S. S. PAPADOPULOS & ASSOCIATES, INC.

Memorandum

Date: July 20, 1998

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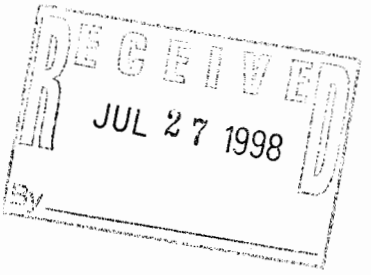

From: Stavros S. Papadopulos

Subject: **Sparton Technology, Inc., Coors Road Facility, Albuquerque, New Mexico**
Work Plan for the Assessment of Off-Site Aquifer Restoration

Enclosed please find the original of the subject Work Plan which was transmitted to you by fax earlier today.

Enclosure

cc: R. Jan Appel, Sparton
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WORK PLAN
FOR THE ASSESSMENT OF
OFF-SITE AQUIFER RESTORATION

Prepared For:

SPARTON TECHNOLOGY, INC.
Coors Road Facility
Albuquerque, New Mexico

Prepared By:

S. S. PAPADOPULOS & ASSOCIATES, INC.
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July 20, 1998

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WORK PLAN

FOR THE ASSESSMENT OF

OFF-SITE AQUIFER RESTORATION

1.0 INTRODUCTION

Sparton Technology, Inc. (Sparton) has agreed to install and test an off-site containment well near the leading edge of an off-site plume of solvents thought to be associated with past operations at its Coors Road Facility in Albuquerque, New Mexico. The installation and testing of the well will comply with the terms of the United States Department of Justice "Work Plan for the Installation of Additional Wells and Conducting a Pump Test in the Area of the Leading Edge of the Contaminant Plume Originating from the Sparton Technology, Inc. Coors Road Facility", dated June 10, 1998 (DOJ Work Plan). At the completion of the tests, Sparton will continue operating the well at a rate that will contain the off-site plume and prevent its further migration [see Work Plan for the Evaluation of the Off-Site Containment System Performance, dated July 14, 1998 (Off-Site Containment Plan)].

Sparton is also proposing to install and operate an on-site containment well immediately downgradient of its Coors Road Facility [see Work Plan for the Installation and Operation of an On-Site Containment Well, to be finalized later this month (On-Site Containment Plan)]. Groundwater pumped by the well will be treated at an on-site air-stripper and returned to the aquifer through a series of on-site infiltration ponds. This proposed well should address potential on-site sources as agreed to in the On-Site Containment Plan. Addressing on-site sources, and the containment of the

off-site plume by the capture and removal of impacted groundwater could create conditions conducive to aquifer restoration in the off-site area.

The purpose of this Work Plan is to describe the procedures that will be used to assess progress in off-site aquifer restoration, evaluate alternate remedial measures, and determine the feasibility of restoring the aquifer to beneficial use.

2.0 DATA AND MONITORING REQUIREMENTS

To assess progress in aquifer restoration, evaluate alternate remedial measures, and determine the feasibility of restoring the aquifer to beneficial use, the following data will be needed:

1. Hydrogeologic data on the lithology and stratigraphy of the aquifer, on transmissivity, recharge, water levels, and pumping rates;
2. Water-quality data from monitoring and containment wells, and/or the influent to the treatment facilities;
3. Data on the fate transport properties of the aquifer and of the constituents of concern;
4. Operational data from the containment systems; and
5. Data on alternate remedial technologies.

Data on the lithology and stratigraphy of the aquifer are available from regional studies, from reports that have been prepared on site conditions, and from the logs of wells that have been drilled at the site and its vicinity. Information on the aquifer transmissivity is available from an on-site test and additional information will be obtained from the tests that will be conducted under the terms of the DOJ Work Plan and from the effects of the continuous operation of the on-site and off-site containment systems. Information on regional recharge rates is available from regional groundwater

studies, and recharge rates from the proposed on-site infiltration ponds and the off-site infiltration gallery will be estimated as part of the evaluations to be conducted under this Work Plan.

Operational data from the on-site and off-site containment systems, data on fate and transport properties, and on alternate remedial technologies will be developed during the evaluations that will be conducted under this Work Plan.

Data on water-levels and water-quality in monitoring wells have been collected in the past under ongoing monitoring programs; these data will continue to be collected in compliance with the Ground Water Monitoring Program Plan (Monitoring Plan), to be finalized later this month (July, 1998). After the on-site and off-site containment wells begin operating, data on containment well pumping rates and water quality, and treatment plant influent and effluent quality, will also be collected in compliance with the Monitoring Plan.

3.0 ASSESSMENT OF OFF-SITE AQUIFER RESTORATION

The tasks that will be performed to assess progress in the restoration of the aquifer in the off-site area, evaluate alternate remedial measures, and determine the feasibility of restoring the aquifer to beneficial use will be:

Task 1 - Assemble and evaluate hydrogeologic data;

Task 2 - Evaluate water-quality data and assess progress in restoration;

Task 3 - Develop groundwater flow model;

Task 4 - Develop transport model;

Task 5 - Evaluate alternate remedial measures and technologies and assess feasibility of restoration; and

Task 6 - Prepare Annual Report and Corrective Measure Assessment Report.

Each of these is briefly discussed below; a schedule for their performance is presented in Figure 1.

3.1 Task 1 - Hydrogeologic Data Evaluation

Available regional and site-specific reports on the lithology and stratigraphy and the overall hydrogeologic setting of the site and its vicinity will be assembled, reviewed and evaluated to determine the conceptual framework that would be appropriate for use in developing the models needed for predicting future progress in off-site aquifer restoration and for evaluating alternate remedial measures. This task will also include the assembly of data on transmissivity, water levels, and containment well pumping rates that will be collected and evaluated under the terms of other data collection and evaluation programs (DOJ Work Plan, Monitoring Plan, Off-Site Containment Plan, On-Site Containment Plan). Operational data on the treatment systems will be evaluated to estimate recharge through the infiltration gallery and ponds. The evaluation of hydrogeologic data will be completed within the first year of off-site containment system operation, and the results will be reported in the first Annual Report. Adjustments to these results, if any, that may be indicated by subsequent data will be reported in subsequent Annual Reports.

3.2 Task 2 - Water-Quality Data Evaluation

Water-quality data from monitoring wells, from the containment wells, and/or from the influent to the treatment systems, which will be collected in compliance with the Monitoring Plan will be reviewed and evaluated. Data from monitoring wells will be used to prepare annual isoconcentration maps for constituents of concern, maps of concentration changes from the previous

year, and plots of concentration against time for wells within the off-site plume. These maps and plots will be used to evaluate spatial changes and temporal trends in the concentrations of the constituents of concern and to assess progress in the restoration process for each year.

Water-quality data from the containment wells and/or from the influent to the treatment systems will be used to calculate constituent mass removal rates. Plots of monthly removal rates for each year of operation, and of cumulative removal rates since the beginning of operations will be prepared to evaluate trends in mass removal rates.

The results of these evaluations will be annually reported in the site's Annual Report which will also include all other site-related data and evaluations.

3.3 Task 3 - Flow Model Development

A numerical groundwater flow model of the aquifer system underlying the site and its vicinity will be developed using the hydrogeologic information assembled and evaluated in Task 1. The model will be based on the MODFLOW[1] simulation code developed by the U. S. Geological Survey, and will be the basis for the subsequent fate and transport simulations discussed in the next section (Task 4). The flow model will be developed within the first year of operation of the containment systems and will be calibrated against water-level data from periods prior to and after the beginning of pumping from the off-site and on-site containment wells. The structure of the model and the results of model calibration will be reported in the first Annual Report of the site. Further

[1]McDonald, M. G. and A. W. Harbaugh, 1988, **A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model**: Techniques of Water Resource Investigations of the U. S. Geol. Survey, Book 6, Chapter A1.

adjustments to the flow model may have to be made in subsequent years if the data so indicate; such adjustments, if any, will be reported in the Annual Report for the year during which they were made.

3.3 Task 4 - Transport Model Development

The calibrated groundwater flow model developed in Task 3 will be coupled with the solute transport simulation code MT3D[96][2] to develop a model capable of simulating the migration of constituents of concern in the aquifer underlying the site. These simulations will initially limited to trichloroethylene (TCE) the most dominant constituent in the off-site are; however, other constituents may also be considered for simulation in later years if warranted by the evaluations of progress in aquifer restoration. Initial estimates of the transport parameters for the model will be based on data available in the literature for aquifer materials similar to those underlying the site. TCE concentrations detected prior to the operation of the off-site containment well will be input into the model as initial concentrations and the model will be operated to simulate the effects of the on-site and off-site containment wells and predict spatial and temporal changes in concentration. Model predicted concentrations and changes in concentration will be compared to actual data from the site, and adjustments to transport parameters will be made to minimize the difference between the computed and observed results.

Development of the transport model will begin during the first year of operation of the off-site and on-site containment systems. It is estimated that the development of the flow model and the initial development of the transport model can be completed within four months. The process of

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[2]S. S. Papadopulos & Associates, Inc., 1996, "**MT3D[96]: A Modular Three-Dimensional Transport Model for Simulation of Advection, Dispersion and Chemical Reactions of Contaminants in Ground-Water Systems**: Documentation & Input Instructions.

aquifer restoration, however, is slow and significant changes in constituent concentrations are not be expected to occur within short periods of time. It is expected that at least four years of water-quality data would be required to develop a transport model that can be used with a certain degree of reliability to predict future progress in aquifer restoration and to evaluate alternative groundwater extraction measures.

Progress in the development of the transport model, including predictions on water-quality conditions at the end of the second year of containment system operation, will be reported in the first Annual Report of the site. At the end of the second year, actual conditions will be compared to the predicted conditions, and adjustments to the model and model parameters will be made as necessary; predictions will again be made for conditions at the end of the next year. This process will be repeated at the end of the third and fourth year and the results will be reported in the Annual Report of each year. It is anticipated that at the end of the fifth year the model should be adequately reliable for making long-term predictions on the progress of aquifer restoration and for evaluating alternate remedial measures involving groundwater extraction.

3.5 Task 5 - Alternate Remedial Measures Evaluation

If at the end of the fifth year of containment system operation, the model is deemed capable of making reliable predictions of future conditions, it will be used to evaluate whether restoration is technically practicable within a reasonable time period. If restoration is practicable, further evaluation will be conducted to determine whether the process can be cost-effectively accelerated. In evaluating acceleration possibilities, groundwater extraction alternatives will be evaluated, as well

as innovative remedial technologies, such as bioremediation and other technologies that may be available at that time for the remediation of groundwater impacted primarily by TCE.

The results of this evaluation, including the complete documentation of the flow and transport models, will be presented in a Corrective Measure Assessment Report. It is anticipated that this evaluation, including the preparation of a Draft Report for regulatory review and of the Final Report, should take six months.

3.6 Task 6 - Report Preparation

Reference has been made to the site's Annual Report in this Work Plan and in both the Off-Site Containment Plan and the On-Site Containment Plan. The purpose of this Annual Report will be to present within a single report all data that have been collected during each year of containment system operation and any data interpretations and evaluations that have been conducted during the year. The information to be presented in the Annual Reports will include the following:

- Background information on the site and a brief description of the remedial measures that have been implemented;
- Operational data on the containment and treatment systems; hours of operation versus hours available during the year; problems and their resolution;
- Containment well flow rates; treatment system influent and effluent rates;
- Water-level data from monitoring, containment and observation wells;
- Water-quality data from monitoring and containment wells, and from the influent and effluent to the treatment systems;
- Plots of monthly extraction rates and of cumulative volume of water pumped;

- Evaluation of water-level data; maps showing water levels and the capture zone of containment well and interpretation of these maps with respect to containment system performance;
- Plots of monthly mass removal rates and of cumulative removal of constituents of concern;
- Isoconcentration and change in concentration maps for constituents of concern; plots of constituent concentration against time in monitoring wells; interpretation of these maps and plots with respect to progress in remediation;
- Compliance with site permits; problems, if any, and their resolution;
- Summary of contacts during the year with representatives of the local community, public interest groups, and state and federal parties; and
- Conclusions and plans for next year.

During the first five years of operation, the Annual Reports will also include information in progress on transport model development and model predictions for the next year.

The results of the evaluations conducted to assess progress in off-site aquifer restoration, evaluate alternate remedial measures, and determine the feasibility of restoring the aquifer to beneficial use, as described in this Work Plan, will be presented in a Corrective Measure Assessment Report to be prepared after the completion of the fifth year of operation. A draft of this report will be prepared within three months after completion of the fifth year for agency review. The report will include the following:

- Summary of progress in off-site aquifer restoration during the last five years;
- Documentation of the flow and transport models developed for the site;

- Predicted future progress in restoration with the existing containment systems, and discussion of the feasibility of restoration within a reasonable time period;
- Evaluation of alternate remedial systems involving groundwater extraction and discussion of their cost-effectiveness in accelerating aquifer restoration;
- Evaluation of alternate technologies and discussion of their applicability to off-site aquifer restoration; and
- Conclusions and recommendations for future actions.

FIGURE 1 - WORK PLAN SCHEDULE