e.g., every five years) conduct a comprehensive analysis of groundwaters that have been polluted by the complex mixture of hazardous chemicals such as at the B&B Superfund site, using expanded analytical procedures.*

*What plans exist for conducting comprehensive analyses for organics in the A- and B-zones in the future to search for previously unrecognized hazardous chemicals in these waters, such as degradation products from the chemicals used at the B&B site?*

*Thanks for review of these issues*

*Fred"*

We will review the response to this note in a future CBA report.

Section 1.5 "Purpose and Scope" states (page 4):
"*This report present a summary of the technical approach and methodology used for developing alternative conceptual and numerical models for subsurface flow of fluids and transport of COCs at the site. Existing data from boreholes and wells were evaluated and analyzed to develop two alternative conceptual hydrogeologic models of the site. Several laboratory test results were analyzed to verify some of the calculated and assumed parameters for the simulations. This report presents the base-case conservative scenario and does not address sensitivity and uncertainty related to transport of the COCs.*

*The purpose of this preliminary phase of the fate and transport project was to evaluate possible mechanisms of transport of the COCs in the vadose and saturated zones at the site. Although one of the major concerns is to evaluate whether there is a potential for these COCs to enter the City of Arvin water supply well at concentrations above maximum contamination levels (MCLs), this preliminary analysis does not address this issue fully. The results of fate and transport analyses will ultimately be used in risk assessment to address the issue of potential risks to the city well. Risk assessment requires uncertainty and sensitivity analyses to evaluate ranges of potential attenuation of the COCs along their exposure pathways. This phase of the fate and transport analysis does not provide the uncertainty and sensitivity analyses to the extent that is needed for the risk assessment."*

The bulk of the Panacea report presents the approach that was used to develop a mathematical model to estimate the rate of transport of selected COCs found in the B&B site groundwater. The approach used is reasonable for making a preliminary assessment of the transport of the named COCs given the limited data available. As more information becomes available, it will be important to refine the modeling and substantiate the reliability of its output. We have discussed deficiencies and limitations for the protection of public health and welfare associated with the focus of evaluation and management on meeting MCL values for a selected group of COCs in other comments on the CBA website.

Section 6.0 "Summary and Tentative Conclusions" states (page 20):

*“Results of the preliminary conservative analyses indicate that the COC plumes in the unsaturated zone require between 20 and 40 years to arrive in the B-zone aquifer. Transport in the B-zone aquifer is relatively fast and, without a source, any existing plume would disappear in less than 10 years. However, the slowly moving unsaturated zone COCs’ contribution to the B-zone aquifer will continue to persist beyond 100 years, but at very low concentrations. For these preliminary analyses, none of the COCs appears to approach the MCL concentrations near the city well.”*

*“The preliminary fate and transport modeling results suggest that the COCs in the unsaturated zone persist longer than in the saturated zone. The conservative scenario modeling results show that transport of the COCs occurs primarily in the vertical direction in the unsaturated zone. This is despite the heterogeneous layering of the hydrogeologic units. Very little lateral flow and transport occurs in the unsaturated zone. In the saturated zone, flow and transport are mainly southwesterly toward the city well. This direction of flow and transport is partly due to the assumptions made based on the available information. These results also show that the COCs in the saturated zone will persist for a maximum of 10 years in the absence of vertical leakage from unsaturated zone. However, leakage from the unsaturated zone persists for more than 100 years. Concentrations of the chemicals reaching the city well are estimated to be below their MCL with or without contribution from the unsaturated zone. This conclusion is reached by several assumptions that should be validated by future investigations. The limited scope of this fate and transport modeling did not allow considering the impact of the presence of the by-product of degradation of the COCs in these simulations and need to be addressed in future analyses.”*

This modeling provided the basis for the overall approach that was adopted by the US EPA of focusing the OU-2 remediation on removing the COCs in the A-zone and using MNA as the remediation approach for the B-zone aquifer once the A-zone source of the COCs has been largely controlled/eliminated. The groundwater concentrations of COCs in the A- and B-zones during the MNA will show whether the assumptions that were used in this modeling effort were reliable.