UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

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February 20, 1996

Certified Mail - Return Receipt Requested Z 698 454 901

Mr. Richard D. Mico
Sparton Technology, Inc.
Vice President and General Manager
4901 Rockaway Blvd., SE
Rio Rancho, New Mexico 87124

Dear Mr. Mico:

The U.S. Environmental Protection Agency (EPA) is responding to the letter and enclosure dated November 6, 1995, from James B. Harris for Sparton Technology, Inc. ("Sparton"). EPA is concerned that Sparton continues to believe that no further remedial action is necessary for the ground water contaminant plume. As outlined in EPA's enclosed response, Sparton has yet to provide information which demonstrates that current migration of the contaminant plume is diffusion-dominated or that restoration of the ground water to its beneficial use or an engineered containment system is technically impracticable. As further discussed in EPA's response, Sparton has not provided information which demonstrates that the contaminant plume originating from the Sparton Coors Road facility does not threaten existing public water supply wells, or that the aquifer impacted by the plume will not be used for future water supply wells. For your reference, I have enclosed a letter from Norman Gaume of the City of Albuquerque addressing issues related to utilization of the contaminated aquifer as a future drinking water source.

Prolonged delays in addressing these problems makes an effective remediation more difficult and expensive as the contamination continues to spread. EPA will continue to work with the City of Albuquerque and State of New Mexico to ensure that this environmental problem is addressed appropriately. Therefore, in light of the environmental situation at the Sparton facility, EPA is committed to taking the necessary steps to achieve an expeditious determination of the appropriate remedy.

OGC-000360

GWB-00432-SPARTON

If you are interested in discussing these technical issues further, please contact Ronnie Crossland at (214) 665-6480 or Vincent Malott at (214) 665-8313.

Sincerely yours,

Desi

Desi A. Crouther, Chief
Hazardous Waste Enforcement Branch

Enclosures

cc (w/ enclosures):

Mr. Ron Kern, HRMB, New Mexico Environment Department
Mr. Dennis McQuillan, GWPRB, New Mexico Environment Department
Mr. Steve Cary, New Mexico Office of Natural Resources Trustee
Mr. Norman Gaume, Albuquerque Public Works Department
Mr. Kurt Montman, Albuquerque Environmental Health Department
Mr. Jan Appel, Sparton Corporation
Mr. James Harris, Thompson & Knight

ENCLOSURE NO. 1
EPA RESPONSE TO SPARTON'S COMMENTS OF NOVEMBER 6, 1995

The U.S. Environmental Protection Agency ("EPA") is responding to issues raised in the letter dated November 6, 1995, from James B. Harris for Sparton Technology, Inc. ("Sparton"). EPA understands from the response that Sparton believes no further remedial action is necessary for the ground water contaminant plume. Sparton's belief is apparently based on interpretations of the existing data and the results of a study completed for the City of Albuquerque in the Albuquerque Water Resources Management Strategy, San Juan-Chama Diversion Project Options, July 1995 ("Water Management Options Study") and the Ground-Water Protection Policy and Action Plan adopted by the Bernalillo Board of County Commissioners in November 1993, and the Albuquerque City Council in August 1994.

Sparton also appears to have misinterpreted the objectives of the future remedial action at the site by excluding the future completion of public water supply wells in or near the contaminated ground water. Installation of public water supply wells is directly related to the future beneficial use of the contaminated aquifer. These objectives were previously outlined in EPA's letter dated October 3, 1995, to Mr. Richard D. Mico of Sparton. As discussed in the following responses to Sparton's arguments, EPA believes that the contaminant plume originating from the Sparton Coors Road facility remains a principal threat requiring both active containment and restoration to beneficial uses.

1. **EPA is mistaken about the value and use of the ground water impacted by Sparton's operations.**

   a. In the Albuquerque area the sole-source of drinking water is not a regional aquifer.

      Citing the study, Albuquerque Water Resources Management Strategy, San Juan - Chama Diversion Project Options, July 1995 ("Water Management Options Study"), Sparton has called attention to the various options for supplying drinking water to the City of Albuquerque. Specifically, Sparton contends that ground water is not the sole source of drinking water for the Albuquerque area. EPA does not concur with this statement for the following reasons: 1) As noted in Appendix B of the Water Management Options Study (page B-4), "[c]urrently, ground water supplies all of the City's potable water deliveries to its customers" and "[t]he aquifer is the sole source of drinking water for all communities in the Middle Rio Grande Basin, including Albuquerque, and is an economical source of supply."

As pointed out in the Water Management Options Study, ground water is currently the sole source of drinking water and will remain so until other alternatives are implemented; therefore, ground water is the sole source of drinking water in the Albuquerque area; and 2) As pointed out in the Executive Summary of the Water Management Options Study (page 5), "[s]ole reliance on local ground water is not a viable long-term strategy for the City." However, should other alternatives be developed for the supply of drinking water, ground water will not diminish in importance as one of those sources according to the Water Management Options Study (page 9 of the Executive Summary); therefore, the available information indicates that ground water will continue to be an integral part of the drinking water supply for the City of Albuquerque. Only the presence and continued migration of the Sparton contaminant plume will prevent future utilization of the ground water in meeting these long-term needs for drinking water.

b. Public water supply wells are not threatened by the Sparton Plume.

Sparton contends that the plume movement and contaminant concentrations do not pose a threat to the existing water supply wells. However, Sparton has provided no quantitative analysis to demonstrate that the plume will not impact the existing water supply wells at concentrations above acceptable media standards. The media standards applicable to the aquifer are based upon the more stringent of either: 1) the Maximum Contaminant Levels (MCLs) for drinking water established under the Safe Drinking Water Act; or 2) the maximum allowable contaminant concentrations in ground water set by the State of New Mexico Water Quality Control Commission (WQCC). Certainly, there has been no convincing demonstration that degradation will materially reduce off-site contaminant levels to acceptable levels. Therefore, EPA does not concur with Sparton's statement that public water supply wells are not threatened by the Sparton plume.

c. No public water supply wells are planned for development within two miles of the Sparton Plume.

Sparton has provided numerous statements in an attempt to justify why the aquifer will not be utilized for drinking water in the area of the Sparton plume. Specifically, Sparton contends that the Critical Management Areas (CMAs) proposed by the State Engineers

Office (SEO) would prevent well development west of the Rio Grande and in the area of the Sparton Coors Road facility. However, the Sparton Coors Road facility and contaminant plume is located northeast of the CMA proposed for the area west of the Rio Grande (see Figure 1 attached to the City of Albuquerque letter dated December 5, 1995). Therefore, there is no obvious restriction from the proposed CMA on future well development in the area of the Sparton facility.

Sparton also contends that arsenic is a specific example of why ground water will not be developed in the area of the Sparton facility. However, a review of arsenic concentrations from the analytical data in the RFI Report indicates that eight of the eleven wells with arsenic concentrations above 5 ppb are located on-site near the original source of the release. Arsenic concentrations in these eight wells range from 6-8 ppb and appear to correspond to areas of high chlorinated solvent concentrations. Of the remaining three wells located off-site, one well had an arsenic concentration of 11 ppb and a corresponding trichloroethylene concentration of 2,000 ppb. The remaining two wells had arsenic concentrations in the range of 6 ppb. The presence of arsenic above 5 ppb appears to be associated with the original release of chlorinated solvents. Therefore, the aquifer appears to be quite suitable as a source of drinking water, even if the arsenic standard is lowered from the present standard of 50 ppb.

Citing the Water Management Options Study, Sparton contends that if future public water supply wells are completed at all, they will be "somewhere near the river where a good hydrologic connection between the river and the aquifer exists" (page B-46 of the Water Management Options Study). However, in Appendix B of the Water Management Options Study, the installation of a wellfield near the river is one alternative in meeting future demands, not a restriction on installation of wells in other areas of the basin. Therefore, there is no apparent restriction or supporting rationale listed in the Water Management Options Study which precludes future well development in the area of the Sparton facility. The most apparent reason for not developing the aquifer as a water supply, is the continued presence and unrestricted migration of the Sparton plume in the ground water.

d. Alternative existing renewable water resources are already available to the city.

Once again, Sparton has provided numerous statements in an attempt to justify why the aquifer will not be utilized for drinking water in the area of the Sparton plume. More specifically, Sparton has called attention to the use of water conservation and alternative water resources, such as treated wastewater effluent and San Juan-Chama water, in an attempt to diminish the value and use of the ground water impacted by the Sparton plume. EPA acknowledges that the use of alternative water supplies can be an important component during implementation of a remedy and, where necessary, as a component of a completed remedy. However, an alternative water supply is not a substitute for active response measures (e.g., treatment and/or engineered containment) as the sole remedy unless such active measures are determined not to be practicable. Sparton has failed to demonstrate that restoration of the ground water to its beneficial use or an engineered containment system is technically impracticable (see OSWER Directive 9234.2-25 Guidance for Evaluating the Technical Impracticability of Groundwater Restoration).

e. The Sparton Plume is not a crucial source of drinking water.

EPA's comments were not intended to imply that the Water Management Options Study alone designates the ground water as crucial for ground water quality protection. Rather, contrary to Sparton's belief, the Water Management Options Study does make clear that ground water will not diminish in importance as a future source of drinking water, even if other alternatives are implemented to meet the long-term drinking water needs (page 9 of Executive Summary). As pointed out in the previous discussions, there appears to be no apparent restriction or supporting rationale which would prevent future development of the aquifer in the vicinity of the Sparton facility as a drinking water supply. The most apparent reason for not developing the aquifer as a water supply, is the continued presence and migration of the Sparton plume in the ground water.

2. **EPA's perception of the importance of the Sparton Plume as a drinking water resource overlooks significant concentrations of naturally occurring arsenic.**

Sparton contends that the concentration of arsenic in the ground water combined with an arsenic standard that may be lowered under the Safe Drinking Water Act will prevent future utilization of the contaminated aquifer as a source of drinking water. A review of arsenic concentrations from the analytical data in the RFI Report indicates that eight of the eleven wells with arsenic concentrations above 5 ppb are located on-site. Arsenic concentrations in these eight wells range from 6-8 ppb and appear to correspond to areas of high chlorinated solvent concentrations. Of the remaining three wells located off-site, one well had an arsenic concentration of 11 ppb and a corresponding trichloroethylene concentration of 2,000 ppb. The remaining two wells had arsenic concentrations in the range of 6 ppb. The presence of arsenic above 5 ppb appears to correspond to the existing release of chlorinated solvents and may represent arsenic associated with the existing release. Therefore, the aquifer appears to be quite suitable as a source of drinking water, even if the arsenic standard is lowered from the present standard of 50 ppb.

Sparton also contends that wellhead treatment is an option for consideration in preventing exposure to contaminants should water supply wells be completed in the area of the contaminant plume. Sparton, however, has not presented an evaluation of wellhead treatment in association with public or private water supply wells as a corrective measure alternative. If Sparton is seriously considering proposing this technology as another corrective measure alternative for review and consideration, then this alternative should be presented in the CMS Report with all relevant and supporting data, including input from the City of Albuquerque on acceptance of such a project.

3. **EPA has overlooked institutional controls that should prevent the completion of drinking water wells in the Sparton Plume.**

Citing 20 NMAC 7.1 Subpart I § 109(C)(1)-(2), Sparton has called attention to the use of institutional controls to prevent or limit exposure to contaminants in the Sparton plume. EPA acknowledges that institutional controls are an important component during implementation of a remedy and, where necessary, as a component of a completed remedy. Institutional controls, however, are not a substitute for active response measures (e.g., treatment and/or engineered containment) as the sole remedy unless such active measures are determined not to be practicable. Sparton has failed to demonstrate that restoration of the ground water to its beneficial use or an engineered containment system is technically impracticable (see OSWER Directive 9234.2-25 Guidance for Evaluating the Technical Impracticability of Groundwater Restoration).

4. **By misunderstanding the available data, EPA incorrectly calculated the rate of plume movement and mistakenly concluded the dominant transport mechanism is advection.**

Sparton contends that EPA incorrectly calculated the rate of plume movement based on ground water velocity calculations. Sparton supplied calculations demonstrating that the ground water velocity decreased from a high of 195 to 456 feet/year on-site at the Facility to a low of 20 to 94 feet/year near the leading of the contaminant plume. Sparton's calculations are directly opposite those supplied by EPA in a letter dated October 3, 1995. EPA's calculations demonstrated that the ground water velocity increased from a low of 12 to 18 feet/year on-site at the Facility to a high of 39 to 134 feet/year near the leading edge of the contaminant plume. Reliable estimates of ground water flow velocities are dependent on accurate measurement of hydraulic conductivity. Unfortunately, interpretation of pumping test data from the upper flow zone has been difficult, and no hydraulic conductivity data has been obtained by Sparton for the off-site area. Consequently, a precise determination of ground water flow velocities is difficult at the Sparton site.

The principal difference between the EPA and Sparton ground water velocity calculations lies in the values used for hydraulic conductivity (K). Sparton utilized a constant hydraulic conductivity range of 21.4 to 31.2 ft/day for all flow zones (upper, upper-lower, lower-lower) in both the on-site and off-site portions of the aquifer. This hydraulic conductivity range was generated from an aquifer test conducted on-site at the Facility with wells screened in all three flow zones. However, the on-site geologic characteristics of the upper flow zone are much different than those found in the upper-lower and lower-lower flow zones. This difference is demonstrated in the range of hydraulic conductivity values (0.1 to 7.2 ft/day) supplied by Sparton in the draft and revised versions of the Report on the Effectiveness of the Groundwater Recovery Well System. The individual hydraulic conductivity values were generated from recent analysis of pumping test data from upper flow zone wells provided in support of the draft Report on the Effectiveness of the Groundwater Recovery Well System and are significantly lower than those reported in the RFI Report. The individual hydraulic conductivity values differ significantly from those now being used by Sparton when calculating the ground water velocity in the on-site portion of the upper flow zone aquifer. In addition, the on-site geologic characteristics of the upper-lower and lower-lower flow zones more closely resemble those found in the off-site upper, upper-lower, and lower-lower flow zones in the aquifer. Sparton apparently believes a single hydraulic conductivity range is the most appropriate value when calculating ground water velocity in the on-site upper flow zone.

EPA utilized a more representative hydraulic conductivity value of 2.1 ft/day for the upper flow zone in the on-site portion of the aquifer. This hydraulic conductivity value (2.1 ft/day) is an average based on the eight separate hydraulic conductivity values supplied by Sparton in the draft and revised versions of the Report on the Effectiveness of the Groundwater Recovery Well System. The average and individual hydraulic conductivity values differ significantly from those now being used by Sparton when calculating the ground water velocity in the on-site portion of the upper flow zone aquifer. Unfortunately, no hydraulic conductivity data has been obtained by Sparton for the off-site area. Therefore, EPA continued to use the range of hydraulic conductivity values provided in the RFI report for the off-site areas since no other values are available and the geologic characteristics of the upper-lower and lower-lower flow zones more closely resemble those found in the upper, upper-lower, and lower-lower flow zones in the off-site aquifer. Therefore, EPA does not agree that the ground water velocity supplied by Sparton is representative for the on-site upper flow zone.

EPA certainly agrees that the ground water gradients in the upper flow zone are steeper in the immediate area of the facility than in the downgradient areas of the contaminant plume. However, these steep gradients only persist for a short distance relative to the total migration distance of the contaminant plume, and smaller gradients more typical of those found throughout the plume begin to be established quickly before the plume leaves the Sparton facility. Sparton should also note that the differences in gradients observed in the upper flow zone are much less pronounced in the upper-lower and lower-lower flow zones. As recent analytical data have indicated, it is becoming increasingly clear that significant contaminant migration has occurred in these flow zones and that contamination has already reached beyond well 55 in the lower flow zones. Thus, based only on the similarity of gradients throughout much of the plume, the average migration rate calculated using the total length of the plume and estimates of the time since the initial release occurred should provide an estimate of migration rates in the downgradient portions of the plume. As EPA indicated in its October 3, 1995, CMS comments, these calculations indicate a migration rate of approximately 100 feet/year. However, it is important to reemphasize that this estimate does not account for any potential variabilities in hydraulic conductivity that may occur spatially along the migration pathway. Although ground water gradients may be similar throughout the plume, increased hydraulic conductivities in the downgradient portions of the plume could lead to higher migration rates in these portions of the plume than indicated by the average plume migration rate.

The approximate rate of 100 feet/year is not an estimate of the ground water flow velocity but rather is actually an estimate of the migration rate including all effects of dispersion, retardation and attenuation. Based on the estimates of ground water velocity in the downgradient portion of the plume provided by Sparton in its response comments (20-94 feet/year), no significant effects of retardation are apparent.

In the absence of actual hydraulic conductivity measurements in the downgradient portion of the plume, EPA has to rely on the empirical indications of migration and ground water flow rates that are available. The increases in concentrations observed since 1991 in the monitoring wells located at the downgradient edge are strongly indicative of significant contaminant migration. While contouring based on the limited data available is certainly not precise, these data and the resulting contouring do indicate that the downgradient edge of this plume is migrating at a rate of at least 100 feet/year and perhaps as fast as 300 feet/year. Groundwater flow rates of 100 feet/year or more are certainly reasonable when considering the gradients and the potential hydraulic conductivities of the sandy gravels that are present in the downgradient area of the plume. Such flow rates are even consistent with the upper range (94 feet/year) of those calculated by Sparton for the west end of the plume. However, the computation of flow rates provided by Sparton for the area near MW-61 appears to significantly underestimate the gradient. Water level contouring provided by Sparton for 1993 data clearly indicate that a gradient of .003 is much more appropriate than .001 used by Sparton. Using the larger gradient, the upper range of the ground water flow rate estimates is 134 feet/year.

Sparton has also contended that migration in the plume is diffusion- rather than advection-dominated. Sparton has cited the ratio of the length to the width of the plume in the various flow zones in support of this contention. Ratios of 10 to 1 are cited as characteristic of advection dominated flow. However, no basis for this particular ratio has been provided by Sparton. The ratio of the length to the width of a contaminant plume is dependent on a number of factors, including the size and shape of the original source area and changes in flow patterns. The size and shape of the original source area is certainly of primary importance in determining this ratio. Although the ponds and sump that acted as the original source at the Sparton site were of limited size, significant spreading of the dense non-aqueous phase liquid ("DNAPL") undoubtedly occurred as it migrated downward and initially encountered the clayey layer present in the vadose and subsequently encountered the water table and underlying zone of reduced permeability that is present beneath the site. Once present in the saturated zone, contaminants are subject to spreading by the prevailing patterns of ground water flow.

As documented in the RFI report, significant changes in flow patterns occur seasonally at the Sparton site. As shown in Figures 25 and 26 of the RFI report, ground water flow is in a predominately southwest direction during the period of highest seasonal water levels. However, during the period of lowest seasonal water levels, water level contours are convex indicating a diffuse flow pattern in the potential source area with flow directions ranging from southwest to southeast. These widely varying flow directions are also likely to have significantly spread the contaminants laterally in the upgradient areas of the plume. It must also be noted that the predominant flow direction depicted in the RFI report for the Sparton facility, itself, is oblique to the westerly direction ultimately taken by the contaminant plume. This initial direction of contaminants migrating from the site would also have increased the lateral dimensions of the plume relative to the longitudinal axis ultimately established in the plume. Due to these various factors that undoubtedly led to significant spreading of the contaminants in the upgradient area of the plume, analysis of the ratio of the plume's dimensions has little value in determining if the plume is diffusion dominated.

Sparton has also cited the logarithmic drop off in TCE concentration at the leading edge of the plume in monitoring wells 48, 58, and 52 as another confirmation of migration by diffusion. Sparton has stated that this characteristic is found in diffusion-dominated transport. However, such contaminant distributions are also highly characteristic of the effects of hydrodynamic dispersion and are generally found along the leading edge of plumes clearly migrating by advection. In fact, when mathematically modeling contaminant transport in ground water, hydrodynamic dispersion and diffusion are generally treated in exactly the same manner. Thus, the logarithmic drop off in contaminants observed at the leading edge of the off-site plume provides no clear indication of diffusion and is much more likely the result of hydrodynamic dispersion.

The potential impact of diffusion on contaminant migration at the Sparton site can best be evaluated using the analytical solution to the equation that governs mass transport by diffusion in liquid. This equation is known as Fick's Second Law, and the solution to that equation has been provided in the text, Groundwater (Freeze and Cherry, 1979). The following equation describing the distribution of contaminants resulting from a diffusive flux is provided in that text (page 104):

$$C_i\ (x,t) = C_o\ \mathrm{erfc}(x/2\sqrt{(D^*t)}),$$

where C_o is the contaminant concentration of the source, C_i is the contaminant concentration at distance x from the source at time t, D^* is the apparent diffusion coefficient, and erfc is the complimentary error function.

Freeze and Cherry have discussed potential diffusion coefficient for non-reactive chemical species in porous media (page 393). Using this equation, an apparent diffusion coefficient of 5×10^{-10} meters^2/second, which according to Freeze and Cherry is a reasonable estimate for coarse grained unconsolidated materials, and a source concentration 25 mg/ℓ (ppm), computations indicate that at the end of 25 years, concentrations would decrease to less than 1.0 μg/ℓ (ppb) in less than 13 feet. Even using the higher diffusion coefficient of 2×10^{-9} meters^2/second which is characteristic of diffusion in water alone, concentrations decrease to less than 1.0 μg/ℓ (ppb) in less than 26 feet. If the computations are performed using a 3 year time frame, a source concentration of 1.0 mg/ℓ (ppm), and the diffusion coefficients for both the coarse grained unconsolidated materials and water alone, concentrations decrease to less than 1.0 μg/ℓ (ppb) in less than 4 and 10 feet, respectively. This distance can be compared to the approximate total plume migration distances of 240-760 feet between 1991 and 1993. Thus, from these calculations, it is clear that diffusion can not possibly account for the migration rates observed in this contaminant plume and that diffusion is not a significant factor in the migration of contaminants from the Sparton facility. Such contaminant distributions are also characteristic of the effects of hydrodynamic dispersion generally found along the leading edge of plumes clearly migrating by advection. Thus, the logarithmic drop off in contaminants observed at the leading edge of the off-site plume provides no clear indication of diffusion and is much more likely the result of hydrodynamic dispersion.

5. **EPA has incorrectly refused to accept that constituent concentrations and constituent mass associated with the plume have substantially decreased since off-site sampling began in 1989.**

EPA does not intend to imply that significant, decreasing trends in contaminant concentrations have not been observed since 1989 in many of the monitoring wells installed on the Sparton facility property. However, the trends in contaminant concentrations observed recently in the wells identified in EPA's October 3, 1995, comments have raised serious concerns that the plume is currently expanding, both horizontally and vertically, particularly in the downgradient, off-site portions of the plume. These increasing trends in off-site contaminant concentrations combined with the coverage of the existing monitoring well network makes it difficult to determine if the total mass of contaminants dissolved in ground water is decreasing, in spite of some significant reductions in contaminant concentrations observed in many on-site wells. The increasing contaminant concentrations observed at depth in the past several years in the well cluster comprised of monitoring wells 48, 56, and 55, including the observation in 1994 of an increasing TCE concentration gradient with depth, clearly indicate that the full vertical extent of the plume is not delineated at this location. The concentrations and full extent of the contamination below the monitoring depths of this well cluster are currently unknown. The increasing trend in contaminant concentrations recently observed in the 48/56/55 well cluster are particularly troublesome when considered in conjunction with the plume of contamination potentially migrating at depth (upper-lower and lower-lower flow zone) from on-site near the location of the monitoring well cluster comprised of wells 15, 41, and 32. Significant contaminant levels have been observed since 1989 in monitoring well 32, which is screened in the lower-lower flow zone at this location.

The TCE plume in the lower-lower flow zone as depicted by Sparton in the contour maps submitted to EPA, has shown the 1000 $\mu g/\ell$ contour as an ever decreasing oval centered around the 15/41/32 well cluster. However, the recent TCE concentrations observed in the 48/56/55 well cluster indicate that the center of this plume may, in fact, be migrating outward towards the 48/56/55 well cluster and that it may be more accurate to extend the 1000 μg/ℓ contour outward toward this well cluster. It is also important to note that, due to the high concentrations observed in well 32, the full vertical extent of contamination at the 15/41/32 well cluster location is not fully defined. Consequently, the full vertical extent of the contaminant plume potentially migrating from on-site near the 15/41/32 well cluster to the 48/56/55 well cluster is currently unknown. In addition, due largely to the lack of coverage of the current monitoring network in the lower-lower and deeper flow zones in the areas to the north and northeast of an axis drawn between these two well clusters, the full horizontal extent of this potential plume of higher contamination in the lower-lower and deeper flow zones is also unknown. Similarly, the quality of ground water in the lower and deeper flow zones in the area to the east and northeast of the 15/41/32 well cluster is unknown. This is an area in close proximity to the sump and pond source areas and may have been contaminated by free-phase DNAPL as it migrated downward from the source.

The contaminant concentration trends recently observed in the upper flow zone in the peripheral downgradient areas of the plume, particularly well 61, also introduce some uncertainty into the depiction of the extent and mass of contaminants in the off-site plume. TCE concentrations in well 61 have increased from below detection limit (BDL) in 1991 to 870 μg/ℓ in 1994 to 2000 μg/ℓ in 1995. No additional monitoring wells are located further downgradient from well 61 in the contaminant plume. Consequently, it is not possible to determine the concentrations and full extent of the contaminant plume extending downgradient beyond well 61.

While EPA can agree that significant reductions in dissolved contaminant concentrations have apparently been achieved in many on-site portions of the contaminant plume, EPA can not agree that the total mass in the plume has decreased. Sparton should realize that the real issue here is whether the full extent of contamination is defined and whether a significant portion of the plume may not be contained and is continuing to move away uncontrolled from the site. Contrary to Sparton's assertion, the current monitoring network is not capable of delineating the full horizontal and vertical extent of contamination.

Sparton has also indicated that it does not understand why EPA cannot accept the conclusion that natural attenuation is occurring based on the number of wells that have shown decreases in contaminant concentrations. However, many of the wells that have shown the decreases in concentration are located on the site in close proximity to the recovery wells currently operating on site. The reduction in contaminant concentrations observed in these wells may be attributable to the influence of the recovery operation and not the result of natural attentuative processes. While a few of the downgradient wells have also shown decreases in contaminant concentrations, a significant portion of the wells located in the downgradient portion of the plume have shown substantial increases in contaminant levels. These increases are indicative of further uncontrolled migration of contaminants in the downgradient portions of the plume, and EPA can not accept that natural attenuative processes are sufficient to control contaminant concentrations in the downgradient portions of the plume when such increases in contaminant concentrations are still observed.

Sparton has expressed concern that EPA is relying on Sparton's plume depictions when calculating plume migration rates but will not accept the plume depictions when computing changes in contaminant mass. However, EPA's use of Sparton's plume depictions to compute horizontal migration rates is based on actual measurements of contaminant concentrations obtained from the upper, upper-lower, and lower-lower flow zones. In contrast, Sparton has absolutely no data upon which to base the contours depicting concentrations below the lower-lower flow zone as well as no data points upon which to base contours depicting contaminant concentrations in the lower-lower flow zone over much of the downgradient plume area (see discussion above).

6. **There is no current information suggesting use of soil vapor extraction will be cost-effective.**

The full extent of contamination is not defined in the vadose zone. However, given the past and present organic contaminant concentrations in the ground water, the residual saturation of chlorinated solvents in the vadose zone may represent a significant source material. Residual saturation measurements for trichloroethene in fine to medium sand have been found in the range of 0.15 to 0.20 in the vadose zone (DNAPL Site Evaluation, Cohen and Mercer, 1993). Soil vapor extraction can be used to remove the residual contaminants within the vadose zone, and held close to the water table underlying and adjacent to the original source areas on the site (sump and ponds). Soil vapor extraction can also be considered in conjunction with lowering the water table and potentially dewatering the upper flow zone in this limited area so as to increase the potential for removing residual and adsorbed contaminants.

EPA agrees that further study is necessary to establish the effectiveness and design parameters of such a system and that reasonably high levels of contaminants should be present in the vapor above the natural and/or lowered water table. However, without further analysis of the factors that might influence the contaminant concentrations measured in the vapor samples taken from existing wells as proposed by Sparton, EPA is not prepared to agree to any specific level of contaminants that must be measured in such a test at this point.

7. **EPA has exaggerated the potential threat to human health, and misidentified potential exposure pathways.**

As previously discussed in EPA's response number 3, Sparton has called attention to the use of institutional controls to prevent or limit exposure to contaminants in the Sparton plume from private or public water supply wells. EPA acknowledges that institutional controls are an important component during implementation of a remedy and, where necessary, as a component of a completed remedy. Institutional controls, however, are not a substitute for active response measures (e.g., treatment and/or engineered containment) as the sole remedy unless such active measures are determined not to be practicable. Sparton has failed to demonstrate that restoration of the ground water to its beneficial use is technically impracticable (see OSWER Directive 9234.2-25 <u>Guidance for Evaluating the Technical Impracticability of Groundwater Restoration</u>).

With regard to future impacts from the Sparton contaminant plume on the down-gradient New Mexico Utility wells, Sparton has not provided a quantitative analysis demonstrating that there is no impact on existing water supply wells. Certainly, there has been no convincing demonstration that degradation will materially reduce off-site contaminant levels to acceptable levels.

8. **Any pump and treat remedy may be "technically impracticable".**

Citing the OSWER Directive 9234.2-25 <u>Guidance for Evaluating the Technical Impracticability of Groundwater Restoration</u>, and the cover letter transmitting that guidance to the EPA Regions, Sparton has called attention to the potential difficulties inherent in the remediation of sites contaminated with DNAPL, and to the fact that achieving final cleanup standards may not be practicable at some sites. EPA readily acknowledges these potential difficulties. However, as documented in the transmittal letter and guidance cited by Sparton, EPA generally makes a decision regarding technically impracticability only after implementing a full-scale remedy and determining that, in fact, achievement of final cleanup standards is not practical. In addition, at those sites where technical impracticability is established, remediation objectives still include the removal of free-phase, residual, and vapor phase DNAPL to the extent practical and the containment of DNAPL sources that cannot be removed. Remediation objectives at such sites also include the containment and restoration of the aqueous contaminant plume. Any remedy proposed by EPA for the Sparton facility will be consistent with these objectives and guidance.

Sparton has also cited and evaluated a number of factors identified in the above EPA guidance to demonstrate the potential difficulties in remediating the Sparton plume. It is interesting to note that in its evaluation of the contaminant phase factor listed in the table presented on pages 11 and 12 of Sparton's comments, Sparton has identified the contaminant phase to be only aqueous, gaseous, and sorbed and not to be DNAPL. Thus, it is not clear whether Sparton believes DNAPL is present in the subsurface, and consequently, whether a finding of technical impracticability based on the presence of DNAPL is appropriate. Certainly, the RFI did not clearly establish the presence and extent of free-phase or residual DNAPL, although the contaminant release scenario and the resulting contaminant concentration in ground water at the Sparton facility are strongly suggestive of the presence of DNAPL.

The evaluation of several of the other factors listed on the table presented on pages 11 and 12 of Sparton's comments also do not appear appropriate, particularly for all the areas impacted by the contamination released at the Sparton site. Sparton has cited the texture of deposits and degree of heterogeneity as adding significantly to remediation difficulty. While the low permeability layer immediately underlying the facility may pose an impediment to remediation, the saturated deposits in the downgradient, off-site areas appear to be relatively homogenous deposits of sands or sandy gravels. The zone of low permeability material found immediately beneath the facility has not been shown to extend into these areas, and no other extensive layers of silts or clays have been identified in the well logs from these areas. Similarly, the sand and gravel deposits found both above and below the low permeability layer present on site appear also to be relatively uniform, although a few isolated lenticular clay and silt deposits were identified below the low permeability layer in the borings logs from the site.

Sparton has also indicated that a high retardation (sorption) potential is also a significant impediment to cleanup. However, TCE is not a strongly adsorbed contaminant. In the EPA document, TCE Removal from Contaminated Soil and Groundwater (EPA/540/S-92/002), a retardation factor of only two is common for TCE. The retardation factor may be even less in the sand and gravel deposits underlying much of the Sparton facility and downgradient areas.

Thus, the highly permeable and relatively homogenous sand and sandy gravel deposits found in the downgradient areas of the contaminant plume, and the low adsorption potential in these deposits appear to combine to provide a favorable environment for a pump and treat remedy. While the contrast in permeability between the sand and sandy gravel deposits found in the off-site areas may result in some preferential flow during pumping, reasonable flushing rates through both layers should be attainable. Thus, Sparton does not appear justified in maintaining that a pump and treat remedy will have little impact on migration in the downgradient areas of the plume, and that it will not fundamentally speed up restoration of water quality to drinking water standards.

In addition, a pump and treat remedy may similarly be effective in remediating the sand and sandy gravel deposits found beneath the low permeability layer present beneath most of the site, provided residual DNAPL (as opposed to adsorbed) is not present in these deeper deposits. Investigations conducted to date have not clearly established whether residual DNAPL is present in these deposits. While these deposits may be subject to the continued release of contaminants from the overlying low permeability materials, the potential impact of such releases on ground water quality in the deeper deposits is currently unknown. Sufficient data is not currently available to identify levels of adsorbed contaminants or residual DNAPL throughout and particularly in the lower portions of the low permeability layer. Similarly the hydraulic and physical characteristics of this layer have not been well established. Thus, it may be possible to effectively restore ground water to acceptable levels throughout most of the contaminated area, with the possible exception of the upper flow zone overlying the potentially heavily contaminated zone of lower permeability directly beneath the sump and pond area. However, the impracticability of restoring ground water in these deposits has not as yet been established.

Sparton has expressed concern that "deeper wells to contain the entire plume would result in contamination being pulled downward into lower, less contaminated zones of the aquifer" and "thus, containment can only be attempted in the UFZ (upper flow zone)." Sparton has further expressed concern that off-site extraction wells used for containment could actually induce the highest contaminant concentrations upgradient to move off-site due to an increased hydraulic gradient. However, it should be possible to deal with these concerns through proper design and operation of a pump and treat system. Containment of the off-site plume can likely be accomplished using a line of wells installed near the downgradient periphery of the plume. Pumpage from such a line of wells sufficient to capture further downgradient migration of contaminants should have little impact on hydraulic gradients in upgradient areas in and near the facility. Remediation of the downgradient, off-site portions of the aqueous plume will likely require the installation of a more extensive network of recovery wells that may have more of a hydraulic impact on ground water gradients beneath the facility. However, design options are available to minimize or eliminate the impact of any such increases in gradients beneath the facility. The hydraulic impact on upgradient areas may be minimized by utilizing a greater density of downgradient wells that require less total pumpage while maintaining hydraulic control and adequate flushing rates. Use of an alternating sequence of recovery and injection wells may also help to eliminate the hydraulic impact in upgradient wells. The installation of a hydraulic barrier at the property line may also be used to prevent off-site migration. Such a hydraulic barrier may be created using a line of either recovery or injection wells. Such a hydraulic barrier at the property line can also be utilized to address the above expressed concerns over operating a system to contain an off-site plume.

Although the vertical distribution of contaminants beneath the site has not been fully characterized, concerns over the potential of drawing of contaminants in the upper flow zone on site through the zone of lower permeability into the lower flow zones may be appropriate. However, a number of design options are also available to address any such valid concerns. Water levels in the upper flow zone over the zone of lower permeability materials may be reduced so as to compensate for reductions in hydraulic head beneath the low permeability layer. The permeability of the sand and gravel deposits beneath the site should be sufficient that minimal drawdowns in hydraulic head will be required to control and effectively flush the area. Potential drawdowns in these deeper deposits can also be progressively minimized by using an increasingly dense network of recovery wells. Injection wells located upgradient and/or beneath the low permeability layer could minimize drawdowns and potentially even reverse the gradient between the upper and lower zones.

As discussed in EPA's response number 5, significant levels of contamination have been found to be increasing in the lower aquifer, and consequently concern over drawing contamination downward from the upper flow zone into the lower flow zones is not as potentially valid for the off-site areas. However, if such concerns prove valid, they could be addressed by maintaining horizontal or upward flow patterns through proper placement of recovery well screens and suitable pumpage amounts.

Sparton has also expressed concern that containment and restoration may be in conflict due to the potential use of pulse pumping during restoration. However, recovery systems designed for both containment and restoration and including the potential use of pulse pumping are routinely implemented and EPA does not see that these goals are in conflict. Sparton should realize that pulse pumping is not required to achieve cleanup and does not necessarily improve cleanup times. Pulse pumping only improves the efficiency of the system by reducing the amount of water that must be pumped and treated. Pulse pumping generally only proves advantageous in the final stages of remediation and in aquifer systems where considerable subsurface heterogeneities are present. Thus, pulse pumping may have only minimal applicability in the off-site plume areas. In any case, there are likely numerous design options that will allow for the use of pulse pumping while maintaining containment at this site. Since pumpage amounts required to maintain adequate flushing rates are generally greater than that required for containment, it may be possible to periodically operate at reduced pumping rates that are sufficient to maintain hydraulic control but that allow residual, sorbed, and dissolved contaminant levels to equilibrate before increasing pumpage to resume flushing. Alternatively, it may be possible to alternate or rotate pumpage between different wells in a recovery system so as to maintain hydraulic containment while allowing equilibration between residual, sorbed and dissolved contaminants to occur in the vicinity of some wells and the flushing of dissolved constituents in other areas. Another option may be simply to continue to operate a line of recovery wells at the downgradient boundary of the area under remediation to ensure capture while turning off or reducing pumpage in upgradient areas to allow equilibration between residual, sorbed and dissolved constituents.

Sparton has also expressed concern over the volume of ground water pumpage that may be required to maintain containment over the plume. Some volume predictions have been presented by Sparton; however, the basis for these predictions has not been provided so it is impossible to evaluate their accuracy. Nevertheless, EPA is also concerned over the volume of ground water pumpage that may be required, particularly when pursuing aquifer restoration rather than containment. For this reason, the inclusion of reinjection of treated ground water as part of the pump and treat strategy should be carefully considered. All practical options for reinjection must be carefully studied and evaluated.

Sparton has also expressed concern over the effectiveness of extraction wells in controlling diffusion-dominated migration. Apparently, Sparton feels that since extraction is an advection-dominated process, it will have little effect on a diffusion-dominated migration. As stated in EPA's response number 4 to Sparton's comment number 5, EPA does not believe that contaminant movement in the off-site plume is diffusion-dominated. Regardless, extraction will be equally effective for diffusion- or advection-dominated transport, provided that flow rates induced by pumpage are sufficient to overcome the fluxes resulting from diffusion or advection. Since the fluxes resulting from diffusion are so small, properly placed extraction wells should easily overcome contaminant fluxes resulting from diffusion.

Sparton is also concerned that EPA has not demonstrated that a pump and treat option will be "meaningfully" quicker than Sparton's proposed remedy. However, Sparton has provided no quantitative analysis in its draft CMS report to identify cleanup times for either option. Certainly, there has been no convincing demonstration that degradation will materially reduce off-site contaminant levels much less restore the off-site contaminant plume to acceptable levels. In contrast, it appears that, based on the subsurface conditions established in the RFI report, a pump and treat remedy should be effective, particularly in the downgradient areas of the plume. The remedial options proposed by EPA should also be capable of significantly reducing contaminant levels on-site so that residual contamination may eventually have minimal impact on ground water quality.

9. **Sparton's Response to EPA'S Request for Supplementation of the Draft CMS.**

a. **Injection wells/surficial reuse.**

Sparton's language proposed for inclusion in the draft CMS report is not acceptable to EPA. The analysis and conclusions provided in the proposed language do not address the requirements listed in Task VIII of the Corrective Action Plan for the Administrative Order on Consent, Docket No. VI-004(h)-87-H, and references are not provided for the source of the information. Regarding the presence of arsenic in the ground water, Sparton should refer to EPA's response number 2. Regarding the direct discharge of treated ground water, there has been no discussion related to the legal requirements for a NPDES discharge into the Rio Grande or increased consumptive use of ground water permitted by the State Engineer's Office.

b. **Hydraulic containment.**

Sparton's language proposed for inclusion in the draft CMS report is not acceptable to EPA. The analysis and conclusions provided in the proposed language are not consistent with EPA's analysis and conclusions and do not appear correct. Sparton should refer to the EPA discussion of these issues in response number 8.

c. **Criteria for changes in development and plume characteristics.**

Sparton's language proposed for inclusion in the draft CMS Report is not acceptable to EPA. The statement "Applications for permits to drill and complete private or public drinking water wells in ground water impacted by Sparton's operations will be monitored" does not indicate the frequency of the monitoring or how the monitoring will be performed. The statement "Sparton will on an annual basis update its description of the impacted areas to take into consideration any expansion or contraction of the impacted groundwater" does not indicate how expansion of the contaminant plume will be monitored.

ENCLOSURE NUMBER 2

the designated crucial area. I am attaching a copy of the GPPAP and ask that it be included as part of the administrative record.

The Sparton Reaction criticizes the crucial area designation because "...there is very little ground in the vicinity of Albuquerque that is not crucial." This presumptuous denigration fails to recognize that: (1) good quality groundwater underlies "most of the ground in the vicinity of Albuquerque," (2) groundwater supply limitations increase its value and the importance of protecting it rather than the reverse as argued by the Sparton Reaction, and (3) the community that relies on this groundwater for its sole source of water supply, as represented by the specific action of its elected officials, says that within crucial areas, "Polluters should mitigate contamination they cause....The City and the County will seek the expeditious remedy of the pollution caused by the responsible parties" (GPPAP, page 49). It simply is not within Sparton's purview to represent that the groundwater they have contaminated is valueless, will not be used for water supply, and is unworthy of cleanup, because local government has expressly stated that its findings are exactly the opposite. Some of the reasons are described below.

Albuquerque is in the process of preparing its long-term water supply plan. I am managing that effort. A report entitled Albuquerque Water Resources Management Strategy: San Juan-Chama Diversion Project Options describes various conceptual options for augmenting local groundwater production with treated surface water, specifically including the City's 48,200 acre feet per year of imported San Juan-Chama project water. That report is also attached with the request that it be included as part of the administrative record.

The Sparton Reaction misrepresents the conclusions of this report. One of the most important conclusions is that groundwater must always remain the City's mainstay source of supply through the year 2060 and that as such the aquifer must be protected. There simply are no other sources available and even if there were, they would cost much more than local groundwater. All water supply planning scenarios rely on continued, sustainable groundwater production. Many options rely on enhanced recharge of the groundwater system to increase sustainable production levels. Sparton's contamination must be remediated such that it does not prevent limited groundwater resources from being used nor foreclose options for enhanced recharge and increased sustainable groundwater supply.

The City's current water supply master plan identifies the Sparton area as the location for a new well field serving the Corrales Trunk, an area that is outside the City's current service area. The Sparton Reaction cites the San Juan-Chama options report not simulating new City wells in this area as their evidence that the City plans no future wells in the area Sparton has contaminated. This statement ignores the study's clear statement that site-specific locations have not been identified for any of the project options and certainly not for the "conceptual future city water wells" which will be required regardless of the method selected for use of the City's San Juan-Chama water. Failure to contain and remediate the plume will certainly reduce the potential new well sites available to the City.

The New Mexico State Engineer Office has issued the report of a staff task force charged with recommending changes in groundwater pumping administration in the Albuquerque area. Their recommendations include establishing Critical Management Areas (CMA) within which no new wells would be allowed. Again, the Sparton Reaction turns the truth on its head. The attached map entitled "Proposed Critical Management Areas in the Albuquerque Area" shows that the Sparton area is outside of the proposed CMA. The Sparton area is located precisely where the task force recommends new wells be allowed; adjacent to the river. In contrast to the Sparton Reaction statement quoted at the beginning of this section, were it not for the Sparton contamination, the Sparton area would be a particularly attractive location for the new City wells that will be required. Wells could be permitted there, but not within most of the City's current groundwater production areas.

Attractive groundwater recharge enhancement and management opportunities that would increase sustainable ground production are endangered by the unremediated and spreading Sparton contamination. These opportunities are the focus of a major planning effort being conducted by the U. S. Bureau of Reclamation in cooperation with the City of Albuquerque. The final report of that study is in preparation. Chapter 5 — Applying aquifer recharge enhancement and conjunctive use concepts — of the report draft identifies "recharge window" areas having maximum recharge potential. These are areas where highly conductive materials exist from the land surface to the top of the Santa Fe Group, which includes the regional aquifer. According to the Bureau of Reclamation, "Calabacias Arroyo from Paradise Hills to its mouth is another area offering high [enhanced recharge] potential." This recharge window is located immediately adjacent to the Sparton contamination and the Sparton plume is moving toward it.

Failure to contain and remediate the plume will not only eliminate this opportunity for enhanced recharge, which is potentially one of the least expensive water resources management opportunities available, but also endangers the deep aquifer due to the contamination proximity to and movement toward a recognized recharge window. Areawide deep pumping has already created the vertical gradient to transport contamination downward.

Sparton Reaction: "EPA's perception of the importance of the Sparton Plume as a drinking water resource overlooks significant concentrations of naturally occurring arsenic"

Here too the Sparton Reaction misrepresents the truth. Sparton says "extrapolation of city data... suggest there should be an arsenic problem in the area where the Sparton Plume is located. For instance, the highest concentrations of arsenic in city wells (over

50 μg/L) occur on the west side of the Rio Grande..." Naturally occurring arsenic is indeed a problem in some Albuquerque locations. It is not a problem in the Sparton area as the Sparton Reaction misstates. In fact, Sparton monitoring data shows that naturally occurring arsenic concentrations at the Sparton site are among the lowest in the City. Arsenic would present a much, much lower long-term problem for the City if all its groundwater contained as little arsenic as the groundwater that Sparton has contaminated.

There are 27 wells for which arsenic measurements are presented in Sparton's RFI report. All were sampled at least twice. Twenty-one of these wells had non-detectable levels of arsenic (less than five μg/L) in one or both samples. Six wells had detectable levels of arsenic in both samples, and most of these values were less than eight μg/L. The highest levels of arsenic were measured in wells MW-36 and MW-37, located close to the source area. Arsenic in these wells was more than 30 percent below the arsenic drinking water maximum contaminant level in the first sample. At the second sample, arsenic was less than the detection limit on one well and almost 80% below the maximum contaminant level in the other. Perhaps the elevated arsenic is associated with Sparton contamination and not with natural occurrence.

Another example of the Sparton Reaction's misconstruing facts is their citation of the San Juan-Chama options report Figure C-38 as evidence of high arsenic. What this figure actually shows is that <u>naturally occurring arsenic concentrations in groundwater nearest the Sparton contamination are the lowest in the City's current service area west of the Rio Grande.</u>

Sparton Reaction: "By misunderstanding available data, EPA incorrectly calculated the rate of plume movement and mistakenly concluded the dominant transport mechanism is advection. EPA has incorrectly refused to accept that constituent concentration and constituent mass associated with the plume have substantially decreased since off-site sampling began in 1989"

Sparton claims that diffusion is the dominant contaminant transport mechanism. Although the areal extent of the contamination is unknown, it is clear the contamination is spreading rapidly. The dimensions of the plume are entirely conssistent with advection and dispersion driven transport mechanisms. If diffusion were the sole transport mechanism, the plume would be moving less than one foot per year. In reality, it has migrated over 2,500 feet. Calculations will be furnished upon EPA's request to substantiate these statements.

Sparton's Reaction repeatedly refers to the heterogeneous nature of the aquifer, yet they completely ignore this fact in their argument for diffusion-dominant contaminant transport. These heterogeneities likely cause some of the contamination to migrate faster than the rate predicted by the estimated average linear ground-water flow velocities (as the groundwater preferentially flows through lenses of materials with higher permeability); and some contamination will migrate more slowly than the average. These local-scale variations in velocities and flow directions have the effect of "spreading" the plume, causing the width to become much broader than the original dimensions of the source area.

The Sparton Reaction calculates plume velocities on the Sparton facility, at the west end of the plume, and in the area near MW-61. For these calculations Sparton assumes that K, the hydraulic conductivity, and n, the effective porosity, are constant. Yet repeatedly, they assert that the aquifer is very heterogeneous. Also inconsistently, Sparton criticizes EPA for what they claim is EPA's assumption that the aquifer is "homogeneous and isotropic". But, Sparton's assumption of a constant K and n, especially on the short distances covered by their analysis (less than 2500 feet), reflects the same simplifying assumption for which they criticize EPA.

Sparton focuses mainly on areal differences in horizontal water movement and velocities. However, they also point out that horizontally, the aquifer zones display similar properties, but vertical discontinuities are such that they have had to refer to a single regional water bearing zone in terms of the three "flow zones". In fact, the May 1992 RCRA report alludes to a perched water zone potentially underlying the site in the upper flow zone which causes localized gradient anomalies. This gradient differential could potentially be causing the confusion about whether ground-water velocities are increasing or decreasing as the plume leaves the site, since all other properties used to calculate velocity are assumed constant. Differences in gradient understanding and differing porosities are factors that could drive the resulting average horizontal ground-water velocities to values as high as 300 feet per year.

Regardless of these arguments, the contamination facts speak for themselves:

Sparton's reports estimate that contamination above drinking water standards has moved at least one-half mile off site and contaminant levels over 140 times greater than standards occur at Well 61, almost 2,000 feet from the site's western boundary. Contaminants continue to move through the aquifer at relatively rapid rates. Well 61 is the most distant well directly downgradient (in the "middle" of the apparent plume). Contamination was not detected there in 1989, 1990, or 1991. But in 1993, TCE concentrations jumped to 610 μg/L in 1993 and to 730 μg/L in 1994.

Sparton has estimated that the extent of TCE contamination above standards is only 700 feet downgradient of well 61. But there are no monitoring data directly downgradient of well 61, so the extent of these high levels of contamination is not known. However, the groundwater in this vicinity appears to be moving to the northwest at a rate of between 100 and 300 feet per year. If Sparton's estimate of the lateral extent of the plume is correct (1,400 feet), then the areal extent of the plume is increasing at a rate of between 3 to 10 acres per year.

Wells 53 and 58 appear to be on the lateral fringe of the plume, southwest of well 61. Contaminant levels are rising here too: no TCE was detected in well 53 during 1989 - 1991, but 1993 sampling recorded 32 μg/L and 1994 data showed 43 μg/L; TCE in well 58 increased from less than 30 μg/L in 1989 - 1991 to 74 μg/L in 1993.

The deeper wells 55 and 56 are about 1,600 feet northwest of the site, and appear to be somewhere between the middle of the plume (suggested by well 61) and the lateral fringe (suggested by wells 53 and 58). They too have seen significant increases in TCE concentrations: well 56 has gone from 63.5 μg/L in 1989-1990 to 200 μg/L in 1991 to 400 μg/L in 1994. The deeper well 55 has gone from 10.6 μg/L in 1989-1990 to 45 μg/L in 1991 to 580 μg/L in 1994. These are high levels of contamination and indicate that the plume is spreading deeper into the aquifer as well as moving rapidly horizontally.

The depth of contamination has also not been determined, but concentrations over 100 times higher than safe drinking water standards have been found in well 55 at depths of over 100 feet beneath the water table and over 250 feet beneath the land surface. This is the deepest well in the main part of the off-site plume.

There no basis for Sparton's claim that contaminant mass is decreasing. They assert that contaminant concentrations are decreasing in most of the wells, but most of the wells are located close to the site where advection and clean-up have lowered concentrations. Sparton fails to highlight the fact that concentrations are actually increasing in most of the downgradient offsite wells in the plume's path. Moreover, because the "bottom" of the plume has not been adequately delineated, the amount of contamination moving to deeper parts of the aquifer cannot be reliably estimated.

Moreover, it should be noted that localized high-permeability lenses may be quite narrow and therefore may not have a ground-water monitoring well installed in them. Therefore the current monitoring network may not be identifying all of the off-site migration of the contaminants. Failure to include this component in a contaminant mass balance could lead to an erroneous conclusion that contaminant mass is decreasing. This may be one explanation for the unsubstantiated assertion that the contaminant mass is decreasing.

Sparton Reaction: "Any pump and treat remedy may be 'technologically impractical'"

There is no basis for Sparton's assertion that pump and treat containment strategies will not be effective in diffusion-dominated plumes. In fact, pump and treat is easiest to implement when there are no opposing advective forces to counter. As noted, the contaminant transport process is largely advective and pump and treat methods are proven reliable ways to effect hydraulic control in this type of aquifer system.

In summary, groundwater in the vicinity of the Sparton contamination, were it not for the contamination, would be especially attractive for development of new wells and/or enhanced aquifer recharge systems. New wells are needed for water supply, regardless of the option(s) selected for supplementary conjunctive use of surface water. The existing water master plan designates the contaminated area for a future well field. Arsenic concentrations at the site are unusually low. The area is adjacent to existing and potential new groundwater recharge sources. Additionally, the area is in a relatively small area of the city where State Engineer Office staff recommendations would allow new wells to be drilled.

The existing contamination is spreading rapidly and lies on the path between the existing recharge areas at the river and the production wells to the west. Contamination is adjacent to a newly defined "recharge window." The contamination not only forecloses the opportunity to enhance recharge but also threatens to spread even more rapidly if it reaches the window.

EPA is requested to make enforcement of laws requiring containment and remediation of the Sparton contamination a regulatory priority.

Sincerely yours,

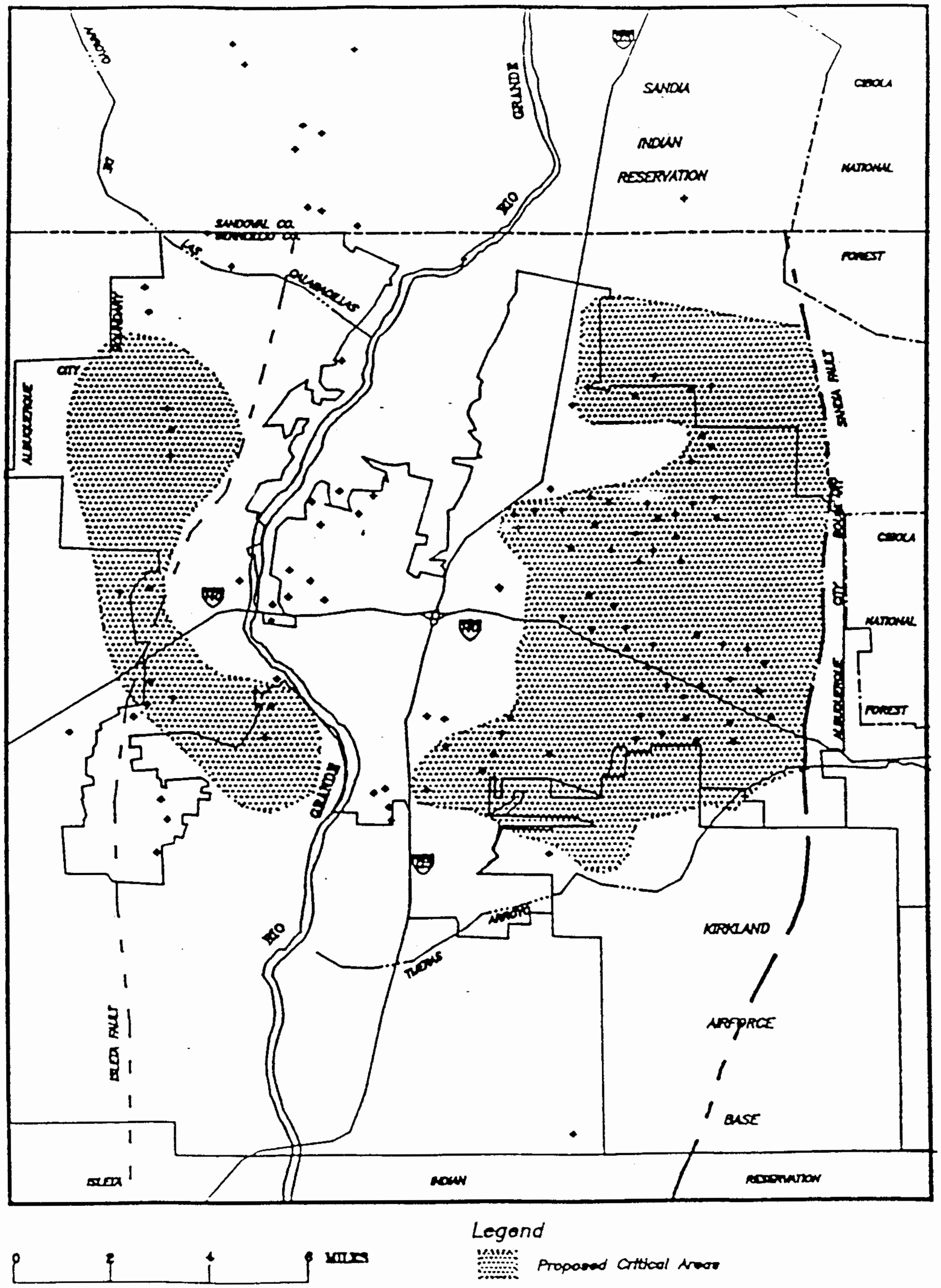
A. N. Gaume

A. Norman Gaume, P.E.
Manager, Water Resources Program

c: Martin J. Chavez, Mayor, City of Albuquerque
Lawrence Rael, Chief Administrative Officer, City of Albuquerque
Juan Vigil, County Manager, Bernalillo County
Mark Weidler, Secretary, New Mexico Environment Department
William Turner, State of New Mexico Natural Resources Trustee
Robert E. Gurule, Director, Public Works Department

Attachments

Figure 1



Proposed Critical Management Areas in the Albuquerque Area

OGC-000391

GWB-00401-SPARTON