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Ser 70233
08 Oct 1997

Dr. Lisa Alvarez-Cohen
Berkeley Environmental Restoration Center
461 Evans Hall, #1706
University of California
Berkeley, CA 94720-1706

Subj: BERC DELIVERY ORDER 005: TREATABILITY STUDY REPORT

Dear Dr. Alvarez-Cohen:

1. The Berkeley Environmental Restoration Center (BERC) submitted the draft report in August 1997 for Delivery Order (DO) 005, Intrinsic Bioremediation at Sites 3 and 13, NAS Alameda, under Contract N62474-94-D-7430.

2. Enclosures (1) to (4) are the review comments on the report. Please use the review comments as well as the previously delivered mark-up of the report text by Mr. Ron Hoeppele to revise the report. A response to the comments shall be prepared by BERC and reviewed by the Navy before final acceptance of the treatability study report.

3. If you have any questions, please contact Mr. Ken Spielman at (415) 244-2539, or FAX (415) 244-2654.

Sincerely,

ORIGINAL SIGNED BY

KEN SPIELMAN
Remedial Project Manager
By direction of
the Commanding Officer

- Encls: (1) Memorandum, Review: Intrinsic Bioremediation at Sites 3 & 13, NAS Alameda, prepared by Ron Hoeppele, Naval Facilities Engineering Service Center, 08 Sep 1997
(2) Memorandum, Treatability Study Report, Intrinsic Bioremediation, Sites 3 and 13, Alameda Point, prepared by Paul West, Code 70231, EFA West, 10 Sep 1997
(3) Transmittal of Comments on the BERC Intrinsic Bioremediation Report at Sites 3 and 13, Alameda Point, prepared by Tetra Tech EM Inc., 15 Sep 1997
(4) U.S.EPA Review Comments, BERC Delivery Order 005, Intrinsic Bioremediation Report at Sites 3 and 13, NAS Alameda, prepared by Ned Black, Code H-9-3, U.S.EPA, 22 Oct 1996

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ENCLOSURE ONE

Memorandum, Review: Intrinsic Bioremediation at Sites 3 & 13,
NAS Alameda, Prepared by Ron Hoeppe, Naval Facilities
Engineering Service Center, 08 Sep 1997

Hoeppel, Ron

From: Hoeppel, Ron
To: Spielman, Ken
Cc: Jenkins, Karla; Ta, Nicholas; Hoeppel, Ron
Subject: Review: Intrinsic Bioremediation at Sites 3 & 13, NAS Alameda
Date: Monday, September 08, 1997 4:01PM

Ken,
I have reviewed the above report by BERC. Overall it is well done and generally complete. I was particularly impressed with the radioactive and stable isotope data, which seemed to infer that much of the carbon dioxide at Site 13 originated from aerobic oxidation of methane, which is the end product of anaerobic biodegradation.

I did find a few major discrepancies that I feel the authors should address:

1. The geochemistry of reduced iron and sulfide, under marine influence in particular (e.g., relatively high pH) needs to be evaluated further. It is not surprising to me that iron II or sulfides are not seen in the groundwater. They will most likely form poorly soluble iron sulfides and generally poorly soluble other metal sulfides. The value of tracing the fate of sulfate in high sulfate environments is an area that will require further assessment. The sulfate concentrations in groundwater from both Sites 3 and 13 were highly variable (background and contaminated site samples) but also appeared to be in the same order of magnitude. Therefore I find it difficult to believe that sulfate respiration is occurring at Site 3 but not at Site 13.
2. Ammonium is not an intermediate of dissimilatory nitrate reduction but rather a highly reduced end product, that seems to occur most readily under very low Eh. Ammonium can also form under reducing conditions through its release from organic matter. This then leaves one with only nitrate and nitrite to assess (nitrite was surprisingly very high at Site 13; is this indicative of poor sample preservation, toxicity or what?)
3. The high methane levels at both sites, especially those locations under asphalt cover, certainly indicate that the end product of hydrocarbon degradation is methanogenesis, but what type? those that use hydrogen or acetate or other low molecular weight compound? However, these organisms almost invariably work in symbiosis with other anaerobic bacteria. This connection was not mentioned but should be addressed in future work.
4. The suggestion that an impervious soil horizon at Site 13 separates oxygen gas diffusion downward from methane and hydrocarbon diffusion upward appeared to be based on minimal field observation. This phenomenon is important as the authors suggest physical disruption of this layer (supposedly below 40 cm depth) as a remediation option. This could be very expensive. Removal or prevention of asphalt-covered areas is a more realistic solution. The authors need additional field verification to prove the existence of such a layer.
5. My feeling is the same as the authors concerning the usefulness of microbial enrichment assays; however, microcosm studies must be planned carefully to duplicate the subsurface environment. The authors put down all microcosm studies just because their aerobic microcosms failed to duplicate the anaerobic soil environment. We need to avoid such microcosms as aerobic fluidized reactors to estimate natural attenuation in the source area, where contaminated soils are usually anaerobic. Such studies may be of some value for assessing degradation rates for the soluble plume in aerobic groundwater. A short description of the makeup of the microcosms and how they were kept aerobic needs to be mentioned in the main body of the text.
6. It would be interesting to correlate aerobic heterotrophic counts with soil Eh. Only facultative anaerobes and spores (obligate aerobes in suspended animation are often unculturable) will be measured by the tests conducted. Obligate anaerobes, which dominate at low Eh, will not be counted, as was suggested by the authors. My feeling is that enrichment cultures should be scrapped because most active degraders are not isolatable on synthetic media but properly done microcosm studies could be of value. Adding only one radiolabeled compound to microcosms can also present problems. If the compound picked is at high concentration, then this may be due to its recalcitrance. I would avoid use of alkanes as these degrade very slowly anaerobically and can duplicate plant waxes in surface aerobic soils.

I will be sending via mail the original text, with my comments and suggested changes.

 Hoeppel

ENCLOSURE TWO

Memorandum, Treatability Study Report, Intrinsic Bioremediation,
Sites 3 & 13, Alameda Point, Prepared by Paul West, EFA West, 08 Sep 1997

10 Sep 1997

MEMORANDUM

FROM: 70231

TO: Ken Spielman, 70233

SUBJECT: "Treatability Study Report, Intrinsic Bioremediation, Sites 3 and 13, Alameda Point, Alameda, California"- Draft dated 2 Jul 97

1. At your request, I have reviewed the subject document and would like to submit the following specific comments for your evaluation:

Reference	Comment
TOC	Section 2.4.1.1 specifies SOP 24.4 was used, but this SOP is not listed in the table of contents. Also, no appendices were listed in the TOC as well.
2.2.1.1	The value for typical groundwater dissolved oxygen content is given as 4-10 ppm. Is there a reference for this?
2.4.2.1	Dissolved Oxygen, Fe^{2+} , Mn^{2+} , SO_4^{2-} , S^{2-} , miscellaneous other parameters are all listed as analyzed during the groundwater characterization phase. There is no SOP referenced as to how this information was obtained.
Table 5-1	What are the detection limits on the analyses? The standard presentation of a non-detect is to list it as "ND" and report the method detection limit as determined in 40 CFR 136, Appendix B.
Appendix H.1 (SOP 24.4), 2.0	The objectives section lists the metabolic byproducts from microbial degradation of petroleum hydrocarbons, and includes nitrate (NO_3^-). While use of the radiocarbon isotopic abundance is elaborated upon nicely, the use of the stable isotope ratios is not sufficiently described. (The question of why to measure stable isotope ratios is not sufficiently described. The technique is, but the intention of why the measurements are being taken is not.)
Appendix H.1 (SOP 24.4), 4.1	The second sentence lists the capability of the Prism Series II mass spectrometer as less than "1 part in 10,000, or 0.1%" and for hydrogen "1 part in 1,000 or 1%". Shouldn't this be "0.01%" and 0.1%, respectively?
Appendix H.1 (SOP 24.4), 5.1	Are the ^2H , ^{18}O and ^{15}N stable isotope ratios compared to VPDB values as well?
Appendix H.1 (SOP 24.4), 5.2	Since a calculation of the result for the stable isotope values are presented, shouldn't one also be presented in Section 5.2?
Appendix H.1 (SOP 24.4), 7.0	The statement in Section 2.4.1.1 (p 11) seems to indicate that SOP 24.4 will describe the analytical methods for the parameters of interest referenced in 2.4.1.1. Section 7.0 (p H.1-7) seems to be beyond the scope of the statement in Section 2.4.1.1.
Appendix H.1 (SOP 24.4), 9.0	For data management, how long will the data sheets be maintained, and who will maintain them? Also, Recommend that data interpretation is moved from the scope of the procedure to the main document. Data interpretation should include a calculation of the correlation factor between two variables that are being compared. Minimum correlation factors should be determined specified so that

ENCLOSURE (2)

inferences from the data sets may be made.

Appendix 24.4 A Would an example of a filled-out Core Log Sheet be helpful?

Appendix 24.4 B, A.1 The precision on the mass of the sample is not specified. Is it +/- 0.1 mg or better?

Appendix 24.4 B,A2 How much HCL is used? Why are the inorganic carbonates being removed? (Won't this also get rid of shell material?)

Appendix 24.4 B,A3 Due to the small amounts of material involved, could the paper filter be a potential source of contamination?

Appendix 24.4, C, 1 Could an estimate of the amount of material needed for 20 mmoles of N₂ be included?

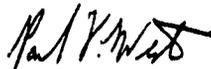
Appendix 24.4, H, 1 It is unclear why resin columns are used to collect the NO₃⁻ from the samples. EPA SW-846 recommends preservation of samples for nitrate/nitrite by acidifying to less than pH 2 with H₂SO₄. Was there a specific reason for using ion-exchange resins to trap nitrate from samples in the field?

Appendix 24.4, K, Forms Shouldn't the forms also include locations for the material identification numbers of the standard materials referenced under "Control of Test Equipment" on p H.1-17? Also, shouldn't a line for a signature for review be included for rapid documentation of the technical review as specified on at the bottom of the same page?

Appendix H.5 Which column is used for the GC separation of the gasses? What set of standard gasses are used to calibrate the instrument? How frequently is it calibrated? Where is the calibration data stored?

Appendix H.11 How is Appendix H.11 different than Appendix 24.4 K?

2. Since I had no prior training in microbiological assays, I have not commented upon the procedures for taking the microbiological data, as well as the data itself. I have only reviewed the data for consistency.
3. This effort is likely to be referenced for inputs to decisions during the Data Quality Objective (DQO) process as described in EPA document EPA QA/R-5. Please forward any responses to these comments.
4. You are welcome to contact me at X 2717, or drop by my office to discuss these comments further.



Paul West, 70231
Chemist

cc: 7023

ENCLOSURE THREE

Transmittal of Comments On The BERC Intrinsic
Bioremediation Report at Sites 3 and 13, Alameda Point,
Prepared by TETRA Tech EM Inc., 15 Sep 1997



Tetra Tech EM Inc.

10670 White Rock Road, Suite 100 ♦ Rancho Cordova, CA 95670 ♦ (916) 852-8300 ♦ FAX (916) 852-0307

September 15, 1997

Mr. Ken Spielman
Department of the Navy
Engineering Field Activity West
900 Commodore Drive
Building 208
San Bruno, CA 94066-5006

**Subject: Transmittal of Comments on the BERC Intrinsic Bioremediation Report at Sites 3 and 13. Alameda Point, Alameda, California
CLEAN Contract No. N62474-88-D-5086, Contract Task Order No. 0107**

Dear Mr. Spielman,

Enclosed are Tetra Tech's comments on the Berkeley Environmental Resource Center (BERC) report on the intrinsic bioremediation study, dated July 2, 1997, that was performed at installation restoration (IR) Sites 3 and 13 at Alameda Point. These comments have been prepared in response to the Navy's request that Tetra Tech review the report.

In general, Tetra Tech agrees with the BERC conclusion that, to some extent, intrinsic bioremediation is occurring at Sites 3 and 13. In addition, the innovative techniques used by BERC to evaluate the occurrence of biodegradation have the potential to be applied in a variety of bioremediation and other biological process applications. However, there are several issues of concern that Tetra Tech has regarding the report. These issues are as follows.

The magnitude of the environmental problem at Site 3, particularly in regards to explosivity hazards, is extremely overstated in the report.

Based on BERC's evaluation of soil gas analytical data, the report stated that methane was being generated at Site 3 at levels that pose an explosivity hazard and concluded that extensive free product is present at the site.

The previously conducted remedial investigation by PRC/Montgomery Watson has indicated that Site 3 does not pose a substantial explosion risk. In fact, the area studied by BERC at Site 3 was part of a special Geoprobe investigation performed by PRC in 1995, which was much more extensive than BERC's relatively limited investigation at Site 3. No explosivity hazards were detected at the site during this investigation. A preliminary risk assessment performed for Site 3, as well as the risk-based corrective action (RBCA) screening of Site 3 do not support BERC's conclusion about the risk of explosion at the site.

The report makes no mention of any air monitoring performed at the site to support that an explosion hazard exists, and no report of air monitoring problems during BERC drilling are found in the report. Also, no gas flux calculations have been developed to quantify methane production at the site. If an explosion hazard was present at the time of investigation, then this condition would have been observed and drilling halted. Furthermore, if a methane buildup had been occurring, then failure of the asphalt cap would have likely occurred, similar to a reported rupture of the surface in the 1940's at Site 13.

If better substantiation and documentation can not be presented by BERC then Tetra Tech suggests that the language in the report stating that explosivity hazards are present and that pavement should be removed should be eliminated from the final report.

The report recommends that pavement be removed above Site 3 in order to enhance biodegradation.

Evidence of biodegradation is already occurring at Site 3 under the paved areas based on the absence of ongoing hydrocarbon migration in the groundwater. The data collected during the remedial investigation indicates that significant fuel hydrocarbon contamination at Site 3 is limited to a relatively small area located to the northwest of Site 3 and does not appear to be migrating. If biodegradation were not taking place, then significant hydrocarbon migration would be continuing to occur at the site. Also, the absence of contamination in most of the screening level samples collected under pavement to the northwest of the site indicates that biodegradation has already effectively taken place at these sampling locations. Tetra Tech does not concur with BERC's recommendation to remove pavement at Site 3.

No evidence exists to support that there is a low-permeability layer of soil above the contamination at Site 13. Furthermore, the removal of fill in no way guarantees more rapid biodegradation.

The report states that soil gas transfer is being hindered by low permeability soil layers in the top few feet of soil at Site 13. The report concludes that the low-permeability layers are hindering biodegradation and that removal of these layers would result in an acceleration of biodegradation. No evidence was cited for existence of a low-permeability layer at the site. The fill deposited at the site is characterized by a mixture of well-graded and poorly-graded sand, with fines generally not present in significant amounts. This interpretation of the hydrogeology is supported by remedial investigation data as well as the BERC soil logging data, which does not indicate the presence of low permeability layers. No evidence exists to support the assertion that removal of fill material overlying the contamination would enhance biodegradation. The only way to significantly increase gas transport through the soil is to install a soil vapor extraction system at the site.

BERC does not recommend a removal of the soil with the highest levels of contamination. Tetra Tech recommends that the soil with the highest levels of contamination should be excavated and treated rather than relying on intrinsic biodegradation to mitigate long-term risks at the site. This would prove far more effective than BERC's recommendation to remove low-permeability fill from the site. This issue should be discussed briefly.

No discussion of contaminant toxicity to the microbes was present.

No discussion of toxicity effects on microbial activity at either Site 3 or 13 was present in the BEREC report. Contaminant concentrations, particularly in soil at Site 13, are extremely high and the potential effects of these high concentrations on rates of biodegradation are not discussed. Product toxicity is a major factor limiting microbial activity at many hazardous waste sites and should be discussed to a greater extent in the report.

The effects of salinity on biodegradation are not discussed.

A discussion of the effects of salinity on biodegradation is not presented. High salinity has the potential to adversely affect biological demonstration. Even if no evidence of salinity effects appears to be present, the topic should at least be briefly discussed.

Nutrient exhaustion is not discussed thoroughly.

Metabolization of the contamination at Sites 3 and 13 may be limited by the absence of essential nutrients such as nitrogen, phosphorous, and others. The discussion of terminal electron acceptors, such as nitrate or sulfate, suggests that the absence of these chemicals indicates that they are not important in the biodegradation process. In fact, the absence of one or more these chemicals may be slowing biodegradation, and the diffusion of these compounds from uncontaminated areas may be controlling the overall rates of biodegradation. This topic should be covered in more detail.

Actual analytical results are not discussed in evaluating biodegradation rates.

When discussing rates of biodegradation and time frames for complete breakdown, temporal variations in analytical data are not discussed. A discussion of contaminant concentrations in existing monitoring wells over time is essential in evaluating degradation rates as well as supporting modeling results. The modeling results presented in the conclusions section do not appear to have been completed with the use of analytical data collected over different time periods. The use of data variation over a temporal scale would greatly strengthen a discussion of degradation rates and would assist in developing a realistic time frame for biodegradation. The BEREC report states that the data were sparse and therefore not discussed. However, Tetra Tech believes that enough data have been collected to at least be included in the discussion of biodegradation rates.

Redox potential measurements do not appear to be accurate or representative of site conditions.

The report identifies that oxidation/reduction (redox) potential is an important parameter in aquifer geochemistry and may indicate the prevalence of certain processes. However, throughout the document, the redox potential measurements appear to contradict with the geochemical conditions indicated by other parameters. These differences call into question the

Mr. Spielman
September 9, 1997
Page 4

quality of the redox potential data. This issue should be discussed. It is unclear whether the redox conditions at the site are not consistent with other parameters or whether the observed redox concentrations are due to measurement errors.

If you have any questions or comments, please contact Mark Wetters at (916) 853-4540.

Sincerely,

A handwritten signature in black ink, appearing to read 'M. Wetters', with a stylized flourish at the end.

Mark Wetters
Project Engineer

ENCLOSURE FOUR

U. S. EPA Review Comments, BERC Delivery Order 005, Intrinsic
Bioremediation Report at Sites 3 & 13, NAS Alameda, Prepared by Ned Black,
Code H-9-3, U. S. EPA, 22 Oct 1997.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

September 2, 1997

Ken Spielman, 5090
Remedial Project Manager
Department of the Navy
Engineering Field Activity West
900 Commodore Drive
San Bruno, California 94066-5006

**RE: BERC Delivery Order 005, Intrinsic Bioremediation at Sites 3 and 13, NAS
Alameda, Alameda**

Dear Mr. Spielman:

EPA has reviewed the above referenced document, prepared by Berkeley Environmental Restoration Center, and received on August 21, 1997. EPA's ecologist, Ned Black, recommends EPA's acceptance of the results of the study. He has based his recommendation on review of the document and on the oral presentation on the sites by Professor Alvarez-Cohen, University of California, Berkeley on August 11, 1997, and has concentrated the review mainly on the data interpretation.

Dr Black found the microscopy and isotope analysis work sound and well-founded in both theory and practice, and the combination of these techniques an innovative and promising method of investigating natural attenuation at sites with very small groundwater gradients. He agrees with the conclusion that intrinsic bioremediation of petroleum hydrocarbons appears to be taking place at both Sites 3 and 13. Site 3, in particular, appears to have strong activity. The activity at Site 13 may need, as the report suggests, some simple manner to stimulate biodegradation.

If you have any questions regarding these comments, please call me at (415) 744-2367, or Ned Black at (415) 744-2354.

Sincerely,

A handwritten signature in cursive script that reads "Anna-Marie Cook".

Anna-Marie Cook
Remedial Project Manager

cc: Ned Black, USEPA
Tom Lanphar, DTSC
Steve Edde, EFAWEST