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RESPONSE TO SOUTH CAROLINA DEPARTMENT OF HEALTH AND ENVIRONMENTAL CONTROL COMMENTS ON DRAFT ANAEROBIC AEROBIC SEQUENCING DESIGN ZONE K SOLID WASTE MANAGEMENT UNIT 166 CNC CHARLESTON SC

7/19/1999

ENSAFE INC.

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY CHARLESTON NAVAL COMPLEX CHARLESTON, SOUTH CAROLINA CTO-029

RESPONSE TO COMMENTS FOR

DRAFT ZONE K, SWMU 166 ANAEROBIC-AEROBIC SEQUENCING DESIGN DOCUMENT (April 16, 1999)

Prepared for:

Department of the Navy
Southern Division
Naval Facilities Engineering Command
Charleston, South Carolina

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Prepared by:

EnSafe Inc.
5724 Summer Trees Drive
Memphis, Tennessee 38134
(901) 372-7962

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Draft SWMU 166 Anaerobic-Aerobic Sequencing Design Document
Comments/ Responses to Comments

The following is a summary of SCDHEC's written and verbal comments and EnSafe's responses on the Draft SWMU 166 Treatability Study Design Document dated April 16, 1999.

Comments of Paul Bergstrand

Comment 1
Page A-14, Section 1.1 Pump Design
The third bullet in this section calls for pumps that are "Top-loading for total fluid recovery." It is not clear how top loading pumps will be an advantage when pumping water contaminated with a chlorinated solvent. Please address.

Response 1 (Page A-14, Section 1.1. Pump Design)
The sentence on top-loading pumps is not needed and deleted. We will use only a down-well located (submersible) air operated pump. The text will be revised accordingly.

Comment 2
Page A-14, Section 1.1 Pump Design
The seventh bullet in this section calls for the pumps to "Know when they are full or empty and therefore, automatically through on or off, using air only on demand during discharge cycle." This statement makes no sense. Please revise.

Response 2 ((Page A-14, Section 1.1. Pump Design, Bullet # 7)
This sentence is confusing. This sentence will be changed to read:
Pump control will be regulated using a liquid level controller located in the holding tank to turn the pump(s) on and off.

Comment 3
Page A-18, Groundwater well system
All proposed wells are 4 inch diameter. The well proposal dated 3 May 1999 had some of the wells as 2 inches in diameter. Please clarify.

Response 3

Injection and extraction wells will be 4 inch diameter to improve efficiency. Monitoring and sparging wells will be 2 inch diameter.

Comment 4

No Page Numbers, Tab B

Most of the diagrams represent wells and recovery systems for free product hydrocarbons. If portions of the systems are intended for use in this project the applicable sections should be highlighted in some manner or the non-applicable sections explained in a text outlining the plan. Please clarify.

Response 4 (Appendix A, Cut sheets).

The same diagrams that are applicable for free-product hydrocarbons are also applicable for recovery of soluble phase chlorinated solvent groundwater. The manufacturer's cut sheets do not come separately for dissolved or soluble phase recovery of contaminated groundwater. Therefore, we have presented all their cut sheets.

Comment 5

Page C-5, Drawdown Corrections. This section is not clear. Please explain.

Response 5

Section 2.2 of Appendix C notes a 1.13 foot average rise in deep well water levels following a 2.93 inch rain event. Section 3.1 later says that ambient water levels had negligible effect on drawdown data. These statements are contradictory as presented. However, the text has omitted the facts that the rainfall event occurred about 24 hours into the test and drawdown data collected after the rain event was not needed to estimate transmissivity and conductivity. The text in Section 3.1 will be revised to reflect this.

Comment 6

Page C-5, Data Reduction and Compilation

The drawdown model used was for a leaky confined aquifer. It appears this model does not represent conditions at SWMU 166. Please address.

Response 6

At the pumping well and nearby observation well there is a localized upper clay semi-confining unit. This local feature caused the aquifer to behave in leaky confined fashion. This clay feature is absent in the newly located treatability study area, however aquifer geology appears otherwise similar.

Comment 7

Page C-7, Conceptual Model

This paragraph is contradictory. The first sentence describes a "mosaic of fluvial and shallow marine deposits containing mostly sands with minimal amounts of clays and silts." Yet the model used "treated the aquifer as a single isotropic and homogeneous layer," Please address the following concerns

A. The flow of groundwater and contaminated groundwater is not uniform. The use of this model does not address the major and minor flow paths, which are presented in the second MNA Report.

B. The distribution of contamination is not uniform across the site. Drastic differences in contaminant levels exist from well to well over the space of 100 feet but have not been explained. The use of this model implies the distribution of contaminants is controlled only by groundwater flow.

C. This model does not address how small scale flow variability within the aquifer may exert significant control of contamination migration during the treatability study.

Response 7

A. Due to the small scale of this treatability study (about 60 feet from injection to extraction) and because all of the water bearing horizons within the unit are hydraulically connected, we do not expect major and minor flow pathways to significantly affect the process. Moreover, any full-scale remedial system would be designed to address the unit as a whole and would not likely be affected by minor variations in flow pathways.

B. The comment is correct in that the distribution of contaminants is not uniform across the site. The addition of extra monitoring wells in the treatability area will better define the

distribution of contaminants and groundwater flow in the study area, however the CAPZONE model will only address hydraulic, not chemical, distributions in the aquifer.

C. Small scale flow variability will occur, however recirculation mixing and chemical diffusion will dampen these effects. However, spatial distribution of test parameters (changes in water levels and contaminant concentrations) will be evaluated among the different monitoring wells to examine whether small scale flow variability had any effect.

Comment 8

Page C-7, Data Compilation. This paragraph indicates the saturated thickness of the aquifer to be 25 feet. The AQTESOLVE program for the drawdown tests used a saturated thickness of 8 feet. Please resolve the contradiction.

Response 8

The localized upper clay semi-confining unit restricted the aquifer thickness to 8 feet in the area of the pumping well. However, this clay unit is absent in the treatability study area where the aquifer is about 25 feet thick. The treatability study was originally planned in the area of the pumping test well. However, pump test results indicated a need to reduce the distance between the extraction and injection wells which would have caused access restrictions due to building and traffic flow in the area of the pumping test well. Therefore, the treatability study was relocated to south of the motor pool parking area.

HydroSOLVE, Inc. can be contacted at 703-264-9024 or www.netcom.com/~gmd.hsi

Comment 9

Page C-9, Analysis. This paragraph states "Approximately 50% of injected groundwater will be recaptured within 6-months by the recovery wells. The remaining 50% will either skirt the anticipated six-month capture zone of the extraction wells or travel on the upgradient side of the upcone re-injection surface. This 50% can likely be captured using a longer time period of performance." Only 50% capture appears to be a lack of hydraulic control. Please address.

Response 9

Modeling indicates that 50% of the reinjectate will reach the extraction wells and be recirculated through treatability study area. Because this is a no-net-loss recirculation

system, some of the reinjectate will not be recovered due to ambient flow. The model placed hydraulic stresses on the sloping configuration of the potentiometric surface, and naturally hydraulic interferences complicate the recovery. If the system were allowed to operate for a longer time frame (2 yrs or longer) then 100% capture would be likely.

Mounding due to the air sparging wells may occur during the study and will be assessed as part of groundwater monitoring at the site. However, air sparging will be done only to provide an oxygen source in this application and will be much less than that seen during typical sparging where the air is used to strip VOCs in-situ.

Comment 10

Page D-1, Baseline analytical Sampling. This section states "Samples will be collected from,,,,,,, treatability monitoring wells and existing monitoring wells located within the area of influence of the treatability study." Given the area of influence from the drawdown test, this study should include wells 14D, 11D and an additional treatability monitoring well. Please revise.

Response 10

Concur. Wells 14D, 11D, and an additional new treatability monitoring well will be included in monitoring and added to Tables D.2 and D.3. These wells will provide better coverage in assessing the spatial distribution of TS effects.

Comment 11

Page D-1, Baseline analytical Sampling. Because the distribution of metals may change and precipitation of metals may result from the treatability test, metals should be sampled at the same frequency as VOC and Biochemical parameters. Please revise.

Response 11

Concur. The drastic changes in redox potential expected in the TS area may result in changes in soluble metals concentrations.

Comment 12

Page D-4, Hydrogeological Monitoring. The treatability study monitoring wells should be included in this measurement effort. Please revise.

Response 12

Concur. Water levels from the TS wells will aid in assessing study area hydrology.

Comment 13

Page D-4, Chemical Feed System. Please describe how decisions to augment chemical feed or to modify flow rates will be made.

Response 13 (Chemical feed System)

The following paragraph can be added to make it more readable:

Monthly groundwater sampling and analysis for total organic carbon (TOC), nitrogen, and phosphorus will be used to determine the need for modification in chemical addition. Generally, the ideal ratio of organic carbon (TOC): nitrogen: phosphorus is 100:5:1. If groundwater sampling results show that there is significant departure form this recommended optimal ratio, chemical feed amounts of carbon and nitrogen will be modified to maintain this ratio.

Comment 14

The Underground Injection Control Application dated February 9, 1999 has not been approved and as of 17 May 1999 has not been updated or resubmitted. The reply letter dated 12 April 1999 clearly states "Air sparging wells are defined as injection wells....." and that "These wells (i.e., all injection wells) must receive a Permit to Construct and Operate from the UIC Program prior to their installation and operation." Please address.

Response 14

Robert Devlin (reinjection permitting) and Tim Eleazor (waste water treatment construction permitting) of SCDHEC have been contacted and concerns in the April 12, 1999, letter have been addressed. The revised injection control permit application was distributed the week of 5/24.

Comments of Mihir Mehta

Comment 1

The referenced document should have an introduction section describing the overall goals and objectives of the document. It should also reference previous documents leading to the development of the referenced document. This will help the reviewer to understand the issue at hand in an appropriate fashion. Please revise the document accordingly.

Response 1

An introduction has been added to the beginning of the document outlining the objectives of the study. Additional detail on goals and objectives can be found in the March 1999 TSWP.

Comment 2

From review of the referenced document, it appears that the area indicated for field implementation of the referenced treatability study has been changed from the review of the work plan dated December, 1998. The current field location for the treatability study is associated with the area of low contaminant concentration. Please provide rational, discussion, and the consequences as a result of this change.

Also note that the December work plan has not been revised consistent with the comment discussion during the conference call.

Response 2

The introduction will include the following explanation for why the study area was offset from the location outlined in the TSWP:

> **The study location was moved based on capture zone modeling which showed that a much smaller area would be required in order to achieve complete recirculation of extracted groundwater in the 4 to 6 month time frame planned for this study. If the test were not moved, it would have interfered with daily operations at the naval Annex through disrupting traffic flow and access to the motor pool area. The new test location lies near the centerline of the plume in an area with about 5,000 ug/L total chlorinated solvents in groundwater based on observations in well 10D. This should provide an even better indication of AA capabilities than the previous location.**

A revised TS work plan was completed in March 1999 to address SCDHEC comments on the December 1998 version. A copy can be obtained by contacting Ted Blahnik in the EnSafe Dallas office at (972)791-3222.

Comment 3

Section I, page A-18

The document has only two maps that are of poor quality and difficult for the reviewer to interpret and correlate them to the text and design. Please provide appropriate maps and figures that illustrate groundwater flow direction, current groundwater contamination, groundwater monitoring wells in the vicinity of the groundwater plume, groundwater aquifer system, and other physical features as deemed appropriate.

The maps need to show the locations of the proposed treatability study monitoring wells.

Response 3

A map (Figure C.1) showing the location of the existing and proposed wells will be added to the document at the end of Attachment C.

Comment 4

Please show the locations of the nearby monitoring wells on a map with respect to groundwater flow direction, contaminant plume and other well locations.

Response 4

Please refer to response 3.

Comment 5

Section 2 and 3 describe what tests have been conducted in order to determine the aquifer characteristics and presents the results respectively. The document fails to detail key points (such as default parameters, chemistry, etc) that are associated with these tests and the rational for their selection. Please provide appropriate figures to understand the results of the tests that are conducted as described in the text. For example, on page C-6 last line states that "this indicates a radius of influence of at least 246 feet; the distance between PW-1 and 06D." It is difficult to picture the radius of influence with respect to the location of the treatability study design wells.

Response 5

Section C.1 has been revised to address Comment 5. In general, aquifer testing and subsequent capture zone modeling was performed in order to adequately size and space the treatability recovery and injection systems. Additional data to be collected as part of the treatability study will further characterize the aquifer and allow for similar estimates of size and spacing required for a full-scale AA system. An additional map (Figure C-1) will be included in the revised design plan showing updated existing and proposed well locations so that the study can be better visualized.

Comment 6

Please provide necessary figure illustrating the conceptual model as described in the test.

Response 6

A lithologic cross section of the area is provided in the Zone K RFI report and March 1999 TS work plan. Boring logs are also available in the RFI report.

Comment 7

The introduction paragraph indicates that the modeling was performed to located the injection and extraction wells and extraction and recharge rates. The modeling failed to evaluate the interference of the extraction wells, injection wells, and air sparging wells, and hydraulic control of the groundwater plume.

The modeling also failed to predict modeled groundwater contaminant concentrations at various locations during the treatability study as quantitative goals to be achieved. This should be evaluated for both anaerobic and aerobic conditions

Response 7

Section C.4.3 has been revised to address the first part of Comment 7. Please note that groundwater table elevations will be monitored during the study to evaluate mounding effects caused by the injection and sparging wells and to assess the extent of hydraulic control of the plume in the study area.

In response to the second part of Comment 7, predictive chemical fate and transport modeling was not completed as part of this design. This study is being performed in part to

answer F&T questions raised in the comment, however there are no quantitative goals. The study aims to produce quantitative estimates for achievable degradation rates and end-point concentrations of TCE and its daughter products so that a site-wide system can be evaluated and designed. Additional details on study goals and objectives can be found in Section 3 of the March 1999 TSWP.

Comment 8

Table D-2. Periodic sampling protocol

Please include monitoring for daughter products as deemed appropriate.

Response 8

Per the request of Mr. Bergstrand, the monitoring suite has been expanded to include metals and VOCs for all analytical sampling well locations.

Comment 9

Please provide a map showing the TS monitoring wells.

Response 9

An additional map (Figure C-1) will be included in the revised design plan showing updated existing and proposed well locations so that the study can be better visualized.