RESPONSE TO COMMENTS FROM MAINE DEPARTMENT OF ENVIRONMENTAL PROTECTION ON THE SUMMARY REPORT BIOSPARGING SYSTEM OPERATIONS AT OLD NAVY FUEL FARM, JULY-DECEMBER 1998, NAVAL AIR STATION, BRUNSWICK, MAINE

COMMENTOR: Claudia Sait **DATED: 17 August 1999**

GENERAL COMMENTS

1. The Navy's responses to MEDEP's comments on the January-June 1998 Bi-Annual Report are appreciated, but were received 6 months after comment submittal. Again, MEDEP was put in a position of not having a chance to provide timely input to the Navy on their recommended upgrades to the remedial system. At least twice a year, this site should be added to the agenda for discussion at future Technical Meetings.

   Response—Comment noted. The Navy would like to set up a technical meeting in the near future to discuss the site.

SPECIFIC COMMENTS

2. ***Site History, Section 1.2, Page 1-1***—The second sentence says that the petroleum bulk storage facility was decommissioned in 1993. The role of MEDEP in this shutdown and the spill number should be stated.

   Response—Comment noted. This section has been deleted in the January-June 1999 Bi-Annual Progress Report and will not be included in future progress summaries in order to streamline and simplify the reports. Consistently repeating this information has no value and, therefore, was deleted.

3. ***Site Geologic Conditions, Section 1.2.1, Page 1-1, 1st and 3rd Sentences***—These statements about the topography at BNAS are inaccurate. The topography at the Old Fuel Farm is relatively flat, but the base topography is not (Mere Brook and Merriconeag Stream drainages are prominent valleys). Also, the erosion of surficial sand is a minor factor in the formation of BNAS topography. The annual reports for Sites 1 & 3 and the Eastern Plume should be consulted to provide a more appropriate description of BNAS geology. Please correct.

   Response—Comment noted. This section has been deleted in the January-June 1999 Bi-Annual Progress Report and will not be included in future progress summaries in order to streamline and simplify the reports. Consistently repeating this information has no value and, therefore, was deleted.

4. ***Soil Vapor Extraction System Enhancements, Section 1.3.2, Page 1-3***—This paragraph briefly states that a de-watering pilot study at the Old Fuel Farm is being conducted in 1999. Probably the most interesting aspect that was not mentioned is the fate of the discharged shallow groundwater. Please state where the Navy will dispose of the pumped water. Also what are the Navy's plan to monitor the dewatering effort?

   Response—The details surrounding the design, construction, and implementation of the de-watering pilot study are outlined in the Old Navy Fuel Farm Bi-Annual Report dated 1 January 1999 through 30 June 1999. Negotiations were conducted in February 1999 with the Brunswick Sewer District who agreed to accept the discharged ground water to the sanitary sewer system provided the analytical results demonstrated that the discharged water would not violate the existing base-wide discharge permit. During initial startup of the system, the de-watering tank was filled, sampled, and the system was shut down pending receipt of the analytical results. The sampling results indicated that the constituents of concern were within the permitted discharge limit. The system was restarted and operated continuously with monthly sampling of discharged water.

5. ***Water Quality Indicator Parameter Measurement Methodology, Section 2.1.2, Page 2-1, 1st Paragraph***—Upon completion of the manufacturer-recommended instrument calibration procedures, field measurements were obtained by immersing the instrument sonde below the water level at each test location.

   Are calibration procedures implemented at each successive test location? This is MEDEP's interpretation of the above sentence. Please clarify this statement in the report.

   Response—Calibration procedures are not implemented at each successive test location. The information will be clarified in the report to read:

   > *The manufacturer-recommended instrument calibration procedures were conducted prior to the start of each day's field effort and after potentially erroneous readings. Field measurements were then obtained by immersing the instrument sonde below the water level at each test location.*

6. ***Overview, Section 2.3.1, Page 2-3, Top***—Monitoring well MW-NASB-056R was obstructed during the reporting period and could not be sampled.

   The Department views MW-NASB-056R as an important downgradient monitoring location for the western hydrocarbon ground-water plume. Currently, only one other well is being sampled in the western downgradient area (MW-NASB-054). The Department expects that this is one of the locations that a new well was installed, if the existing well could not be rehabilitated. Apparently, the opportunity for MEDEP input did not materialize.

   Response—Comment noted. The 6 proposed additional monitoring wells have not been installed to date pending further source soil delineation to provide sufficient data for optimal well placement. The Navy will work with MEDEP to select the appropriate well locations to ensure proper monitoring at the site.

7. ***Summary of Biosparging System Operation and Monitoring Data, Section 3.1, Page 3-1, 4th Bullet***—Inspection of biosparging system components and remedial area for evidence of active air injection (sparging).

   This task needs to be explained, as it is not apparent to MEDEP why active air injection is not documented by site instrumentation, and therefore negating a need for remedial area inspection. Please explain.

   Response—The air flow from the sparge blowers is measured in standard cubic feet per minute (scfm) by analog flowmeters within the treatment building. However, useful information is also gathered by conducting visual inspections of the remedial area. Under Section 1.3.1, *Aquifer Air Sparging System Enhancements*, the installation of 138 air sparging control valves is summarized. A qualitative assessment of air flow to each sparge well is helpful in adjusting the control valves to target areas known to exhibit higher concentrations of petroleum hydrocarbons. Also, a visual inspection has at times revealed short-circuiting to atmosphere conditions around specific air sparge wells that, if undetected, result in reduced remedial influence of each sparge blower.

8. ***Biosparging System Operational Summary, Section 3.1.1, Page 3-2***—It should be noted that the system was deactivated from 30 November to 31 December to accommodate the installation of the de-watering pilot study process equipment.

   This fact seems to have been forgotten when discussing the ground-water analytical results of the 8-9 December sampling round. Intuitively, the shutdown of the biosparging system 8 days before sampling began should cause chemical differences (field and/or laboratory) as compared to the previous analytical results when the system was in operation. Our examination of Table 3-1 (well gauging data) and Table 3-2 (field water quality measurements) suggests significant changes in values for the 8-9 December round. For example, water levels in some wells broke with a downward trend, showing rises on 3 December. On this same date, dissolved oxygen increased by 3-7 mg/L in many wells over the 23 November values. Differences between the 8-9 December laboratory analytical data and previous rounds are harder to characterize, as historically most data sets have shown considerable fluctuation. The Navy should reiterate the above text statement in Sections 3.2.2 and 3.3.2, and analyze the 8-9 December data through concentration versus time graphs.

   Response—Comment noted. While the Navy agrees that the shutdown of the biosparging system 8 days before sampling may cause differences when compared to previous analytical and field results, it questions the usefulness of performing such a detailed analysis of system shutdown repercussions at this stage of the remediation process.

   As MEDEP stated in Comment No. 7 dated 11 December 1998, the water within the screened interval is stagnant and not representative of ground water... *Only after purging the stagnant water can one obtain meaningful data about the* in situ *concentrations at this site.* The Navy agrees that the purging process typically yields more representative field water quality measurements. Therefore, a detailed analysis of the dissolved oxygen concentrations in relation to system shutdown will not be performed utilizing data that MEDEP does not

find meaningful. The interpreted isopleth areas (Figures 3-6 through 3-8) are sufficient documentation of any suspected rebounding of petroleum-related concentrations from system shutdown.

9. ***Well Point Headspace Vapor Measurements, Section 3.1.4, Page 3-3, Top Paragraph***— Elevated FID responses observed without corresponding PID responses were assumed to be indicative of the presence of methane gas.

   What are the other possible explanations, and why were they ruled out?

   Response—Section 3.1.4 will be clarified. The Navy is aware that FID responses may or may not indicate the presence of methane gas. As stated in Section 3.3.1 *In Situ* Biodegradation Conditions, Page 3-7, 3rd Paragraph, *Based on FID/PID responses, limited concentrations of methane.....were potentially indicated at well points.... It should also be noted that the presence of methane gas was only confirmed by direct measurement with the LandTec GA-90....* This section will be modified as follows:

   > *The FID/PID instrument only meets the EPA data quality level 1A: Qualitative Screening. General field applications for the FID/PID are limited to indications of general presence of contamination and for health and safety applications. However, some assumptions can be made from the operating principles of the instrumentation. While FIDs provide significant response to most organic vapors, they are more sensitive to aliphatic (or chained) hydrocarbons because these compounds burn more efficiently than aromatic (or ringed) hydrocarbons. FIDs are typically calibrated with methane. PIDs use an ultraviolet lamp to ionize organic vapors rather than a hydrogen flame. Ultraviolet lamps range in energy from 8.4 to 11.7 eV; the Navy Foxboro TVA 1000 PID currently uses a 10.6-eV lamp. Compounds with higher ionization potentials (e.g., aliphatics) require more energy for ionization; therefore, the strength of the ultraviolet lamp determines the compounds that are ionized. PID instruments are most sensitive to aromatic hydrocarbons (e.g., BTEX compounds), but some aliphatics can also be detected with the higher energy lamps.*

10. ***Summary of Ground-Water Sampling Program Results, Section 3.2***—Ground-water sampling was performed at the Old Navy Fuel Farm on 8 and 9 December 1998...following approximately 28 months of active biosparging.

    The statement should be worded such that the 8 days of shutdown prior to this round is mentioned.

    Also, much information in the first two paragraphs is a repeat of sampling information in Section 2.3, and is not needed under "Program Results."

    Response—The following sentence will be added at the end of Section 3.1.1 Biosparging System Operational Summary:

    > *Therefore, the system was inactive for 8 days prior to the 8-9 December 1998 sampling event.*

Also, the first two paragraphs of Section 3.2 Summary of Ground-Water Sampling Program Results will be deleted.

11. ***Well Gauging Results, Section 3.2.1, Page 3-4, 2nd Paragraph***—Ground-water flow is interpreted to be to the southeast.

    Although this differs from the south-southeast direction given on Page 1-2, the difference is explained in the next sentence as the effect of temporary system shutdown. This finding is quite interesting and may eventually take on importance to future evaluation of hydrocarbon cleanup. No response necessary.

    Response—Comment noted. However, the subsequent explanation in Section 3.2.1 Well Gauging Results, Page 3-4, 2nd Paragraph, with regard to flow direction in comparison to system operation, describes that the *overall ground-water flow direction observed during the 3 December 1998 gauging event, when the biosparging system was inactive, was similar to that observed during the August 1996 gauging event (prior to activation of the biosparging system)* ***and during subsequent periods of active biosparging***. The general flow direction is south-southeast as shown on Figure 3-1, and has not significantly varied when the system is active or inactive. The word "south-" will be added to southeast in Section 3.2.1 Well Gauging Results.

12. ***Ground-Water Sampling Results, Section 3.2.2, Page 3-5, 1st Paragraph***—Although VOC were not reported in the trip and rinse blanks submitted with the monitoring well ground-water samples, several VOC (toluene, ethylene, and total xylene) were reported from the 8-9 December 1998 sampling event at (= or <) 2 μg/L. Review of historical analytical results from five prior sampling events indicates that these results are not representative of actual conditions.

    The Department strongly disagrees with both statements. The contamination at this site was originally BTEX, which has degraded into various compounds measured as DRO and GRO. However, the current database shows that toluene, ethylene, and total xylene have been, and are yet present at substantial concentrations in places. Please delete the second sentence above, and revise the first sentence to reflect Table 3-5 data.

    Response—Comment noted. The second sentence will be deleted. The first paragraph will be modified to read:

    > *VOC were not reported in the trip and rinse blanks submitted with the monitoring well ground-water samples. However, several monitoring wells exhibited BTEX concentrations. The total BTEX concentrations were calculated consistent with the laboratory analytical results for monitoring well ground-water samples.*

13. ***Assessment of Biosparging System Performance, Section 3.3, Page 3-6, 1st Paragraph***—It should be noted that variation in some or all indicator parameters, relative to the previous reporting period (January-June 1998), may be attributed to seasonal effects.

    The next sentence properly adds that the biosparging system was inactive from 30 November to 31 December 1998. It is MEDEP's view that most of the variation noted in the indicator

parameters should not be attributed solely to seasonal differences, and at least equal weight should be given to the effects of temporary system shutdown during the sampling period. Please modify the existing explanation.

Response—Comment noted. The paragraph will be modified to read:

> *It should be noted that the variation in some indicator parameters, relative to the previous reporting period (January-June 1998), may be attributable to seasonal effects. However, the biosparging system was inactive during the period of 30 November – 31 December 1998 to allow completion of engineering modifications undertaken to enhance remedial system performance. Some variation in indicator parameters may also be attributable to the temporary system shutdown.*

14. ***In Situ Biodegradation Conditions, Section 3.3.1, Page 3-7, 4th Paragraph***—The general partial recovery of dissolved oxygen in ground water (1998 data) at many monitoring points might be addressed in this analysis as further evidence of remediation occurring. However, some hot spots yet remain, and the higher dissolved oxygen values may decrease significantly if the air sparging were terminated for longer than 3 weeks (compare the 23 November and 21 December recorded values in Table 3-2). How does the Navy explain this relationship?

Response—The Navy does not dispute the relationship between biosparging system shutdown and a general partial recovery of dissolved oxygen in ground water (3 December 1999 readings) followed by a decreasing trend (21 December 1999 readings). However, as the Navy's response to MEDEP Comment No. 8 states, MEDEP has expressed its concern over utilizing data from wells that were not purged. As MEDEP stated in Comment No.7 dated 11 December 1998, the water within the screened interval is stagnant and not representative of ground water...*Only after purging the stagnant water can one obtain meaningful data about the* in situ *concentrations at this site.* The Navy agrees that the purging process typically yields more representative field water quality measurements. Therefore, a detailed analysis of the dissolved oxygen concentrations in relation to system shutdown will not be performed utilizing data that MEDEP does not find meaningful.

15. ***In Situ Biodegradation Conditions, Section 3.3.1, Page 3-8, 3rd and 4th Paragraph***—Based on the December 1998 ground-water sampling data, the manganese concentrations do not appear to have changed significantly during the reporting period, and were not significant indicators in previous sampling events (August 1996 – June 1998).

Based on the December 1998 ground-water sampling data, the ferrous iron concentrations have not changed significantly during the reporting period.

Based on the lack of significant changes in ferrous and manganese concentrations, future sampling events will not include analysis for ferrous iron and manganese.

Any decision to discontinue ferrous iron and manganese sampling needs to be based on data other than those collected in December 1998, due to possible effects from eight days of system shutdown. The discontinuing of sampling for ferrous iron and manganese should be postponed until the review of the next event's data. Data for all historic and current events

should be presented in graphs of concentrations versus time. Such an analysis will determine if good cause exists for deleting iron and manganese sampling.

Response—The decision to discontinue ferrous iron and manganese sampling in future sampling events was not based solely on the data collected in December 1998. While this fact is clear for manganese concentrations in the 3rd Paragraph....*Based on the December 1998 ground-water sampling data, the manganese concentrations do not appear to have changed significantly during the reporting period,* ***and were not significant indicators in previous sampling events (August 1996 – June 1998)***, the report is not clear that the same comparisons were made for ferrous iron concentrations based on all previous sampling events. Clarification will be made in the report. Also, following system modifications outlined in the January-June 1999 Bi-Annual Progress Report, the Old Navy Fuel Farm remediation network is no longer being operated as a biosparging system, but as an SVE/AAS system. Therefore, a quantitative assessment of alternative electron acceptors is no longer a major indicator of remedial effectiveness.

16. ***Assessment of Dissolved-Phase Hydrocarbon Removal, Section 3.3.2, Page 3-10, 3rd Paragraph***—Dissolved-phase MTBE was almost entirely absent from ground water at the Old Navy Fuel Farm by the June 1997 interim sampling event.

This statement is misleading, and should be revised. While all the originally installed well point locations now have non-detects for MTBE, the two newer well points (WP-21 and WP-22) in hot spots have not shown a declining trend. Also, 3 of 8 sampled wells in the last two sampling events contained for MTBE. These data indicate to MEDEP that that MTBE is yet a concern. It is interesting that the older well points (which are distributed throughout the plume) have not had recent detections of MTBE. This absence appears to be the basis of the Navy's statement. However, benzene has been found in more than several well point samples in every sampling event. Benzene is more volatile than MTBE, but is less water soluble. This relationship is unanswered if as the Navy contends in its response to Comment 13a (11 December 1998) that advection is not a significant factor in measured reductions of MTBE.

Literature research has shown the MTBE can be transported effectively in groundwater and is more persistent over time than BTEX. Because ground-water containment has not been an objective at the Old Fuel Farm and water table contours indicate an appreciable gradient to the southeast (see Figure 3-1), MEDEP has concerns that downgradient ground water is inadequately monitored with only two wells monitored south of Avenue B.

The Navy has proposed to install 6 new monitoring wells to replace well points with very low yields (Comment 7 response, 11 December 1998). Two or 3 of these new wells need to be located south of Avenue B. We would like to discuss these locations with the Navy, presuming that they have not already been installed.

Response—The sentence concerning MTBE will be clarified in the report. However, the Navy strongly disagrees with MEDEP that MTBE is yet a concern, especially from offsite migration. As Table 3-6 indicates, from 25 June 1997 until 9 December 1999, there has been only 1 MTBE analytical result for well points or monitoring wells above the MEDEP cleanup goal of 35 μg/L (MW-NASB-211, 36 μg/L, 8-9 December 1998 sampling event).

MW-NASB-211 is in a known hot spot area. MTBE was not detected in the four monitoring points downgradient of MW-NASB-211 (WP-17R, MW-NASB-046, MW-NASB-049, and MW-NASB-058) during the December 1998 sampling round, clearly not substantiating a claim that MTBE is rapidly flowing offsite. Of the 3 of 8 monitoring wells referenced by MEDEP during the last two sampling events in June and December 1998, the analytical results for MTBE were as follows: MW-NASB-211 (ND and 36 μg/L, respectively), MW-NASB-058 (4 μg/L and ND, respectively), and MW-NASB-061R (5 μg/L and 4 μg/L, respectively). Furthermore, while WP-21 and WP-22 showed levels of MTBE (11 and 9 μg/L, respectively) during the December 1998 sampling event, they were substantially below the MEDEP mandated cleanup goal of 35 μg/L. Therefore, MTBE is not a constituent of concern that warrants further detailed investigation solely on its own merits. Should sampling indicate a rebound of MTBE in site monitoring points, the issue will be addressed. The Navy intends to install additional monitoring wells at the Old Navy Fuel Farm to ensure proper monitoring of site conditions and will be discussing modifications to existing remediation practices and placement of additional wells with MEDEP.

17. ***Conclusions and Recommendations, Section 3.4, Page 3-10, 4th Sentence***—Additional hydrocarbon mitigation has likely occurred due to natural attenuation, especially in anaerobic areas located outside the biosparging area of influence.

    Natural attenuation undoubtedly is a factor in the reduction of hydrocarbons at the site. The process of biodegradation will change the environment from aerobic to anaerobic, instead of biodegradation being initiated by an anaerobic environment. The above statement implies that an oxygen-depletion "shadow" surrounds the biosparging area of influence as a result of fuel contamination that spread over a larger area than is being remediated by sparging. It is likely that in the downgradient direction, a shadow has been created. Table 3-2 suggests that low oxygen concentrations did occur at wells MW-NASB-49 and MW-NASB-58 at various times during July-October 1998. Please revise the above sentence.

    Response—The above paragraph will be modified to read:

    > *Additional hydrocarbon mitigation has likely occurred due to natural attenuation. Anaerobic conditions are probable evidence that natural attenuation is occurring. Well sampling conducted outside the influence of the biosparging system has shown decreased dissolved oxygen concentrations, evidence that anaerobic conditions exist.*

18. ***Conclusions and Recommendations, Section 3.4, Pages 3-10 and 3-11***—Recommendations are not given, only conclusions and initiated modifications/improvements. Please restructure to indicate which are recommendations that MEDEP should consider.

    Response—There are no recommendations for MEDEP to consider that have not already been initiated except the installation of the 6 additional monitoring wells (for which the MEDEP has already expressed approval). The Navy has expedited the initiation of the system modifications to enhance the effectiveness of the remedial system. Additional recommendations will be discussed in a future technical meeting with MEDEP.

19. ***Historical Dissolved-Phase BTEX, GRO, and DRO Concentrations in Ground Water, Figures 3-6 through 3-8***—The graphs indicate a possible rebound of concentrations (due to short-term system shutdown) for the >10,000 μg/L isopleth for BTEX, GRO, and DRO, and for the >1,000 μg/L isopleth for DRO. At this point in the remediation, a small but perhaps significant rebound in concentrations is expected, as ground water replaces circulated air surrounding contaminated soil. The Navy should consider this phenomenon when addressing the probable timeframe of remediation. Please comment.

    Response—Comment noted. The Navy has reviewed the probable timeframe for remediation and has found it to be unacceptable. The Navy will evaluate alternative remedial options that could expedite site closure in the future.

20. ***Sampling Methodology, Appendix A, Page 4, Navy's Response to MEDEP Comment 8***— The Department notes that for the July-December 1998 sample collection in the low-yielding well points, an ISCO Model 2700 peristaltic pump is now used. The flow rates are not recorded in Appendix D, however, under comments all read "purge dry or 5 min purge."

    What are the purging rates? Will the well points still go dry if the rate is 200-300 ml/min.?

    Response—The Navy-owned ISCO Model 2700 peristaltic pump was utilized on monitoring wells or wells points with limited diameter or yield. The speed of the peristaltic pump is non-variable and pumps at approximately 500 ml/min. The Navy's consultant attempted to limit the flow rate by crimping the sampling tubing, but limited success was achieved.