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PROJECT REVIEW COMMENTS TO DRAFT FINAL REMEDIAL INVESTIGATION REPORT SITE 13 NAS PENSACOLA FL

3/22/1994

PROJECT REVIEW COMMENTS
NAS PENSACOLA OPERABLE UNIT 10 AND SITE 13
REMEDIAL INVESTIGATION REPORT (DRAFT FINAL, NOVEMBER 1993)
CONTRACT TASK ORDER NO. 048, CONTRACT NO. N62467-89-D-0318
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1. Par. 5.4.1, pg. 5-27. The top paragraph indicates that the selected screen slot size and gravel pack for monitoring wells were determined to be suitable for the site soil based on grain-size analyses included in Appendix F. However, no gradations in Appendix F appear to correspond to the depths of formation soils surrounding the screened intervals of the monitoring wells. The difficulty in properly developing wells 33G16 and 33G17, which as noted on page 5-29 still yielded a high concentration of fine grained material, may be attributable to an improperly sized gravel filter pack and screen slot size.

Recommend on future well installations, grain size analyses be performed on samples from the depths of formation soils where the well screens will actually be located and gravel pack and screen slot sizes be designed based on pertinent filter and drainage criteria.

2. Par. 6.3.1, pg. 6-7. The discrepancies noted in this paragraph appear to be indicative of the complicated nature of salt water intrusion geohydrology. The following is an attempt to offer some insight into some of the possible geohydrological factors that may be influencing the response of the piezometric surfaces to the tide fluctuations.

The last paragraph states water levels in shallow and intermediate wells in the interior portion of the peninsula actually dropped during the time the tide was rising from low to high tide, whereas the water level rose in wells near the beach. This drop in water table at the interior wells is in fact the expected response to a rise in the salt water wedge elevation beneath the fresh water aquifer. Because of water density differences and other parameters, the geohydrology of salt water intrusion yields the general approximation of the elevation of the salt water interface to be 40 feet below a point at sea level for each one foot of fresh water piezometric head above sea level. Thus for every 1-foot rise in the elevation of the salt water wedge, a 1/40-foot drop in the fresh water piezometric head would be expected.

Theoretically, the water level in the wells near the beach should have also fallen in response to a rising salt water interface. The fact that the drop in water level near the beach did not occur at the same time as that in the interior might be explained by the water level in the shallow and intermediate wells experiencing a significant lag from the tide changes in the bay, i.e., the drop in water level in the interior wells may actually be in response to an earlier high tide cycle and the rise at wells near the beach may be in response to a previous low tide. The significant lags may be due to a combination of the distance from the bay, relatively low permeability of the intermediate zone, and the effective hydraulic separation of the shallow and intermediate zones from the primary salt water wedge located beneath the low permeability clay zone. The actual pattern of response of water level in different areas of the site to tide fluctuations could probably be determined by examining the continuous water level measurements for the 24-hour period at representative wells.

The relatively small variance in elevation in the interior shallow and intermediate wells as compared to the wells near the beach is probably because 1) the secondary salt water wedge that exists above the clay zone may not extend very far inland because of the small thickness of the aquifer above the clay and the relatively low permeability in the intermediate zone, and 2) the interface curving upward toward the bay would result in higher variation in the height of the salt water interface as the tide fluctuates.

Similarly, the greater increase in water levels in the deep wells even in the center of the peninsula, as noted on page 6-12, is likely due to the direct hydraulic connection with the underlying primary salt water wedge through the higher permeability soils of the deep zone, or "main producing zone", beneath the clay layer and the length of the wedge into the interior. This primary salt water wedge would extend farther inland than the shallower secondary wedge because the aquifer below the clay is much thicker and has a greater hydraulic conductivity.

Recommend the effects of tidal influence and the upconing response of the salt water interfaces to pumping stresses be considered in any future groundwater modeling efforts to upgrade and expand the recovery well system.

3. Par. 6.3.2, pg. 6-13. The last paragraph indicates during the RI discrepancies were discovered in elevations previously established for top of existing well casings. Consequently, all wells were resurveyed to the same datum. For your information, Tom Sailors and I have arranged for the A/E performing RCRA quarterly groundwater level monitoring in this area to begin using these newly established top of well casing elevations for determining groundwater elevations. The first RCRA monitoring event with the revised elevations should occur in April 1994.

Likewise, beginning with the April monitoring event, the twenty monitoring wells installed during the RI will also be measured for groundwater level by the RCRA contractor to yield more accurate plots of piezometric surfaces for the three aquifer zones. To minimize the effects of tidal influences, the future quarterly groundwater level measurements will be limited to an 8-hour period centered on the occurrence of high or low groundwater levels based on the average 4 hours and 40 minutes lag from published tide values for Warrington, Florida, as noted in paragraph 6.3.1.

These improvements to the RCRA groundwater monitoring program should also provide a more useful database for any future ground water modeling and risk assessments during the completion of the RI/FS and the remedial design.

4. Figures 6-11, 6-12, and 6-13. These figures should be noted to indicate they depict piezometric surfaces measured while the recovery wells were operating. The recovery wells actually in operation should be identified and shown on the drawings to facilitate a review of their individual and combined effects on the water level and their ability to contain the contaminant plumes.

According to reports submitted by Rust Environmental, the RCRA contractor, RW-1 and RW-3 have not been in operation since Rust began O&M work on the recovery well system in September 1993. Based on the location of groundwater contamination, RW-3 should apparently be pumping instead of RW-2. On 21 March 1994, Rust was instructed to adjust valves to pump from RW-3 instead of RW-2.

The wells actually pumping during the RI should be clarified to permit proper analysis of the effects of the recovery well system.

5. Par. 6.3.2, pg. 6-23. The list of possible reasons for discrepancies between piezometric surface maps illustrated in this report and similar maps from previous RCRA reports should include the fact that maps produced in the various RCRA reports were probably based on water levels measured while the recovery well system was in operation. Likewise, the past operation and pumping rates of the recovery well system have not been consistent, eg, RW-1, RW-2, and RW-3 have not been operated continuously as noted in comment no.4 above, and original pumps throughout the system have been replaced with smaller capacity pumps to minimize cycling frequency.

6. Par. 6.3.2, pg. 6-24 and Figure 6-12. The extent of the capture zone for RW-7 as described and illustrated appears to be greatly over estimated. Based on the low hydraulic conductivity of the intermediate zone, the relatively large drawdown, and small well yield, rough calculations indicate the radius of influence of RW-7 is only about 100 feet instead of the approximately 500 feet shown in Figure 6-12.

As stated on page 6-36 and shown in Table 6-8, the drawdown in observation wells surrounding RW-7 during the aquifer pumping tests was so slight that the observation well drawdowns could not reliably be used to determine the aquifer properties. The slightly lower elevations observed in monitoring wells 33G09, 33G10, and 33G11 during the 4/22/93 measurement period when the recovery wells were pumping as compared to elevations during the 2/18/93 measurement period when they were not pumping is, therefore, apparently not due to the effects of pumping RW-7 but instead may likely be due to seasonal variations in water level as a result of infiltration and aquifer recharge.

Recommend piezometric surfaces illustrated on Figure 6-12 be reevaluated using simple analytical or modeling techniques based on the known aquifer properties and well pumping rates and drawdowns. Historical biweekly data for the well pumping rates and drawdowns is available from SouthDIV if needed.

Currently, RW-7 is only yielding 2 to 2.5 gpm with a drawdown of about 23 feet. The low well yield and relatively high drawdown (low specific capacity) is indicative of the low hydraulic conductivity in the intermediate zone in this area. The radius of influence of the well and consequently the effectiveness of the well in remediating the intermediate zone therefore appear to be relatively insignificant. Although the drawdown at the well is relatively high, the drawdown effect decreases rapidly with distance from the well as evidenced by the slight drawdown at GM-64 nearby to RW-7. As stated on page 3-9, previous studies have also concluded that the recovery system is having little or no effect since well discharge rates have decreased in recent years.

7. Par. 7.1.1, pg. 7-11. In the last paragraph, the 2.41 ppm cadmium concentration stated for boring 33S57 should apparently be listed as 241 ppm according to Figure 7-4 and Appendix L.

8. Par. 7-4, pg. 7-57. This paragraph states that contouring of contaminant plumes was not performed because of inconsistencies with contaminant concentration data trends over time. However, this report apparently contains no graphical representations of data, which are an effective tool to evaluate whether any trends or relationships between wells or aquifer zones actually exist.

Time series graphs of concentrations for contaminants of primary concern for effected wells often yield insight into the migration of the plume(s) and the effectiveness of the recovery well system when compared with similar graphs for surrounding wells, their spatial relationship to the recovery wells, and the expected migration based on the groundwater gradients.

Likewise, the limited data available from the relatively few sampling points can often be contoured even though consistent trends are not readily apparent. Techniques such as geostatistical methods can be used to develop a statistical model, or variogram, of the data to generate estimated values at a defined grid spacing. These estimated values can then be plotted with any contouring software, eg, "Surfer". Such contour plots can be prepared for subsequent sampling events and compared to also evaluate the migration of the plume(s) and the effectiveness of the recovery wells in capturing the plume.

The Geostatistical Environmental Assessment Software, GEO-EAS, available from EPA is a good tool for performing such geostatistical analysis of data. GEO-EAS will also yield a contour map of the standard deviation of the estimated values. The standard deviation contour plot can then be evaluated to determine if the degree of accuracy is adequate and where the estimated values are least accurate in order to optimize the location of additional sampling points, or monitoring wells, if necessary.

Recommend graphical representations of data and techniques such as geostatistics be used on future studies to facilitate analysis of data, to provide contours of the plume(s) with an indication of the degree of accuracy of the estimated plume concentration contour values, and to be able to optimize the location of any future sampling points or wells required.

9. Par. 7.4.1, pg.7-72. This paragraph and several other paragraphs throughout the report, eg, page 2-20, page 6-24, and page 11-7, indicate the recovery system is removing relatively little water from the shallow zone as compared to the intermediate zone because the wells are screened in the intermediate zone. The report also indicates that the shallow zone is now relatively clean as compared to the intermediate zone. Some additional factors that should be considered in interpreting the effectiveness of the recovery system and the migration of contaminants include the following:

a. As described on page 2-17 although the wells are screened in the intermediate zone, the gravel pack surrounding the screens extends up through the shallow zone to the top of the water table. Normally, vertical flow through the gravel pack to the screens would be insignificant compared to radial flow from the formation surrounding the screens. However, in this case the hydraulic conductivity of the intermediate zone is one to two orders of magnitude less than that of the overlying shallow zone, as shown on page 6-32, and much less than that of the gravel pack.

For example, rough calculations based on well and aquifer parameters at RW-7 using methods referenced on page 444 of "Groundwater and Wells" (Driscoll) indicate nearly all of the flow at RW-7 could possibly be attributed to vertical flow through the gravel pack from the shallow zone. In other words, even though the wells are screened in the intermediate zone, a significant portion of the flow may in fact come from the shallow zone because the permeability of the intermediate zone is so low.

b. The shallow zone may be relatively clean compared to the underlying intermediate zone because many of the contaminants found remaining in the intermediate zone (reference Section 7 of RI report) appear to be dense non-aqueous phase liquids (DNAPLs). These DNAPLs which are relatively insoluble and denser than water would tend to sink from the shallow zone and accumulate in the intermediate zone above the confining clay layer. The downward migration of contaminants from the shallow to the intermediate zone may be equally or more attributable to the density and insolubility of the DNAPLs than to the vertical hydraulic gradients noted on pages 7-92 and 9-4.

Relatively soluble and or less dense contaminants in the shallow zone, on the other hand, may have been largely flushed from the shallow zone at the site by the induced well flow when well yields were significantly higher during the early years of the recovery system operation or, now more likely, by flow to the bay under the natural hydraulic gradient through the relatively pervious sand in the shallow zone. The groundwater velocities shown in Table 6-9 indicates groundwater will flow (and contaminants flush) toward the bay one to two orders of magnitude faster in the shallow zone than in the intermediate zone.

The DNAPLs in the intermediate zone may also flow in a direction different from the groundwater flow whether groundwater flow is from a natural or well induced hydraulic gradient. DNAPLs reaching the bottom of the aquifer would tend to flow along the top of the confining layer in the direction the confining layer slopes. The DNAPLs would tend to mound in depressions or low areas of the top of the confining layer.

Figure 6-2 illustrates the slope of the clay confining layer appears to be relatively flat or slightly downward sloping to the north and east in the central area of the site but begins to slope upward on the north and east sides of the site. In this case DNAPLs may tend to pool or mound along the interface where the clay layer begins to slope upward. The increasing concentrations of some contaminants downgradient on the east side of the site, as noted on page 7-90, could possibly be indicative of DNAPLs mounding along this slope interface before reaching the bay. The lack of influence of two recovery wells on the eastward migration of the contaminants as noted on page 9-4 may be indicative of the DNAPLs flowing along the top of the confining layer and the difficulty of removing DNAPLs with recovery well systems.

Consequently, recommend the migration of DNAPLs and the difficulties of removing DNAPLs with pumping systems because of limitations involving liquid partitioning and dissolution rates, sorption to soil particles, and low hydraulic conductivity of the intermediate zone be fully considered when performing groundwater and contaminant transport modeling to design an upgraded recovery well system during the remediation design phase.

10. Appendix G. The groundwater table elevations and their relationship to screened intervals should be shown on the monitoring well construction logs. Appendix G should also include the well development records for each well.