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Sparton Technology, Inc.

B&V Project 26602.100
March 14, 1997

1997

Mr. Ronald Crossland, Chief
Technical Section (6H-CX)
RCRA Enforcement Branch
U.S. EPA Region 6
1445 Ross Avenue, Suite 1200
Dallas, Texas 75202-27733

Subject: Revised Final Corrective Measures
Study Report
Sparton Technology, Inc.
Coors Road Facility
Albuquerque, New Mexico

Dear Mr. Crossland:

Transmitted herewith is Sparton's revision to the May 13, 1996 Draft Final Corrective Measures Study Report approved by U.S. EPA on June 24, 1996. This revision consists of revised pages and a new Appendix 5. These pages revise and supersede information given in the May 13, 1996 Report. Please insert these pages as replacements to those in the previous Report.

This revision is based on additional investigations conducted since May 1996 and meetings and discussions with U.S. EPA, State of New Mexico, City of Albuquerque, and New Mexico Utilities. This revision is being submitted on behalf of Mr. Richard D. Mico, Vice-President and General Manager of Sparton Technologies, Inc. Additional copies are being transmitted to parties indicated on the Distribution List contained in the Report.

Sincerely,

BLACK & VEATCH

Pierce L. Chandler, Jr.

Pierce L. Chandler, Jr.
Senior Project Manager

cs
Enclosure

A Report Prepared for:

Sparton Technology, Inc.
4901 Rockaway Boulevard, SE
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REVISED FINAL CORRECTIVE MEASURE STUDY
Sparton Technology, Inc.
Coors Road Facility
Albuquerque, New Mexico

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March 14, 1997

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pathways with respect to the contamination characterization for the Sparton Facility. As noted in Section III, some 43 groundwater wells have extensive time-histories. Of the 32 wells that have detection histories, 24 wells (75%) exhibit decreasing concentration with time and 7 wells (22%) show increasing concentration. These trends are consistent in the UFZ, ULFZ, and LLFZ with decreasing/increasing percentages of 82/18, 64/27 and 75/25 respectively. The plume has continued to expand at the extreme western (down-gradient) end; however, as of July 1996, there are nine non-detect downgradient monitoring wells around the leading edge of the plume -- UFZ wells MW-50, MW-52, MW-57, MW-62, and MW-68; LLFZ wells MW-65, MW-66, and MW-69; and TFZ well MW-67.

Under the NFA alternative, quarterly monitoring of selected wells would continue. Confirming vertical plume limits in the vicinity of well cluster No. 4 (MW-15, MW-41, MW-32) could be accomplished by installing a fourth well in the Third Flow Zone (TFZ). It should be noted that well cluster No. 4 is the only onsite cluster showing an increase in TCE concentration with depth. This new well would also be monitored on a quarterly basis.

The results of the continued groundwater monitoring and changes in land use/development would be monitored by requesting notices of proposed subdivision groundwater gradient by injection in the vicinity of the downgradient edge may cause the plume to disperse over a larger area and spread the contamination.

- Infiltration galleries and injection wells are used primarily for small groundwater plumes. The areal extent of the plume makes the use of these alternatives infeasible. Furthermore, these alternatives require a steady flow of water to be effective. Under typical groundwater extraction plans, wells are pumped in a pulse format, i.e., a several week pumping period followed by a similar recovery period. This type of pumping scheme will not supply either sufficient quantities, or a continuous supply, of water to the injection wells or infiltration galleries for them to be effective.

3. Extraction Wells for Containment

EPA has directed that groundwater extraction wells be evaluated for containment of the contaminant plume (US EPA, 1996). Based on understanding of the current plume, containment could be provided by a single extraction well located in the western end (leading edge) of the plume. The partially penetrating well would be screened through the entire vertical of the plume as defined during installation activities. Using aquifer properties given in the RFI Report and confirmed by the USGS, a pumping rate of 50 to 100 gpm would give a capture zone width (at the well) of approximately 1,500 to 2,000 feet which would adequately cover the width of the plume. Calculations for these capture zones and other confirming calculations are given in Appendix 5. Alternatively, capture zone width could be based on the 600-foot-plus radius of influence demonstrated in pumping tests reported in the RFI. The pumping rate would give a drawdown in the range of six to ten feet. The pumping rate should be adjusted to provide sufficient drawdown for containment but not so much drawdown to pull shallow contamination deeper into the aquifer.

Extracted water would either be treated near the wellhead or conveyed through a buried pipeline installed in the public right-of-way to the Sparton facility for treatment. It should be noted that bringing contaminated water to the surface in off-site areas poses some risk to the general public, off-site landowners and the environment.

Costs for a single well extraction system are given in Figure 24.

C. Restoration of the Dissolved Groundwater Phase (Saturated Zone)

Groundwater remediation alternatives for this project would include no further action, groundwater extraction and treatment system, vapor extraction system, in situ air stripping, and in situ bioremediation. Treatment of the water effluent pumped from the ground may utilize air stripping, granular activated carbon (GAC), advanced oxidation, aerobic bioreactors, or a combination of all the above to treat volatile organics. The treatment train may include ion exchange and chemical precipitation for metal treatment. Vapor obtained from vapor extraction and/or in situ air stripping may be treated with granular activated carbon (GAC) or thermally destructed. Bioremediation provides total treatment in place.

Figure 23 Screening of Corrective Measure Technologies, this technology, if previously considered, would have been eliminated for several reasons. First, lining of the canal would be relatively ineffective since the majority of the recharge is coming from the irrigated fields supplied by the canal. The canal represents only a small fraction of the recharge area and lining would have little impact. Secondly, seasonal fluctuation of the groundwater levels in the UFZ onsite probably enhances both the performance of the IM and in situ bioremediation by alternatively saturating and then exposing and aerating a portion of the UFZ.

3. Expansion of Interim Measure

This alternative is similar to the previous discussion in Item 2 with the exception of adding two or more groundwater recovery wells to the existing IM system. On-site lower lower flow zone well 32 and upper lower flow zone well 42 would be added to the IM to address the high concentrations of VOC in these wells. Additional wells would be included in the expanded IM as necessary to achieve a total combined extraction rate of 20 gpm. Any additional wells would be selected based on their potential yield and the presence of elevated VOC concentration. Based on historical data, wells to be considered for expanded IM purposes would include MW-43 and MW-19. Capital costs would be approximately $10,000. Operation and maintenance costs would be unchanged from Item 2.

4. Large-Scale Groundwater Extraction and Treatment System

Extracting groundwater with pumped wells on a large scale and treating it at the surface has been retained as a corrective measure alternative at the Sparton site for groundwater remediation. Use for containment was previously discussed in VII.B.3. This technology is more suitable in high permeability materials such as the subsurface gravelly sands and less effective in the clays and silts at the Sparton site. It should be noted that groundwater extraction and treatment is limited in its ability to reduce groundwater

Section VII.C.4.a.(1). Costs for pumping to the golf course from extraction wells on the Sparton facility (source control) would be approximately doubled due to the increased distance and increased elevation difference.

Other options are currently being explored with both the City of Albuquerque and New Mexico Utilities. Beneficial reuse requires some suitable site that can accept and use the water year round. In the absence of a potential user year round, the extraction system would either require seasonal suspension or alternative disposal.

(6) Calabacillas Arroyo Recharge

EPA also directed that surficial recharge in the Calabacillas Arroyo be considered (U.S. EPA, 1996). A "Calabacillas Recharge Window" was described by Mr. Steve Hansen of the USDOI Bureau of Reclamation (BuRec) during the public meeting on February 1, 1996, and in a subsequent memorandum furnished to EPA. The memorandum provided little meaningful or area-specific information on hydrogeological features to allow evaluation of this alternative. The memorandum further referenced several reports published through 1996 (by author and date); however, review of these referenced reports did not provide any specific information. However, in November 1996, Metric Corporation conducted a 24-hour, 200-gpm infiltration test in the Calabacillas Arroyo, approximately 3,300 feet upstream from Coors Road. Water was discharged from a New Mexico Utilities fire hydrant into a City of Albuquerque storm sewer that feeds into the Calabacillas Arroyo. The test demonstrated that 97 to 99 percent of the discharge infiltrated into the arroyo bottom. Based on this test, discharge to the Calabacillas Arroyo is technically feasible.

(7) Summary

Legal issues related to injection wells and beneficial reuse include: potential liability for the creation of toxic conditions not present not from use of the

For highly porous subsurface conditions with high VOC concentrations observed in the uppermost portion of an aquifer, operation of vapor recovery systems installed immediately above the water table can significantly impact the groundwater dissolved-phase VOC concentrations. Removal of soil gas from above the water table reduces the vapor phase VOC concentrations resulting in off-gassing (dissolution) from the groundwater in accordance with Henry's Law. To be most effective, vapor recovery systems should be operated in a pulsed mode similar to groundwater extraction systems. Vapor extraction is also useful in removing adsorbed phase VOC from soil materials dewatered during groundwater extraction.

Soil gas surveys and groundwater sample analyses indicate highest soil gas (and groundwater) VOC concentrations occur under the facility. In April 1996, soil gas immediately above the saturated zone was sampled from on-site and off-site UFZ wells. Results are discussed in the Section III.B.1.c. Deep Soil Gas and included in Appendix 2. This deep soil gas information indicates that : elevated soil gas concentrations are found only in the immediate, original source area; significant off-gassing from the groundwater is not occurring since soil gas concentrations are generally below equilibrium conditions; and subsurface gas transmissivity is not has high as expected. In fact, significant negative pressures were required to produce gas flow rates in the order of one standard cubic foot per minute (scfm).

In June 1996, a six-probe cluster VP-1 was installed near the old closed sump. Soil-gas TCE concentrations ranged from 24000 mg/m^3 (5376 ppmv) at 30 feet bgs to 8200 mg/m^3 (1837 ppmv) near the aquifer (50 feet bgs). In February 1997, five soil gas monitoring/recovery wells VR-1 through VR-5 were installed in and around the original source area in accordance with the proposals included in Appendix 5. TCE concentrations ranged from 7400 mg/m^3 (1658 ppmv) in the closed sump area to 870 mg/m^3 (195 ppmv) approximately 100 feet to the north. This latest data suggests that soil gas concentrations above 10 ppmv extend out less than 200 feet from the closed sump area.

Based on the characterization discussed in the RFI, an average radius of influence of approximately 150 feet was anticipated for SVE recovery wells. SVE pilot testing conducted by AcuVac Remediation, Inc., in February 1997 at well VR-1 indicates an actual radius of influence of approximately 200 feet.

Depending on the overlap between vapor extraction wells, and well-specific radius of influence, between ten and twenty wells will be required to cover the area showing elevated soil gas concentration in the most recent (1991) soil-gas survey. Recent deep soil gas investigation indicates that the area and number of wells will be much less. The 1997 SVE pilot testing and sampling indicate that recovery well VR-1 is probably sufficient to cover the area of elevated soil-gas VOC. Combined extraction rate would thus range from 50 standard cubic feet per minute (scfm) to 200 scfm (or 5 to 10 scfm per well). Extracted vapor would be routed to a central vacuum unit. The effluent from the vacuum unit would then be treated using GAC air polishing or thermal destruction as required by applicable regulations to remove VOC. Estimated costs for VES installation and operation are given in Figure 40.

The benefits of using vacuum extraction include:

- Implementation can be conducted in situ and requires relatively little disturbance to existing facilities or operations.
- The process reduces contaminant concentration and mobility at the treated area.
- Implementation can be flexible, allowing for adaptation to changing site conditions or as additional analytical and subsurface data is developed.
- In situ installation and operation requires little handling of contaminated materials, limiting the risk of exposure to workers and the public.
- Vacuum extraction has few secondary impacts.

Based on the subsurface characterization detailed in the RFI Report, the observed decrease in surface soil gas concentration, the April 1996 deep soil gas sampling, the June 1996 cluster probe sampling and the February 1997 recovery well sampling, and pilot testing, the following observations are pertinent:

- The subsurface is a layered, heterogeneous and anisotropic sequence of gravelly sands, silts, and clays.
- Highest VOC concentrations are associated with clay layers.
- The subsurface directly above the aquifer is not as gas transmissive as previously thought.
- Soil gas concentrations are highest in the closed sump area and decrease exponentially with distance.
- Significant off-gassing from the groundwater is apparently not occurring.
- Effective radius of influence is approximately 200 feet.

As discussed in Section VII.C.2., lining of the Corrales Main Canal has no technical basis and, in fact, would defeat the synergy of a VES with a fluctuating water level as described above.

6. <u>In Situ Air Stripping (Air Sparging)</u>

An innovative technology for treatment of volatile organic compounds in groundwater is in situ air stripping or sparging. This technology is an enhanced version of vapor recovery and utilizes air injection wells installed in the aquifer in addition to the vapor extraction system (VES). Dissolved-phase VOC are stripped from the groundwater by the mechanics of the rising air bubbles around the air injection wells. The vapor-phase VOC are then removed by the VES. Typical operation utilizes standard VES operation until a tailing phenomenon is observed in soil-gas VOC concentrations. Air injection is then

VIII JUSTIFICATION AND RECOMMENDATION OF THE CORRECTIVE MEASURE

A. General

The recommended corrective action alternative consists of three elements: plume leading edge containment through groundwater extraction; a phased approach to soil vapor extraction; and expansion of the current onsite Interim Measure (IM) groundwater recovery and treatment system. Included in the three elements is additional characterization of soil, soil-gas, and groundwater contamination and further evaluation of subsurface characteristics through aquifer testing and vapor extraction system pilot testing. The recommended corrective action alternative utilities efficient and environmentally friendly discharge of produced water to the Calabacillas Arroyo. This recommendation has evolved from further study/characterization and various meetings/correspondence with local, state, and federal agencies. This recommendation was based on the following:

- Lack of risk from current conditions considering both current and potential receptors and exposure pathways identified at the site.
- Lack of impact on use of the affected groundwater considering potential use of that resource.
- Inability of available technologies to restore groundwater quality to Maximum Contaminant Levels (MCLs) within any reasonable time period or at a reasonable cost.
- Constituent concentrations in much of the plume area have already dropped

below technology application levels.

- Effectiveness of previous corrective actions (i.e., closure and capping of the ponds/sump).
- Effectiveness of the currently operating IM system to prevent migration off-site.
- Cost effectiveness of the IM system relative to other alternatives retained from the Initial Screening.
- Discharge to the Calabacillas Arroyo will result in beneficial recharge to the shallow portions of the aquifer.

Detailed background information for the recommended alternative can be found in Sparton's proposals dated September 18, 1996, Sparton's revised proposals dated December 7, 1996, and Sparton's revised proposals dated January 17, 1997. Copies of these proposals are included in Appendix 5. It should be noted that an application for an NPDES permit was filed on January 31, 1997, and other permits, including water rights, are being obtained. Further, proposed field work for soil gas characterization and the VES pilot test was completed in February 1997.

B. Description of the Recommended Alternative

Based on the characterization in the RFI, and subsequent confirming investigations and analyses completed to date, corrective action consisting of plume leading edge containment, a phased approach to soil vapor extraction, and expansion of the existing IM is recommended. The recommended corrective action would be supported by additional investigation/characterization consisting of additional monitor wells/piezometers, aquifer testing, and soil-gas investigation.

Plume leading edge containment would be provided by one or more extraction wells located near the leading edge of the plume. Recovered water will be air-stripped to remove VOC and discharged to the Calabacillas Arroyo. Any extraction well would be screened through the entire vertical interval of the plume as detailed in the December 6, 1996, proposal in Appendix 5, and further discussed in §VII.B.3. on page VII-10. Capture zone calculations were furnished in the September 18, 1996, proposal in Appendix 5. Containment (capture) will be demonstrated by a series of pumping tests in the installed well.

Based on current information, soil vapor extraction will be conducted, as a minimum, from installed vapor recovery well VR-1 in the closed sump area. Continuing analyses and further investigation, as necessary, will be used in a phased approach to evaluate the need for further soil vapor extraction. Details of the VES are detailed in the proposals in Appendix 5 and discussed in §VII.C.5.. Through the current date, additional vapor recovery wells have been installed, additional soil gas sampling, and VES pilot testing have been conducted as detailed in the proposals. Additional phases of investigation, and additional VES, will be utilized as necessary to reduce soil vapor concentrations to less than 10 ppm_v.

The existing IM would be expanded to include pumping from existing wells MW-32 and MW-42 and potentially wells MW-43 and MW-19 to achieve a production rate of approximately 20 gpm as detailed in the proposals in Appendix 5 and §VII.c.3.. Water will be treated in the existing onsite air stripping system. Treated water will be discharged to the Calabacillas Arroyo.

Additional monitoring/characterization of groundwater contamination would be provided by two additional non-detect monitoring wells and the containment well as detailed in the December 6, 1996, proposal in Appendix 5.

As part of this recommendation, groundwater monitoring wells at selected locations would be sampled and analyzed on a semi-annual to annual (40CFR265.92) basis to confirm plume characteristics. The results of groundwater monitoring and evaluations of any changes in land use/development would be monitored by requesting notices of proposed subdivision approvals and zoning changes within two miles of the Sparton facility be provided to Sparton. An annual evaluation would be conducted to determine the need, if any, for further corrective measure studies, based on changes in land use.

Applications for permits to drill and complete private or public drinking water wells in groundwater impacted by Sparton's operations will be monitored on at least an annual basis. Notice will be given to the State Engineer's Office of the area impacted by Sparton's operations and that Sparton should be notified in the event that any applications are received for the drilling and completion of wells within that area. Sparton will, on an annual basis, update its description of the impacted area to take into consideration any expansion or contraction of the impacted groundwater as shown by the quarterly monitoring and other data. Sparton will participate in any permit proceedings, and to the extent a permit is granted that will allow a well to be drilled in the impacted area, Sparton will undertake an additional corrective measure study to determine what response is appropriate in order to address any threat that may be presented.

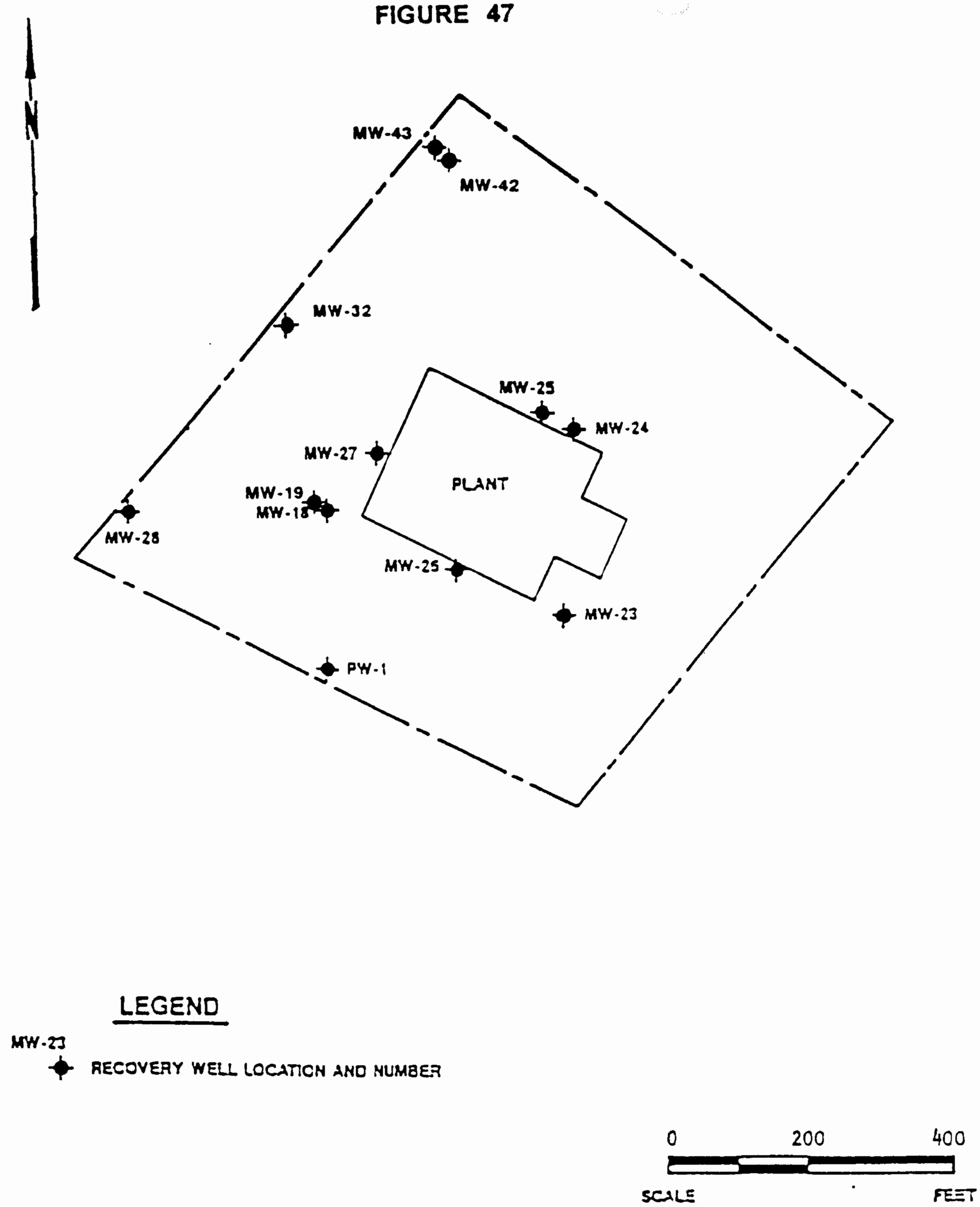
The IM consists of groundwater extraction wells and treatment in a packed tower aeration unit. The current IM groundwater recovery network is comprised of eight wells (PW-1, MW-18, MW-23, MW-24, MW-25, MW-26, MW-27, and MW-28) installed in the upper flow zone at the on-site locations shown on Figure 47 (Figure 5, Effectiveness Report). The wells are set in the upper flow zone (UFZ) with screened interval depths ranging from 60 to 78 feet below the existing ground surface. Figure 48 (Table 1, Effectiveness Report) lists the pertinent construction details for each of the eight wells.

Compressed-air-operated, positive-displacement pumps were installed at or near the bottom of each well. The compressed air is supplied by an air compressor located in the central control building. Air is pumped through piping to the well pumps and pump controllers. Four controllers are provided to control pump operations. Two pumps are controlled by each controller. Each well pump is equipped with a remote well operator to allow independent adjustment of pumping rates for each well. Each well pump discharges through flexible tubing into a common gravity drain or header. Each discharge line is equipped with a two-way sampling valve for sample collection and flow measurement.

The enhanced IM system would include pumping from onsite lower lower flow zone (LLFZ) monitoring well MW-32 and upper lower flow zone (ULFZ) monitoring well MW-42. Drilling records indicate reasonable water production can be obtained from these wells.

Well MW-32 has historically exhibited erratic and anomalously high concentrations of VOC relative to surrounding adjacent wells. Well MW-42 has also exhibited elevated concentrations of VOC. If additional extraction is needed to fully utilize the 20 gpm treatment capacity of the existing IM system, consideration will be given to including LLFZ well MW-43 and ULFZ well 19 into the enhanced IM. These wells have a history of VOC detection and should produce some quantity of water. All of these wells are located onsite and relatively close to the IM treatment unit. Well locations are shown on Figure 47 and construction details are given on Figure 48.

FIGURE 47



HDR
HDR ENGINEERING, INC.
DALLAS, TEXAS

Recovery Well Location Plan
Sparton Technology, Inc.
Coors Road Facility
Albuquerque, New Mexico

Date 8/92

Revised 3/97

FIGURE 48

IM GROUNDWATER RECOVERY NETWORK WELL CONSTRUCTION DETAILS						
Well No.	Well Diameter (inches)	Well Screen Material	Riser Material	Depth of Screened Interval (feet)	Elevation at top of Screen (ft., MSL)	Construction Date
PW-1	10	PVC (1)	PVC	60-70	4984.54	9/84
MW-18	4	PVC	PVC	68-78	4977.58	5/86
MW-19	4	SS	PVC	97-107	4949.25	5/86
MW-23	2	SS(2)	PVC	72-77	4976.51	8/86
MW-24	2	SS	PVC	68.4-73.4	4980.30	12/86
MW-25	2	SS	PVC	67.7-72.7	4981.30	12/86
MW-26	2	SS	PVC	73-78	4972.71	5/88
MW-27	2	SS	PVC	67-72	4978.50	5/88
MW-28	2	SS	PVC	65-70	4977.69	5/88
MW-32	4	SS	PVC	108-118	4940.05	6/88
MW-42	4	SS	PVC	105-115	4952.33	10/89
MW-43	4	SS	PVC	127-137	4930.74	11/89

(1) Polyvinyl chloride
(2) Stainless Steel

Groundwater extracted simultaneously at each well location is piped to an air stripper system for treatment and ultimate beneficial use in the Sparton Facility. The collection piping system consists of discharge lines encased in secondary piping to provide leak detection and containment. Figure 49 (Table 2, Effectiveness Report) describes the pumping flow rate for each recovery well as of late February 1992.

The produced groundwater is collected in a 550-gallon fiberglass-coated steel tank. The double wall tank has a leak detection system with a visual and audible alarm in the control building. A centrifugal transfer pump, which is controlled by the water level in the collection tank, transports water from the collection tank to the top of the packed tower (air stripper).

The twenty-gallon-per-minute packed tower aeration unit receives untreated water from the transfer pump and discharges to the storage tank. A 400-cfm blower provides a counter-current flow of air through the packed tower to remove volatile organic constituents (VOC) from the water. A recirculation line is provided on the packed tower discharge to allow a portion of the flow to be recirculated to the collection tank. The recirculation shortens the time between pumping cycles of the transfer pump. This procedure maintains the tower packing in a wet condition, thus improving treatment efficiency. The rate of recirculation may be adjusted by setting the butterfly valve on the recirculation line.

Effluent from the packed tower is discharged to a 15,000-gallon fiberglass-coated steel tank for storage. The double-walled tank has a leak detection system with a visual and audible alarm in the control building. Water from the storage tank is used in the main plant building as cooling and flushing water and eventually discharged into the sewer system.

FIGURE 49

CURRENT RECOVERY WELL NETWORK FLOW RATES	
Well No.	Flow Rate (gal/hr)
PW-1	3.7
MW-18	10.0
MW-23	21.3
MW-24	1.0
MW-25	1.8
MW-26	2.0
MW-27	13.4
MW-28	2.9
TOTAL	56.1

To date, approximately 3.82 million gallons of water have been treated in the packed tower. The air stripping system has demonstrated an average VOC removal efficiency of 99 percent for the measured indicators, which include 1,1-dichloroethylene (DCE), methylene chloride (MeCl), 1,1,1-trichloroethane (TCA), and trichloroethylene (TCE). Total influent concentrations have exceeded 1000 micrograms per liter (µg/l). Air stripper treatment is producing effluent concentrations in the range of one µg/l for each constituent being monitored. Demonstrated reliability and performance to date indicate a remaining useful life of at least ten years.

C. <u>Justification of Recommended Corrective Measure</u>

1. <u>Human Health/Environmental</u>

The recommended corrective actions are consistent with the requirements of 40 CFR 264.100. The RFI, and subsequently obtained data, indicates that the groundwater plume is expanding slowly to the west-northwest; however, in the majority of monitoring wells, constituent concentrations are decreasing. Highest concentrations of TCE and TCA are present in the immediate vicinity of the source at the Sparton Facility.

As previously discussed, the plume does not present a risk of injury to potential receptors and will not cause the loss of any reasonably foreseeable use of the aquifer. Therefore, neither containment of the plume nor restoration of the aquifer are necessary to achieve the corrective action objectives of implementing those measures necessary to protect public health or the environment.

Even if restoration was necessary to protect public health or the environment, which it is not, that goal cannot be achieved. Given the conditions of this site, the most reasonable technical conclusion about the effectiveness of a pump and treat remedy is that it might achieve health-based standards within hundreds of years. NMED has concurred with this conclusion. The remedy proposed in this study should achieve the same result within approximately the same time period.

2. Performance

Groundwater extraction, combined with PTA treatment, is considered a best demonstrated available technology (BDAT) for volatile organic constituents (VOC) such as TCE and TCA. Further, over 7-1/2 years successful experience with the current IM consisting of groundwater extraction and PTA treatment confirms the applicability of this technology to the Sparton site. Any containment well near the plume leading edge will be screened through the entire vertical interval of the plume to provide effective vertical capture. In addition, previous RFI pump testing and a number of recent studies/ investigations show that a single well will have horizontal capture capabilities exceeding the current width of the plume (see calculations in September 18, 1996, proposal in Appendix 5). However, horizontal and vertical capture of the containment well will be verified by extended demonstration as discussed in the proposals in Appendix 5. Long-term performance of the containment well can be monitored through the existing groundwater monitoring network.

The ability of the IM system to achieve significant reduction in contaminant concentration coupled with the location in the area of maximum constituent concentration should provide an effective source removal/groundwater remediation tool. As previously demonstrated, the IM system performance can also be easily monitored through the numerous available sampling points existing at the Sparton site.

Soil vapor extraction (SVE), using a vapor extraction system (VES), is a well-established methodology for remediating both soil-sorbed (residual NAPL) phase and groundwater-dissolved phase VOC contamination. For the subsurface conditions existing at the Sparton site, SVE would be considered a BDAT for unsaturated zone VOC remediation. SVE performance has been confirmed through recent implementation in the Albuquerque area in similar hydrogeologic conditions and by recently completed onsite pilot testing.

3. Reliability

The recommended corrective actions consists of proven, state-of-the-art technologies that have been designated BDATS. It should be noted that the IM has been operated for over 8 years without any significant difficulty or breakdown. There has been no evidence of any decrease in system performance.

SVE has been widely implemented and proven to be reliable. Components of a VES are generally "off-the-shelf" and commonly available as modular units. Operation can be easily monitored. Recently completed pilot testing confirms the applicability of the technology to this site.

4. Implementability

As detailed in the proposals in Appendix 5, groundwater extraction from a containment wells near the plume leading edge and from an expanded IM can be efficiently implemented. Air stripping to remove VOC has been demonstrated by over 8 years' experience with the IM. Discharge of the treated water to the Calabacillas Arroyo is feasible and provides for beneficial use of the water with minimal losses as compared to other disposal alternatives.

Any containment well will be installed on a developed lot to provide security for the wellhead and site screening. Treatment can be provided either at the wellhead or at the Sparton facility. Storm sewers accessing the Calabacillas Arroyo are available at both locations.

Since the IM system is already in operation, there are no implementability concerns or restrictions for the enhanced IM. Based on recent study, it is anticipated that any implementation of VES would be on-site in localized areas near the original source. The combination of on-site location and wide documented usage confirms implementability of VES. BDAT designation for technologies incorporated in the recommended alternative further confirms the implementability.

5. Summary

The recommended corrective measure alternative is a synergistic combination of proven technologies capable of containing plume movement and achieving reductions in contaminant levels in the source area and limiting, if not preventing, further migration from on-site areas in an efficient, cost-effective manner. Continued operation of the enhanced IM and implementation of SVE will meet the requirements for source control and removal and reduction of VOC in the most heavily impacted areas on-site. However, SVE implementation and continued operation of the enhanced IM will not achieve MAC/MCL within any reasonable time period. The plume containment well will also remove VOC from ground water; however, based on current rate of movement within the plume, containment will not achieve MAC/MCL within any reasonable time period. Continued monitoring over the operation period of this alternative will provide ample opportunity to assess the need, if any, for additional measures beyond the recommended system. Any new development in off-site areas will also be periodically evaluated during the operational period relative to potential receptor/exposure pathways. Any significant increase in risk or threat resultant from unexpected off-site development may require additional corrective measure studies.

APPENDIX 5

CORRECTIVE ACTION PROPOSALS

a) September 18, 1996
b) December 7, 1996
c) January 17, 1997