



# Oregon

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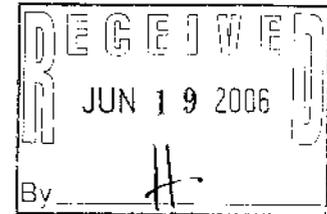
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## COPY

June 15, 2006

Mr. Tom McCue, Environmental Manager  
Siltronic Corporation  
7200 NW Front Avenue  
Portland, OR 97210



**Re: Enhanced Bioremediation Pilot Study Work Plan  
Siltronic Corporation  
Portland, Oregon  
ECSI No. 183**

Dear Mr. McCue:

The Oregon Department of Environmental Quality (DEQ) has reviewed the "Draft Enhanced Bioremediation Pilot Study Work Plan, Siltronic Corporation, Portland, Oregon" dated April 10, 2006, and the "Siltronic - Pilot Study Work Plan Addendum" dated April 14, 2006 (the Addendum). The two documents are collectively referred to as the Draft Work Plan in this letter. Maul, Foster, and Alongi, Inc. prepared the Draft Work Plan on behalf of Siltronic.

The Draft Work Plan provides Siltronic's proposed approach for assessing the performance of enhanced bioremediation in treating contamination at the Siltronic Corporation (Siltronic) facility by trichloroethene (TCE) and its degradation products. The TCE impacts are associated with an underground storage tank (UST) system formerly used at the site. Groundwater contaminated by TCE and its degradation products (the TCE plume) have migrated from the former UST system to the Willamette River.

Based on the results of a technology screening and laboratory bench scale tests, Siltronic has selected a treatment technology that involves injecting a slurry of controlled release carbon and zero-valent iron (i.e., EHC) into the subsurface, followed by bioaugmentation with a commercial culture of dehalobacteria (i.e., KB-1). Siltronic proposes to pilot test the EHC/KB-1 combination in the vicinity of the former UST system and in a downgradient portion of the TCE plume near the river. The pilot study will test the performance of EHC/KB-1 under field conditions operating in each pilot test area.

During meetings on April 24 and May 18, 2006, via e-mails, and by telephone, Siltronic and DEQ discussed and reached agreement on the pilot study scope of work. Given Siltronic's desire to proceed expeditiously with EHC/KB-1 pilot testing, the pilot study is currently being implemented consistent with our agreement(s).

This letter provides DEQ's remaining comments to the Draft Work Plan so that the document can be: 1) revised to reflect the pilot study being implemented, and 2) finalized for the administrative record. The letter does not reference revisions already made to the work plan that were presented and discussed

during the May 18<sup>th</sup> meeting (e.g., revised versions of Figure 4-1 and Addendum Figure 1). Additionally, DEQ anticipates that the information provided in the Addendum will be fully incorporated into the final version of the work plan.

## GENERAL COMMENTS

### Supplemental Drilling and Sampling Work

On April 24, 2006 the DEQ met with Siltronic to discuss the Draft Work Plan. During the meeting Siltronic and DEQ agreed that more detailed geologic and groundwater chemistry data were needed to support pilot study scoping and planning, especially in the UST system pilot study test area.

In an e-mail dated April 27, 2006, DEQ provided Siltronic with a scope of work to expedite data collection. The scope of work was discussed with Siltronic by telephone and subsequently modified via e-mails prepared by Siltronic (May 2, 2006) and DEQ (May 3, 2006).

The supplemental drilling and sampling program was completed prior to a meeting on May 18<sup>th</sup> during which the scopes of work for the downgradient and source area pilot tests were finalized. DEQ expects the results of the supplemental drilling and sampling program to be included in the final version of the work plan.

### Pilot Study Goals and Data Collection Objectives

DEQ understands from the April 24<sup>th</sup> and May 18<sup>th</sup> meetings that:

- The pilot study is designed to assess the following remediation scenarios:
  - In the downgradient pilot test area EHC/KB-1 will be used as a permeable treatment medium to reduce dissolved phase concentrations of TCE and its degradation products as contaminated groundwater passively flows through a "curtain" of injected material; and
  - Injecting EHC/KB-1 directly into a source area to assess reductions in the concentrations of TCE and its degradation products where the highest levels of these contaminants have been detected.
- The pilot study will assess whether the EHC/KB-1 combination will treat TCE partitioned into MGP DNAPL.
- Groundwater sampling will be conducted upgradient, within, and downgradient of each pilot study treatment area to monitor:
  - Concentrations of TCE and its degradation products;
  - The influence, if any, of EHC/KB-1 on dissolved phase concentrations of polycyclic aromatic hydrocarbons associated with manufactured gas plant waste contamination;
  - The potential for metals to be mobilized by groundwater chemistry changes resulting from EHC injection; and
  - Chemical by-products indicative of TCE treatment by EHC/KB-1.

The items listed above form the basis for the pilot study scope of work; however they are not mentioned in the Draft Work Plan.

The overall pilot study goals and the data collection objectives should be clearly described in the final work plan. This information provides the framework assessing the performance and effectiveness of EHC/KB-1 under the field conditions unique to each pilot study test area.

## **SPECIFIC COMMENTS**

**Section 1.2.1.** As discussed during the April 24<sup>th</sup> meeting, it is not clear to DEQ whether the proposed enhanced bioremediation approach will treat TCE that has partitioned into DNAPL. Siltronic has suggested that the TCE will partition back into the groundwater as the dissolved concentrations of the chemical are reduced by the EHC/KB-1 treatment combination. DEQ considers further evaluation and documentation of this process a primary data collection goal for the pilot study.

DEQ understands from your May 2<sup>nd</sup> e-mail that Siltronic is developing a proposal for assessing desorption of TCE from MGP DNAPL using laboratory bench tests. Because assessing treatment of TCE in DNAPL is primary goal of the pilot study, DEQ anticipates that the proposed approach for conducting bench-scale testing will be submitted to DEQ for review and approval prior to implementation.

**Section 2.2.** DEQ understands from the Draft Work Plan that: 1) conditions of thermodynamic instability may not develop at the Siltronic site; and 2) the effectiveness of EHC/KB-1 is not dependent on thermodynamic instability. DEQ requests that Siltronic confirm and/or correct our understanding of the role, if any, of thermodynamic instability in treating TCE and its degradation products at the site.

**Section 3.0.** The list of performance criteria should include post-pilot test assessment of treatment media application into the subsurface (i.e., assess whether EHC/KB-1 was delivered where it was intended). DEQ's comments to Section 5.2 (below) elaborate on this comment.

**Section 3.1.** The Draft Work Plan focuses on evaluating the effectiveness of treating TCE dissolved in groundwater. There is little discussion of how the second treatment goal of the pilot study (i.e., treatment of TCE partitioned into MGP DNAPL) will be assessed. The final work plan should include Siltronic's proposal for addressing this information need.

**Sections 3.4, 3.5, and 3.7.** These sections of the Draft Work Plan indicate the pilot study will generate information about the EHC/KB-1 application method, application rate, and monitoring parameters. The work plan also indicates this information will be used to support planning for full-scale implementation of the treatment approach. However, the work plan does not describe the types of data that will be collected and/or how it will be used to support scaling up the approach. Although Section 5 describes the data that will be collected, descriptions of how it will be used are not provided.

DEQ requests a table be added to the work plan that shows the data being collected and the corresponding performance criteria being evaluated.

**Section 4.1.** Siltronic proposes to inject EHC/KB-1 at numerous locations in the downgradient and source area pilot study test locations. DEQ understands that the injection boreholes will be abandoned using EHC. Abandonment procedures should be described in the final version of the work plan.

**Section 4.1.2.** The work plan should indicate that dissolved oxygen (DO) and oxidation-reduction potential (ORP) will be measured at the monitoring wells located within and near injection areas to document the onset of reducing conditions associated with EHC injection.

**Section 5.2.** DEQ expects that post-pilot study drilling will also evaluate whether EHC injection occurred as intended. Visual observations of EHC in the injection depth interval(s), and EHC overlap between adjacent injection points would address this information need and provide application method/rate information to support planning for full-scale use of the treatment technology.

**Section 5.4.** The Draft Work Plan indicates that the EHC/KB-1 dosages used for the pilot study will be effective for many years. Subsequent to completion of the pilot study, and based on the data collected, Siltronic should plan on continued sampling at selected monitoring wells to evaluate the performance of EHC/KB-1 over time.

Monitoring well WS-11-125 is located within the downgradient pilot test injection zone. This monitoring well has historically provided groundwater monitoring data considered to be representative of the axis of the TCE plume near the Willamette River. For this reason DEQ considers WS-11-125 to be an essential component of the TCE plume monitoring well network. DEQ expects that in the near future a replacement well will be installed in the vicinity of WS-11-125. The replacement monitoring well should be located outside the influence of the pilot test area.

**Section 5.4.1.** This section of the Draft Work Plan should be revised consistent with Item #1 of Siltronic's e-mail dated May 19, 2006. In addition, the groundwater sample collection stabilization criteria should be included in the final work plan for DEQ's information and completeness.

**Section 5.4.2.** Consistent with DEQ's comment to Section 5.2, the number and location(s) of post-pilot study borings should allow the distribution of treatment media in the subsurface to be evaluated.

**Table 4-1 (Addendum Table 1).** These tables should be revised to reflect modifications made to the pilot test injection lay-outs based on the results of the supplemental drilling and sampling work.

**Table 5-1 and 5-2 (Addendum Tables 2 and 3).** These tables should be combined and revised consistent with Item #1 of Siltronic's May 19<sup>th</sup> e-mail. The tables should also specify the individual fixed gases that will be included in laboratory analyses for DEQ's information and completeness.

**Figure 1-2.** Section 4.1 of the work plan references the WS-12 and WS-14 monitoring well locations. These nested well clusters should be added to the figure for completeness.

Mr. Tom McCue  
Siltronic Corporation  
June 15, 2006  
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## NEXT STEPS

The Final Pilot Study Work Plan should incorporate DEQ's comments and be submitted within 30 days of receipt of this letter. DEQ is not expecting Siltronic to prepare and submit a separate response to our comments.

DEQ appreciates Siltronic's ongoing efforts to evaluate and address uplands and in-river contamination associated with releases from the facility. Please don't hesitate to contact me if you have any questions regarding this letter.

Sincerely,



Dana Bayuk, R.G.  
Project Manager  
Cleanup & Lower Willamette Section

Cc: Christopher Reive, Jordan Schrader  
Alan Gladstone and Bill Earle, Davis Rothwell Mullin Earle & Xochihua, P.C.  
James Peale, MFA  
Ted Wall, MFA  
Eric Bakkom, MFA  
Dan Hafley, C&LWS  
Tom Gainer, C&LWS  
ECSI No. 183 File





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June 30, 2006  
Project No. 8128.01.08/10

Mr. Dana Bayuk  
Oregon Department of Environmental Quality  
2020 SW 4th Avenue, Suite 400  
Portland, Oregon 97201-4987

Re: Draft Enhanced Bioremediation Pilot Study Work Plan  
Siltronic Corporation  
7200 NW Front Avenue, Portland, OR  
ECSI #183

Dear Dana:

Maul Foster & Alongi, Inc. (MFA) received comments regarding the above-referenced document (the draft work plan) from the Oregon Department of Environmental Quality (DEQ) in a letter dated June 15, 2006. The majority of the comments will be incorporated in the Final Pilot Study Work Plan. Siltronic Corporation (Siltronic) has identified a few issues that require clarification for the administrative record. This letter references specific DEQ comments and provides the necessary clarification. DEQ's comments are included in italics with Siltronic's response following.

## **GENERAL COMMENTS AND RESPONSES**

Page 2 – Section Heading “Pilot Study Goals and Data Collection Objectives”

*DEQ understands from the April 24<sup>th</sup> and May 18<sup>th</sup> meetings that:*

- *The pilot study is designed to assess the following remediation scenarios:*
  - *In the downgradient pilot test area EHC/KB-1 will be used as a permeable treatment medium to reduce dissolved phase concentrations of TCE and its degradation products as contaminated groundwater passively flows through a “curtain” of injected material; and*

- *Injecting EHC/KB-1 directly into a source area to assess reductions in the concentrations of TCE and its degradation products where the highest levels of these contaminants have been detected.*

It should be noted that in both areas, the injected materials are expected to act as permeable treatment zones through which contaminated groundwater flows. Also, DEQ's comment should reflect that the objectives of the pilot study are to generate performance and cost data to be used in the Feasibility Study for remedy selection, as stated in Section 3 of the draft work plan.

- *The pilot study will assess whether the EHC/KB-1 combination will treat TCE partitioned into MGP DNAPL.*

The pilot study is designed to evaluate performance of the EHC/KB-1 product combination within the existing subsurface conditions in aggregate, which includes TCE in the dissolved (aqueous) phase, adsorbed to soil, and adsorbed in MGP DNAPL. The pilot study is designed to meet the objectives stated in the draft work plan, and is based upon the results of the bench test. The bench test did not evaluate MGP DNAPL as a variable related to degradation of TCE and its degradation products. Dechlorination of TCE (and its degradation products) partitioned into MGP DNAPL may be an implicit conclusion upon evaluation of the data, but such an assessment is not a primary objective of the pilot study.

As discussed during the April 24<sup>th</sup> and May 18<sup>th</sup>, 2006 meetings, the understanding of the nature and extent of MGP DNAPL is far too limited to allow quantification of the MGP DNAPL mass. Consequently, the potential mass of TCE and its degradation products sorbed into MGP DNAPL cannot be estimated, let alone quantified. MFA is working with its subcontractors to develop a bench test to examine desorption of TCE from MGP DNAPL. It may be possible to correlate bench test data to the pilot study data to develop an implicit understanding of the desorption phenomenon.

- *Groundwater sampling will be conducted upgradient, within, and downgradient of each pilot study treatment area to monitor:*
  - *Concentrations of TCE and its degradation products;*
  - *The influence, if any, of EHC/KB-1 on dissolved phase concentrations of polycyclic aromatic hydrocarbons associated with manufactured gas plant waste contamination;*

- *The potential for metals to be mobilized by groundwater chemistry changes resulting from EHC injection; and*
- *Chemical by-products indicative of TCE treatment by EHC/KB-1.*

*The items listed above form the basis for the pilot study scope of work; however they are not mentioned in the Draft Work Plan.*

It should be noted that the items in the list were agreed to in emails exchanged between MFA and DEQ following the meetings. Also, the draft work plan specifically identifies (Sections 3, 4, and 5, and Figure 4-1) that contaminant destruction efficiency will be evaluated using data (including some of the items in the list) collected upgradient, within, and downgradient of the treatment zones.

*The overall pilot study goals and the data collection objectives should be clearly described in the final work plan. This information provides the framework [for] assessing the performance and effectiveness of EHC/KB-1 under the field conditions unique to each pilot study test area.*

It should be noted that the objectives of the pilot study are to generate performance and cost data to be used in the Feasibility Study for remedy selection, as stated in the first sentence of Section 3 (Pilot Study Objectives) of the draft work plan.

## **SPECIFIC COMMENTS AND RESPONSES**

*Section 1.2.1 As discussed during the April 24<sup>th</sup> meeting, it is not clear to DEQ whether the proposed enhanced bioremediation approach will treat TCE that has partitioned into [MGP] DNAPL. Siltronic has suggested that the TCE will partition back into the groundwater as the dissolved concentrations of the chemical are reduced by the EHC/KB-1 treatment combination. DEQ considers further evaluation and documentation of this process a primary data collection goal for the pilot study.*

With respect to the first sentence, it is our understanding that the EHC/KB-1 products will primarily dechlorinate TCE and/or its degradation products that are in the dissolved (aqueous) phase. The second and third sentences relate to evaluation of the desorption of TCE and its degradation products from MGP DNAPL into the aqueous phase. Siltronic agrees that this desorption may be a relevant phenomenon, and is working with its subcontractors to develop a bench test to evaluate desorption. As stated previously, desorption and subsequent dechlorination of TCE and its degradation products may be an observation or implicit conclusion upon evaluation of the data, but documentation and/or

quantification of desorption cannot realistically be a primary objective of the pilot study without further characterization of the nature and extent of MGP DNAPL.

*DEQ understands from your May 2<sup>nd</sup> e-mail that Siltronic is developing a proposal for assessing desorption of TCE from MGP DNAPL using a laboratory bench test. Because assessing treatment of TCE in [MGP] DNAPL is [a] primary goal of the pilot study, DEQ anticipates that the proposed approach for conducting bench-scale testing will be submitted to DEQ for review and approval prior to implementation.*

It is important to note the distinction between evaluating desorption phenomenon and “assessing treatment of TCE in MGP DNAPL”. The additional bench testing will be designed to evaluate desorption of TCE from MGP DNAPL, but assessing treatment of TCE partitioned into MGP DNAPL is not a primary goal of the pilot study.

*Section 3.1. The Draft Work Plan focuses on evaluating the effectiveness of treating TCE dissolved in groundwater. There is little discussion of how the second treatment goal of the pilot study (i.e., treatment of TCE partitioned into MGP DNAPL ) will be assessed. The final work plan should include Siltronic’s proposal for addressing this information need.*

Siltronic disagrees that assessing treatment of TCE partitioned into MGP DNAPL is a goal of the pilot study or an information need. The lack of information regarding nature and extent of MGP DNAPL means that the outcome of such an assessment would be technically unsupportable, and likely engender irresolvable questions.

*Section 5.4...Monitoring well WS-11-125 is located within the downgradient pilot test injection zone. This monitoring well has historically provided groundwater monitoring data considered to be representative of the axis of the TCE plume near the Willamette River...DEQ expects that in the near future a replacement well will [be] installed in the vicinity of WS-11-125. The replacement monitoring well should be located outside the influence of the pilot test area.*

During the week of June 12, 2006, MFA installed monitoring well WS-21-112 upgradient of the riverbank pilot test area, and along the axis of the TCE plume near the Willamette River. This monitoring well will function as a replacement for WS-11-125 in addition to providing data regarding concentrations of TCE and its degradation products upgradient of the treatment zone.

## **NEXT STEPS**

The Final Pilot Study Work Plan will be revised to reflect the remaining comments (most of which were addressed in the meetings and following emails) and will incorporate the contents of the addendum describing the source area injection approach. MFA anticipates

Mr. Dana Bayuk  
June 30, 2006  
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submitting the Final Pilot Study Work Plan on July 19<sup>th</sup>, 2006 (30 days from the receipt date). MFA is working with its subcontractors to develop a bench test to evaluate desorption of TCE and its degradation products from MGP DNAPL; a proposal for the bench test will be submitted under separate cover.

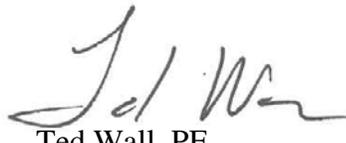
Siltronic appreciates DEQ's flexibility with respect to approving the injection work on a very short time frame. Please call either of us at (971) 544-2139 if you have questions or comments.

Sincerely,

Maul Foster & Alongi, Inc.



James G.D. Peale, RG  
Senior Hydrogeologist



Ted Wall, PE  
Principal Engineer

cc: Matt McClincy, DEQ  
Tom McCue, Siltronic  
Chris Reive, Jordan Schrader  
Alan Gladstone, Davis Rothwell Earle & Xochihua, P.C.