STREAMLINED REMEDIATION SYSTEM EVALUATION (RSE-LITE) FOR A GROUND WATER PUMP AND TREAT SYSTEM

CHEMKO TECHNICAL SERVICES, INC. FACILITY
MIMS, FLORIDA

SUBMITTED:

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EXECUTIVE SUMMARY

A Streamlined Remediation System Evaluation (RSE-Lite) involves a team of expert hydrogeologists and engineers, independent of the site, conducting a third-party evaluation of a ground water pump and treat system or other remedy of environmental contamination. It is a broad evaluation that considers the goals of the remedy, site conceptual model, above-ground and subsurface performance, and site exit strategy. The evaluation includes reviewing site documents, communicating with the site team, and compiling a report that includes recommendations to improve the efficiency and effectiveness of the remedy. Recommendations with cost and cost savings are provided in the following four categories:

- Improvements in remedy effectiveness
- Reductions in operation and maintenance costs
- Technical improvements
- Gaining site closeout

The recommendations are intended to help the site team identify opportunities for improvements. In many cases, further analysis of a recommendation, beyond that provided in this report, may be needed prior to implementation of the recommendation. Note that the recommendations are based on an independent evaluation by the RSE-lite team, and represent the opinions of the RSE team. These recommendations do not constitute requirements for future action, but rather are provided for the consideration of all site stakeholders.

The Chemko Technical Services, Inc. Facility ("Chemko") is a RCRA Corrective Action facility. The site was nominated based on the ongoing ground water remedy and the impact to nearby receptors.

Identification of the Chemko facility as a RCRA corrective action site is relatively recent and initial site assessment was completed in 2003. The ground water contaminant plume consisting of tetrachloroethene (PCE) and its breakdown products has migrated beyond the property boundary and has impacted a domestic drinking water well. An interim measure pump and treat (P&T) system was installed for source control on the Chemko property in 2004. Monitored natural attenuation (MNA) has been selected as the interim remedy for the downgradient plume.

An initial review of the P&T system suggests that the average pumping rate is sufficient for source control, but additional evaluation based on future potentiometric surface maps and concentration trends should be performed to confirm this preliminary finding.

The recommendations provided by the RSE-lite team focus on improving remedy protectiveness, reducing system cost, and site closure. The recommendations pertaining to improving system protectiveness involve further evaluation of source control provided by the P&T system, further evaluation of the effectiveness of MNA for the downgradient plume, tracking the potable well sampling results, and considering the potential for vapor intrusion at nearby residences. The recommendations pertaining to reducing system costs include a suggested cost-effective monitoring and reporting program that should provide the necessary data for evaluating source

control and MNA. One recommendation is provided that pertains to remedy progress and site closure. It recommends that the site team evaluate the interim remedy for a three year period to determine if the interim remedy is appropriate as a final remedy.

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1.0 INTRODUCTION

1.1 PURPOSE

In 2003 and 2004, the EPA Corrective Action program and the EPA Office of Superfund Remediation and Technology Innovation (OSRTI) sponsored independent optimization evaluations called Remediation System Evaluations (RSEs) at five RCRA sites with pump and treat (P&T) systems. These RSEs involved an independent team of experts reviewing site documents, interviewing site stakeholders, and providing recommendations for improving remedy effectiveness, reducing costs, and gaining site closure.

A RSE involves a team of expert hydrogeologists and engineers, independent of the site, conducting a third-party evaluation of site operations. It is a broad evaluation that considers the goals of the remedy, site conceptual model, above-ground and subsurface performance, and site exit strategy. The evaluation includes reviewing site documents, visiting the site for 1 to 1.5 days, and compiling a report that includes recommendations to improve the system.

Based on the positive results of these RSEs, EPA Technology Innovation Field Services Division (OERR) and the Office of Solid Waste (OSW) have commissioned a new pilot study that involves developing and piloting a streamlined RSE process that reduces the cost relative to a full-scale RSE based on the consideration that many sites do not require a full-scale RSE and a streamlined RSE will provide same level of beneficial results for those sites with the reduction of cost. This streamlined RSE or "RSE-lite" evaluation includes reviewing site documents, conducting conference calls with the site team, and compiling a report of recommendations.

For this new pilot study, up to five RCRA Corrective Action facilities with operating remedies have been selected to receive RSE-lites. The site managers have been asked to provide site documents for review by the RSE-lite team. After reviewing the documents for each site, the RSE-lite team has a conference call with the site managers to learn more about the site and to fill in information gaps not covered by the documents. As part of this streamlined effort, no site visit is conducted.

This RSE-lite report for the Chemko Technical Services, Inc. facility ("Chemko") is one of the RSE-lite reports from this new pilot study. Chemko was nominated by EPA OSW based on a nomination from EPA Region 4 and the Florida Department of Environmental Protection (FDEP). The report consists of the following elements:

- A brief summary on site history, site conceptual model, ground water remedial system, remedy goals, and costs

- Recommendations to improve remedy effectiveness and efficiency of the operating pump and test system (an interim remedy that is only one component of the site-wide remedy)

1.2 RSE-LITE PROCESS

Once a site is selected, a representative of the RSE-lite team contacts the site project manager to obtain site documents for review. The documents typically include information pertaining to site investigations, remedy design, and remedy operations and maintenance (O&M). Upon reviewing this information, the RSE-lite team conducts a conference call with the remedy project manager to address questions that may have arisen as part of the document review or other information gaps. Based on the site documents and the information from communications with the site project manager, the RSE-lite team prepares a short report documenting recommendations for improving efficiency and effectiveness. The text of the RSE-lite report includes a brief background of the site, series of findings from the document review and conference call, site-specific recommendations, and a cost summary table summarizing estimated costs and cost savings associated with implementing each recommendation.

1.3 PARTICIPANTS ON RSE-LITE CONFERENCE CALL

The following individuals participated in the conference call as part of RSE-lite:

- Dot Jones, Chemko Technical Services, Inc.
- Mark Nozokowsky, Nelson Egineering Corporation (contractor to Chemko)
- Doug Outlaw, FDEP
- John White, FDEP
- Kim Katonica, EPA OSW
- Ellen Rubin, EPA OSRTI
- Doug Sutton, GeoTrans, Inc.
- Peter Rich, GeoTrans, Inc.
- Yan Zhang, GeoTrans, Inc.

1.4 DOCUMENTS REVIEWED

The following documents were reviewed as part of this RSE-lite:

- Ground Water Monitoring Plan (OGC File No. 00-2301), Nelson Engineering Co., April 11, 2001

- Contamination Assessment & Closure Plan (OGC File No. 00-2301), Nelson Engineering Co., April 11, 2001

- Contamination Assessment & Closure Plan (OGC File No. 00-2301), Nelson Engineering Co., April 11, 2002

- Sample results for portable wells around Chemko, Brevard County, June 25, 2002

- Letter of proposed assessment methodologies for revised SWMU's, December 6, 2002

- FDEP Comments on Chemko Letter “SWMU Designation & Additional Assessment” dated December 6, 2002, January 29, 2003

- Interim Measures Plan (OGC File No. 00-2301), Nelson Engineering Co., April 2, 2003

- 2nd Addendum Contamination Assessment & Closure Report (OGC File No. 00-2301), Nelson Engineering Co., January 20, 2004

- Interim Measures Plan (OGC File No. 00-2301), Nelson Engineering Co., November 25, 2004

2.0 BACKGROUND

2.1 SITE HISTORY

The Chemko Technical Services, Inc. (Chemko) facility is located at 5325 North U.S. Highway 1 in Mims, Florida. Chemko purchased the property in 1972. Prior to Chemko's purchase, the facility had been used for fiberglass fabrication as well as heavy equipment repairs. Operations at the Chemko site historically, and currently, consist of metal fabrication and cleaning.

Assessments completed in 1996 and 1997 did not reveal any soil or ground water contamination concerns, but complaints from nearby residences in 1998 led to sampling of 10 nearby potable wells. Chlorinated compounds above standards were detected, and an investigation was conducted between April and December 1999. Based on the results of investigation, Chemko entered into a Consent Order with FDEP on February 27, 2001 in order to further determine the source and extent of contamination and provide the necessary closure and cleanup.

A series of site assessment activities were conducted beginning in 2001, which included drain system delineation, a soil vapor study, geologic borings, monitoring well design and installation, ground water sampling, and surface water sampling. Identification of the Chemko facility as a RCRA corrective action site is relatively recent and initial site assessment was completed in FY 2003. An interim measure P&T system was installed in the source area in FY 2004 and started operation in August 2004.

2.2 SITE CONCEPTUAL MODEL

Source Area and Contaminants of Concern

The former drain, drain field, and PCE storage tank area have been determined to be on-site contaminant sources for the ground water contamination. The primary ground water contaminants consist of tetrachloroethene (PCE) and the PCE degradation products trichloroethene (TCE) and cis-1,2-Dichloroethene (DCE). Vinyl chloride has not been detected in ground water, but has been detected in surface water at concentrations ranging from 3.1 ug/L to 46 ug/L. Acetone has been detected in two monitoring wells near the source area. Based on ground water monitoring, PCE contamination appears to be limited to the Chemko property. However, TCE and DCE are present downgradient of the property. Figures generated by the site contractor are attached at the end of this report. Figure 1 illustrates monitoring well locations and provides a contaminant concentration map (plan view) with results from sampling conducted between December 2001 and July 2002. A PCE plume distribution map (cross section) is presented as Figure 2.

The facility and the State agree that the sources of contamination have been fully addressed, and no further investigation activities are planned. The drain and drain field were excavated. No soil

around the PCE storage tank was excavated, but it is believed that the contamination has already migrated to ground water and the soil no longer acts as continuing source. The facility believes there is a possibility that the original contamination resulted from activities prior to Chemko's operation.

The highest contaminant concentrations detected between December 2001 and July 2002, are listed in the following table. Sampling during this time period at various wells was conducted in December 2001, January 2002, March 2002, and July 2002. No routine ground water monitoring data was collected and documented for 2003 and 2004.

Concentration	PCE (ug/L)	TCE (ug/L)	Cis-1,2-DCE (ug/L)	Acetone (ug/L)
Shallow Zone	1500	530	190	1100
Intermediate Zone	8400	1300	30	< 50
Deep Zone	18	3	< 1	120

** All zones pertain to the surficial aquifer*

Hydrogeology

The regional hydrogeologic units include a surficial aquifer, an intermediate confining unit, and the Floridan aquifer. Site activities are limited to the surficial aquifer, which has been divided into the following three zones for site characterization and monitoring:

- The shallow zone extends from 0 to 14 feet below ground surface and is comprised of fine to coarse sand with some silty sand. The shallow zone is screened by site wells with an "A" suffix (e.g., MW-1A). The horizontal hydraulic conductivity for this zone has been estimated at approximately 40 ft/day.

- The intermediate zone extends from 14 to 50 feet below ground surface and is also comprised of fine to coarse sand with some silty sand. The intermediate zone is screened by site wells with a "B" suffix (e.g., MW-1B). The horizontal hydraulic conductivity for this zone has been estimated at approximately 18 ft/day.

- The deep zone extends from 50 to 75 feet below ground surface and is comprised of sandy shell beds with varying amounts of clay. The deep zone is screened by site wells with a "C" suffix (e.g., MW-1C). The horizontal hydraulic conductivity for this zone has been estimated at approximately 2 to 3 ft/day.

Ground water flow direction at the site is northwest. Vertical gradients are downward near the facility (presumably due to deep supply well pumping) and are upward downgradient of the facility.

Potential Receptors

Six potable wells are located in the vicinity of the site, and one of those potable wells has detections of site-related contamination with 7 ug/L of TCE and 3 ug/L of cis-1,2-DCE (March 2002 sampling event). Another well has detections of trihalomethanes that appear to be

unrelated to the site. The sampling of the residential wells in the vicinity of the property is conducted by the Department of Public Health. The sampling frequency of the residential wells is not documented; however, the typical procedure in Florida is for annual monitoring. The impacted residential well has a point of entry treatment (POET) system installed to remove the site-related contaminants. Maintenance of the POET system is provided by the Department of Public Health.

2.3 GROUND WATER REMEDIAL SYSTEM

The ground water remedial system was installed on August 20, 2004 and started operation on August 30, 2004. The ground water remedial system consists of following components:

- Six recovery wells comprised of three bi-clusters each fitted with submersible compressed air-driven pumps to remove contaminated ground water
- A low-profile air stripper (located outside) to remove VOCs
- An infiltration gallery to receive the treated ground water

Three of the recovery wells, RW-1A, RW-2A, and RW-3A are shallow wells (approximately 15 to 25 feet below the land surface), and the other three recovery wells, RW-1B, RW-2B, and RW-3B are deeper wells, screened in the intermediate zone (approximately 30 to 40 feet below land surface). The designed pumping rate is 60 gpm with 10 gpm from each recovery well. However, the actual instantaneous extraction rate is approximately 5 gpm per well (30 gpm total) because the wells are throttled back. In addition, because the system operates only 8 hours per day, the average system rate is 10 gpm.

The infiltration gallery is located sidegradient of the extraction well network. It is 75 feet by 25 feet in horizontal dimensions and is 5 feet deep.

2.4 REMEDY GOALS

The current remedial goal is source control with monitored natural attenuation (MNA) for the downgradient plume. The ground water cleanup criteria, along with State natural attenuation criteria, for the primary contaminants of concern are listed below.

Contaminants	Ground Water Cleanup Target Level (ug/L)	Natural Attenuation Criteria (ug/L)
PCE	3	300
TCE	3	300
Cis-1,2-DCE	70	7000
Acetone	700	40

2.5 LEVEL OF EFFORT AND COSTS

Site activities include system O&M, ground water sampling, and process water sampling plus project management and reporting. System O&M is provided by the facility foreman within his typical workday. Ground water sampling is conducted quarterly from all wells, and process sampling of influent and effluent is conducted monthly. Project management and reporting may be reduced moving forward. The operation and maintenance (O&M) costs are estimated below:

Cost Category	Costs ($/year)
Project Management and Reporting [1]	$6,000
Utility [2]	$3,000
Operator Labor [3]	$0
Sampling Labor/Equipment [4]	$12,000
Laboratory Analytical [5]	$22,000
Process Monitoring [6]	$3,250
Total	**$50,250**

Notes:

1. If it is continued to be provided by an outside contractor, the current site contractor estimates that it would cost approximately $500 per month.
2. Utility cost is estimated based on $250 per month provided by the site team
3. The operator labor cost negligible because the site foreman is able to accomplish the required tasks within his typical work day. His estimated level of effort for system O&M is approximately 0.5 to 1 hours per day.
4. The labor cost for quarterly ground water sampling is estimated at $3,000 per event (including labor and equipment), assuming each event requires three days.
5. Analytical cost is estimated based on quarterly sampling at 48 monitoring wells, 6 recovery wells, and some QA/QC samples at an approximate cost of $90 per sample.
6. Process monitoring cost is estimated based on monthly sampling of influent, effluent, and one QA/QC sample for $90 per sample.

3.0 RSE-LITE FINDINGS

In general, the RSE-lite team found an efficiently operated P&T system. The system had been operating for approximately six months at the time the RSE-lite was conducted. It was operating as an interim remedy, and the site team was interested in the RSE-lite team's opinion as to the effectiveness of the remedy and its potential viability as an interim remedy. The findings indicated below are not intended to suggest a deficiency in the remedy design or operation. These findings have the benefit of operating data that was not available to the site team during design. These findings are not intended to suggest requirements for the site. Rather, these findings are the opinions of a third-party evaluation team and are only provided for consideration by the site team.

3.1 FINDINGS PERTAINING TO REMEDY PROTECTIVENESS

- The remedy calls for P&T to control the source and MNA to address the downgradient portion of the plume. However, the degree of source control (i.e., hydraulic containment) by the P&T system has not been fully evaluated. The system design included an extraction rate of 60 gpm, and the average actual extraction rate is closer to 10 gpm, but it is unclear what the site team used as a basis for the original 60 gpm estimate. That original estimate may have been overly conservative.

  An appropriate first step in evaluating plume capture is conducting a ground water flow rate analysis to compare the amount of contaminated water flowing through a plume width and the amount of water extracted from the site. In general, for complete hydraulic containment the amount of water extracted should be greater than the amount of contaminated ground water flowing through the plume width. A general rule of thumb is 1.5 times greater, but this factor depends on site-specific factors. The formula for a ground water flow rate analysis is as follows:

$$Q = K \times (b \times w) \times i \times \textit{factor}$$

  Where
  Q = pumping required
  K = hydraulic conductivity
  b = saturated aquifer thickness
  w = plume width
  i = horizontal hydraulic gradient
  factor = assumed to be 1.5 for an initial estimate

  For this calculation, only the shallow and intermediate zones are considered because the contamination has generally not reached the deep zone, the extraction wells are only located in the shallow and intermediate zones, and the deep zone has the lowest hydraulic conductivity value. The *Contamination Assessment & Closure Report* (April 11, 2002*),* provides estimates for the horizontal hydraulic gradients and horizontal hydraulic conductivities for the shallow, intermediate, and deep zones of the surficial aquifer. The

average horizontal gradient is 0.00522 for the shallow zone and 0.00531 for the intermediate zone. The average horizontal hydraulic conductivity is approximately 40 ft/day for the shallow zone and approximately 18 ft/day for the intermediate zone. The aquifer saturated thicknesses are about 10 feet for the shallow zone, 36 feet for the intermediate zone. Site figures suggest that the plume width is approximately 100 feet wide in the vicinity of the extraction wells.

Based on these values and the above equation, the RSE-lite team estimates that approximately 1.1 gpm is flowing horizontally through the shallow zone and approximately 1.8 gpm is flowing horizontally through the intermediate zone. In total, this simple calculation suggests that approximately 2.9 gpm is flowing horizontally through the plume width. As a result, the average pumping rate should be approximately 4.5 gpm (2.9 gpm × 1.5) to control horizontal migration.

Site monitoring data suggest limited or no contamination in the deep zone, and the RSE-lite team agrees with the conceptual model depicted in the site cross-sections, which indicates that site-related contamination remains primarily in the shallow and intermediate zones. However, the RSE-lite team believes that this conceptual model should be confirmed on a routine basis through additional monitoring.

This ground water flow rate calculation includes many simplifying assumptions and should not be used as the sole piece of evidence in evaluating plume capture. It does, however, indicate that the average actual extraction rate of 10 gpm is likely appropriate. Concentration trends, potentiometric surface maps, and ground water modeling can also be helpful in evaluating capture. The RSE-lite provides additional information on plume capture in the Recommendations Section of this report.

- The degree of MNA has not been fully evaluated. However, it is apparent that degradation is occurring based on the limited areal extent of the PCE plume and the presence of both TCE and DCE.

- Two residential properties are located within the plume area, and one of the residences has well that is impacted with site-related contaminants. It is unclear if these residences have been evaluated for potential vapor intrusion impacts.

- The site team does not conduct the annual sampling of the potable wells in the area. The sampling is conducted by the Department of Public Health. The degree of expected future coordination between the Department of Public Health and the site team was not discussed.

3.2 FINDINGS PERTAINING TO COST-EFFECTIVENESS

The facility is able to operate the P&T system cost effectively. The highest costs associated with the site are for ground water sampling (labor and analytical) and the analytical costs for the process water. The costs for these categories are not unreasonable, they are just the highest cost categories of this relatively inexpensive remedy. The remedy has only been operating for

approximately 6 months, and the site team has not determined the frequency or content for future progress reporting.

3.3 FINDINGS PERTAINING TO REMEDY PROGRESS AND SITE CLOSURE

The current remedy is an interim remedy, and the site team is interested in the RSE-lite team's opinion as to the viability of this interim remedy to serve as a final remedy.

4.0 RSE-LITE RECOMMENDATIONS

4.1 RECOMMENDATIONS TO IMPROVE SYSTEM PROTECTIVENESS

4.1.1 Evaluate Source Control Provided by the P&T System

The water budget analysis suggests that the current average extraction rate is likely sufficient for source control; however, this water budget analysis involves a number of simplifying assumptions. The RSE-lite team therefore recommends further evaluating the degree of source control by monitoring concentration trends in key wells and preparing and evaluating potentiometric surface maps. Sections 4.2.1 and 4.2.2 provide the RSE-lite team's recommendations with regard to monitoring and reporting. More information on monitoring and potentiometric surface maps as they pertain to source control is provided in these two sections. There are no estimated costs or cost savings associated with this specific recommendation.

4.1.2 Evaluate the Degree of Monitored Natural Attenuation

The limited extent of the PCE plume and the presence of TCE and DCE suggest the potential for contaminant degradation, but the RSE-lite team recommends additional monitoring and evaluation to determine the effectiveness of an MNA remedy for the downgradient plume. Sections 4.2.1 and 4.2.2 discuss the RSE-lite team's recommendations for monitoring and reporting and include information on evaluating the effectiveness of the MNA remedy for the downgradient plume.

4.1.3 Track Results of Potable-Well Sampling Conducted by Dept. of Public Health

Although the Department of Public Health will reportedly conduct the annual sampling of the potable wells in the area, the site team should track the sampling results. The results provide useful data on the effectiveness of the both the source control and natural attenuation aspects of the remedy. By tracking the results, the site team will be aware if there are shortcomings in the remedy's ability to protect human health. Furthermore, the site team will be aware if there are gaps or missed sampling events. This effort may require a few hours of time each year and could be coordinated with the site reporting (see Section 4.2.2).

4.1.4 Consider the Potential for Vapor Intrusion at the Residences Located within the Contaminant Plume

Two of the residences noted in Figure 1 (attached at the end of this document) are located within the estimated extent of the downgradient contaminant plume. Given that relatively shallow ground water is contaminated, the site team should consider the potential for vapor intrusion at these two residences. The site team may begin by determining if the residences have basements or sumps that may increase the likelihood of vapor intrusion. In addition, the site team should consider the depth to ground water and the level of contamination. If these initial considerations suggest the possibility of vapor intrusion, the site team should likely consider taking indoor

vapor samples from these residences. Additional vapor samples may also be appropriate if the contaminant concentrations in shallow ground water near the residences increase as the plume continues to migrate. Based on site figures, MW-7A, MW-12A, and MW-14A appear to be the most appropriate wells to monitor with regard to vapor intrusion at these residences. Based on the reported site costs, a preliminary evaluation of the two residences and vapor samples from each residence might cost $2,000 for a single event, including the analytical costs.

4.2 RECOMMENDATIONS TO REDUCE SYSTEM COST

4.2.1 Monitor Concentrations at Select Monitoring Wells Routinely

It is recommended that the site team monitor concentrations in select monitoring wells over time. The following monitoring program is recommended for consideration by the RSE-lite team based on a qualitative assessment of the site data. The plume map and cross-section prepared by the site contractor (attached at the end of this document) indicate the locations of monitoring well clusters and the representative depths of well clusters.

- The following wells are located side-gradient of the plume and have had undetectable (or very low) concentrations of site-related contaminants. The RSE-lite team recommends sampling them annually for three years. If they continue to have undetectable concentrations, the site team could consider removing them from the sampling program, or further reducing the sampling frequency to once every two years.

    - BW-1A,B,C
    - MW-4A,B,C
    - MW-5A,B,C
    - MW-6A,B
    - MW-8A,B,C
    - MW-13A,B

- The following wells are located adjacent to extraction wells and are redundant sampling points. The RSE-lite team suggests removing these from the VOC sampling program (but continuing to use them for measuring water levels).

    - MW-1A,B
    - MW-3A,B
    - MW-15A,B1,B2

- The RSE-lite team believes the following wells are important for evaluating source control. It is recommended that they are sampled quarterly for one full year of P&T system operation and that the frequency is reduced to semi-annual thereafter.

    - MW-1C
    - MW-2A,B
    - MW-3C
    - MW-7A,B,C

- MW-9A,B,C
- MW-15C

If source control is adequate, then the contaminant concentrations in these wells should either remain undetectable or should decrease to undetectable levels over time. It should be noted, however, that there may be contamination between the RW-3 cluster and the MW-7 cluster such that concentrations at MW-7 may continue to increase even though the RW-3 cluster is effectively controlling contamination that remains upgradient of it. After a number of years of semi-annual sampling (perhaps three to five years), the site team may determine that annual sampling is sufficient.

- The RSE-lite team believes that the following wells are important for evaluating the MNA remedy for the downgradient portion of the plume. It is recommended that they be sampled quarterly for one full year and that the frequency be reduced to semi-annual thereafter. After a number of years of semi-annual sampling (perhaps three to five years), the site team may determine that annual sampling is sufficient.

    - MW-10A,B,C
    - MW-11A,B,C
    - MW-12A,B
    - MW-14A,B
    - All potable wells in the area (will reportedly be sampled by the Department of Public Health)

- The RSE-lite team also recommends sampling each of the six recovery wells annually.

- Water levels should be measured and recorded for each well during each sampling event. Even if a particular well is sampled annually or has been removed from the sampling program, the water level should still be measured and recorded for every well during each sampling event. That is, if MW-4A is sampled annually (or is even removed from the sampling program altogether) and MW-12A and other wells are sampled semi-annually, the water level in MW-4A should be measured and recorded semi-annually.

Based on this sampling program, the number of samples per year will decrease from approximately 240 samples each year (16 monitoring wells and 6 recovery wells sampled quarterly plus QA/QC samples) to approximately 70 samples each year. This should reduce annual sampling labor costs to approximately $5,000 from $12,000 and analytical costs from $22,000 to approximately $7,000 per year while maintaining an appropriate monitoring program for evaluating remedy performance.

4.2.2 Prepare Annual Progress Reports

Although data will be collected quarterly through much of 2005 and semi-annually for a number of years thereafter, the RSE-lite team believes that annual reporting is sufficient. With respect to figures, the annual reports should include updated plume maps and cross-sections similar in nature to those previously developed for the site. In addition, the reports should include potentiometric surface maps. The RSE-lite team cautions that the water levels from operating

recovery wells should not be used when developing potentiometric surface maps because they over estimate the degree of drawdown due to well inefficiencies and/or well losses. Rather, the use of water levels from nearby monitoring wells is more appropriate. With respect to tables, the reports should include current and historic sampling data so that trends can easily be determined by looking at the most recent report. In some cases, it may be appropriate to include concentration trend plots for certain monitoring wells. Tables should also be used to report well construction information for the monitoring and recovery wells. Tables should also be used to document extraction rate, uptime, and the influent and effluent concentrations of the treatment system for the current and historic reporting periods.

The report text should evaluate source control and MNA effectiveness based on the data depicted in the figures and reported in the tables.

The RSE-lite team believes that this annual reporting is a cost-effective method of evaluating and tracking the remedy progress. The report may be more detailed than the reports currently produced within the $6,000 per year project management and reporting costs in Section 2.5, but the reporting frequency is likely lower. Therefore, the RSE-lite team assumes that the reporting described in this recommendation can be accomplished within the indicated $6,000 per year (i.e., for this recommendation, there is no estimated change in annual costs relative to those indicated in Section 2.5 of this report).

4.3 RECOMMENDATIONS PERTAINING TO REMEDY PROGRESS AND SITE CLOSURE

4.3.1 Evaluate Interim Remedy for Three Years

Based on the information provided, the RSE-lite team recommends continuing the current interim remedy and evaluating its performance over a three-year period. An initial evaluation of source control with a ground water flow rate analysis suggests that the P&T system extraction rate is sufficient. Additionally, the limited extent of PCE and the presence of TCE and DCE suggest that natural degradation is occurring and that MNA may be an appropriate remedy for the downgradient plume. The RSE-lite team, however, recommends that additional data be evaluated to confirm these preliminary conclusions. The system has only operated for approximately six months, and the RSE-lite team believes that data collected over the next three years will help with this confirmation. Therefore, unless there are time constraints on declaring a final remedy, the RSE-lite team suggests following the above-indicated monitoring and reporting program for three years to determine the effectiveness of the current interim remedy. If it effectively controls the source area and the downgradient plume shows continued signs of attenuating, then the remedy could likely be declared a final remedy. If there is a time constraint and the site team cannot wait three years to evaluate the plume, the site team could either attempt to evaluate the remedy with less data (e.g., two years of data instead of three) or, more appropriately, the site team could develop a ground water model to help evaluate source control and a transport model to evaluate the effectiveness of natural attenuation. Such modeling efforts, however, would represent significant additional costs to the site (perhaps on the order of $25,000 or more depending on the level of complexity).

If evaluation suggests that the current remedy is not sufficiently controlling the source area, the most straightforward option would be to run the P&T system continuously during the week. The only additional cost would be the incremental cost of electricity for operating the pumps and blower over night. If evaluation suggests that MNA is not effective for the downgradient portion of the plume, the site team will need to consider other options. The most straightforward would be nutrient injection to enhance degradation; however, with the potable wells nearby, nutrient injection may not be appropriate.

Recommendation Cost Summary Table

Recommendation	Reason	Estimated Additional Capital Costs ($)	Estimated Change in Annual Costs ($/yr)
4.1.1 Evaluate source control provided by the P&T system	Protectiveness	Not quantified	Not quantified
4.1.2 Evaluate the degree of monitored natural attenuation	Protectiveness	Not quantified	Not quantified
4.1.3 Track results of potable-well sampling conducted by the Department of Public Health	Protectiveness	Not quantified	Not quantified
4.1.4 Consider the potential for vapor intrusion at the residences located within the contaminant plume	Protectiveness	$0	$2,000 [1]
4.2.1 Monitor concentrations at select monitoring wells routinely	Cost Reduction	$0	($22,000)
4.2.2 Prepare annual progress reports	Cost Reduction	$0	$0
4.3.1 Evaluate interim remedy for three years	Closeout	$25,000[2]	$0

Costs in parentheses imply cost reductions.

1. Estimated cost is for a single event
2. Estimated cost is for development of a ground water model

FIGURES*

** Prepared by the site contractor and included for reference*

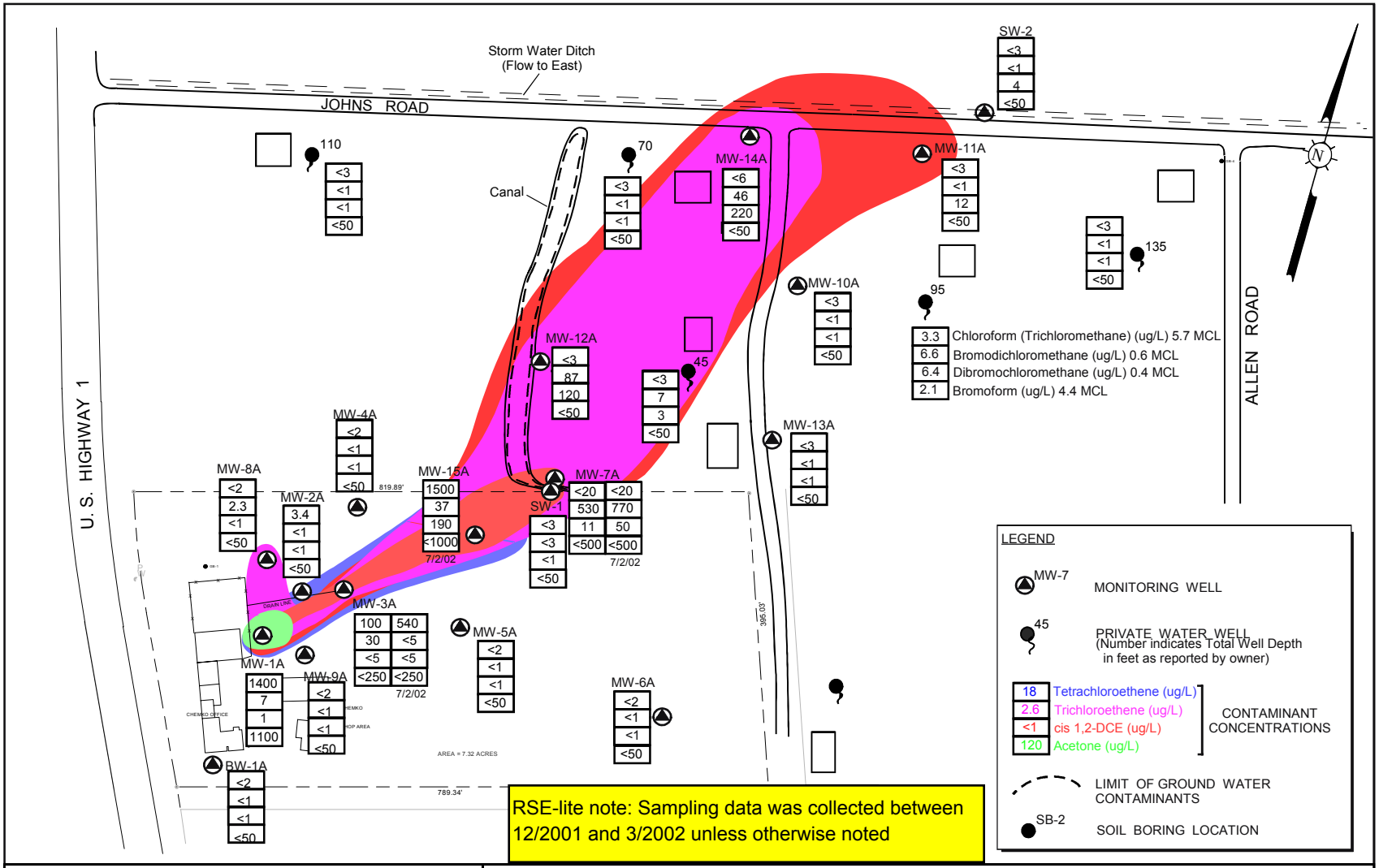

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Figure 1. Contaminant Concentration Map - Shallow Zone (8 to 13 feet NGVD)

0 100 200 FEET
SCALE

Chemko Facility
Mims, Florida

Customer: Chemko Technical Services, Inc.	Engr: Novokowsky/Nelson	
Date: 28 Mar 2002	Dwg No: IND-117-CACR-007	Rev: 7/15/02
	Scale: 1" = 200 feet	

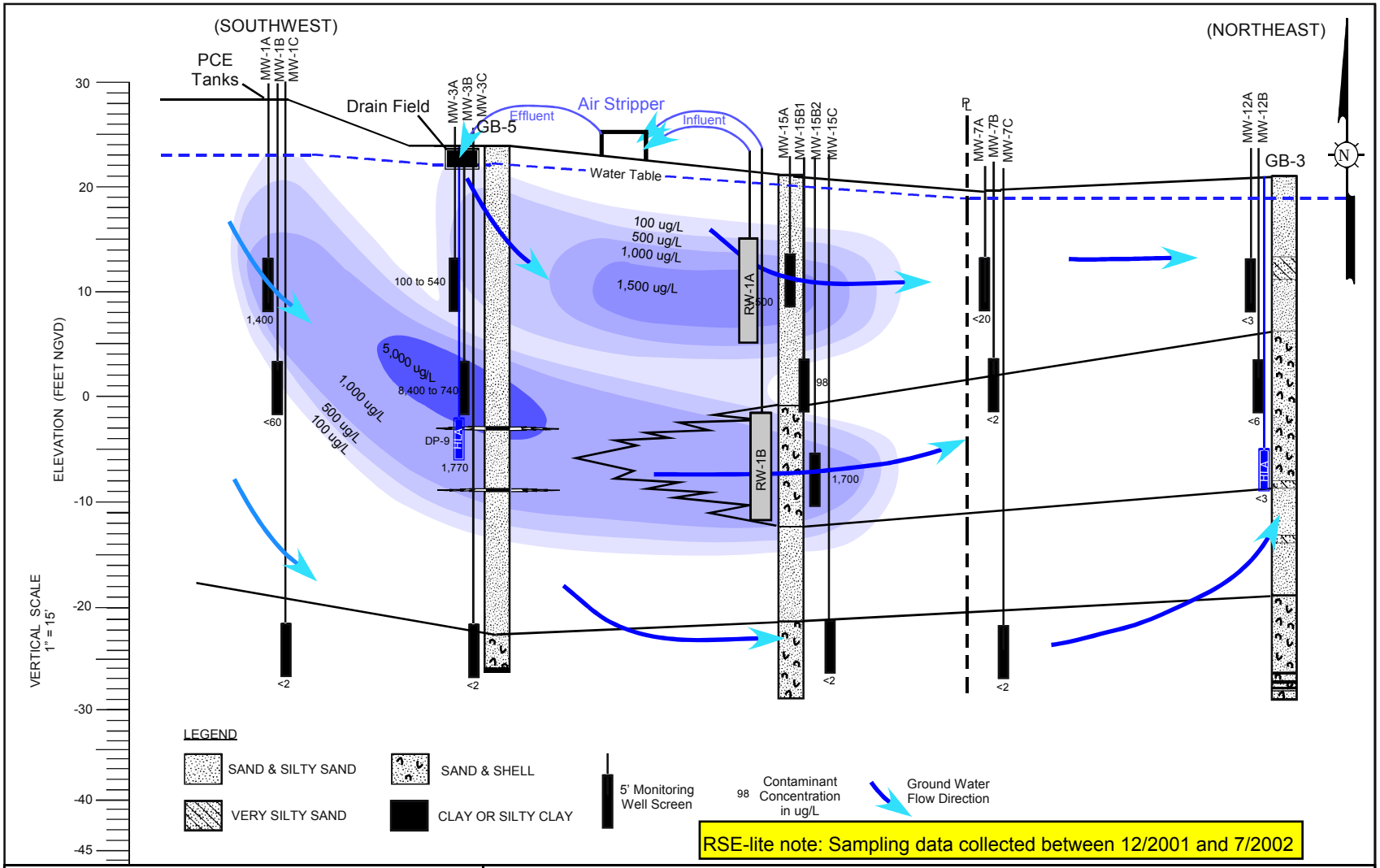

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Figure 2. PCE Distribution Cross Section

0 40 80 FEET
SCALE

Chemko Facility
Mims, Florida

Engr: Novokowsky/Nelson	
Customer: Chemko Technical Services, Inc.	Scale: 1" = 80 feet
Date: 30 Mar 2002	Dwg No: IND-117-IMP-011 / Rev: 3/25/03