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DEPARTMENT OF THE NAVY
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From: Commanding Officer, Navy Environmental Health Center
To: Commanding Officer, Atlantic Division, Naval Facilities Engineering Command, Code 1823, Norfolk, VA 23511-6287

Subj: MEDICAL REVIEW OF INSTALLATION RESTORATION PROGRAM DOCUMENTS FOR MARINE CORPS BASE, CAMP LEJEUNE, NC

Ref: (a) Baker Environmental, Inc., Transmittal ltr of 27 Oct 93

Encl: (1) Medical Review of Draft Final Remedial Investigation/ Feasibility Study Work Plan and Sampling and Analysis Plan for Operable Unit 10 (Site 35), Marine Corps Base, Camp LeJeune, North Carolina

1. As requested by reference (a), we completed a medical review of the forwarded documents ("Draft Final Remedial Investigation/ Feasibility Study Work Plan for Operable Unit No. 10 (Site 35)..." and "Draft Final Remedial Investigation/Feasibility Study Sampling and Analysis Plan for Operable Unit No. 10 (Site 35), Marine Corps Base, Camp Lejeune, North Carolina," dated October, 1993. Our comments and recommendations are provided in enclosure (1).

2. The technical point of contact is noted in the enclosure. We are available to discuss the enclosed information by telephone with you and, if desired, with you and your contractor. We are also available to provide health-related review for future documents associated with this site.

3. If you require additional assistance, please call Ms. Sheila A. Berglund, P.E., Head, Installation Restoration Program Support Department at 444-7575, extension 430.

J. H. ZIMMERMAN
Acting

MEDICAL REVIEW OF DRAFT FINAL REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORK PLAN AND SAMPLING AND ANALYSIS PLAN FOR OPERABLE UNIT NO. 10 (SITE 35) MARINE CORPS BASE, CAMP LEJEUNE, NORTH CAROLINA

References:

(a) "Supplemental Region IV Risk Assessment Guidance," U.S. EPA Region IV memo, dtd March 26, 1991

(b) *Assessing Human Health Risks from Chemically Contaminated Fish and Shellfish* (EPA 503/ 8-89-002, September 1989)

(c) *Standard Operating Procedures and Quality Assurance Manual (February 1, 1991)*, U.S. EPA Region IV, Environmental Compliance Branch)

(d) "New Interim Region IV Guidance," U.S. EPA Region IV memo dtd February 11, 1992

General Comments:

1. The draft documents entitled "Draft Final Remedial Investigation/Feasibility Study Work Plan for Operable Unit No. 10 (Site 35)..." and "Draft Final Remedial Investigation/ easibility Study Sampling and Analysis Plan for Operable Unit No. 10, Marine Corps Base, Camp Lejeune, North Carolina," dated October, 1993 were provided to the Navy Environmental Health Center (NAVENVIRHLTHCEN) for review on 28 October 1993. The reports were prepared for Atlantic Division Naval Facilities Engineering Command by Baker Environmental, Inc.

2. The information presented in the work plan (WP) and field sampling and analysis plan (SAAP) is generally in accordance with guidance provided in pertinent Environmental Protection Agency (EPA) documents such as *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final (October 1988)*. However, there is a need for more specific information to be included. Our primary concern is that neither the WP nor the SAAP includes a detailed, site-specific risk assessment methodology section. The review comments and recommendations provided below address the need to include additional and more specific health information.

3. The technical point of contact for this review of the remedial investigation WP and field SAAP is Ms. Andrea Lunsford, Head, Health Risk Assessment Department, Environmental Programs Directorate, NAVENVIRHLTHCEN, who may be contacted at 444-7575, extension 402.

Review Comments and Recommendations:

Sampling and Analysis Plan

1. Page 1-19, section 1.2.2 (Potential Migration and Exposure Pathways), bullet 2; and pages 5-18 to 5-24, section 5.6 (Biological and Fish Sample Collection)

Comments:

a. The Section 1.2.2 list of exposure pathways includes "wildlife (deer, mammals), fish and fowl exposure to surface and subsurface soil and surface water." Characterization of hunting activities at Marine Corps Base (MCB), Camp Lejeune are neither addressed in the SAAP nor in the WP. Nor do the texts specifically state whether exposure pathways to be included in the human health risk assessment will include human exposures resulting from consumption of wildlife and fowl.

b. Bob White quail, deer, and turkey are hunted on base. Hunting activities may or may not extend into the site. Evaluation of this pathway may not significantly impact the risk assessment; however, risks should be calculated for all completed pathways. If hunting activities are impacted by the site under investigation, risks from the consumption of wild animals should be assessed for all individuals who hunt at MCB, Camp Lejeune.

c. The Agency for Toxic Substances and Disease Registry (ATSDR) strongly encourages characterization of food chain pathways:

(1) The ATSDR Public Health Assessment Manual (PHA manual), section 6.5.1 ("Location of Populations") states: "When uptake into plants and animals is possible, the health assessor should identify populations that are exposed or potentially exposed through consumption of contaminated plants and animals." The guidance manual directs assessors to determine site-specific factors that influence the amount and frequency of contaminated food intake. In some areas, wild plants, animals and fish may constitute a significant portion of the diet of local residents, as may be the case with subsistence fishermen.

(2) In recent ATSDR/Department of Defense (DOD) meetings (e.g., November 10, 1993 meeting at the Pentagon), ATSDR has repeatedly emphasized the need for DOD facilities to ensure that food pathways are adequately addressed.

Recommendations:

a. Include a discussion of the hunting activities on or around this site. If appropriate, assess risks related to the consumption of wild animals.

b. Ensure that food pathways are specifically addressed. To facilitate ATSDR in developing an appropriate public health assessment for the site, include a separate section in the SAPP and WP documents, to describe probable food chain pathways and how they will be characterized.

2. Page 1-19, section 1.2.2 (Potential Migration and Exposure Pathways), bullet 2; and pages 5-18 to 5-24, section 5.6 (Biological and Fish Sample Collection)

Comment: The text does not specifically state whether exposure pathways to be included in the human health risk assessment will include exposures resulting from consumption of fish:

a. The last paragraph of section 5.6, which addresses the collection and analysis of fish tissue, states that fish fillets (vice whole body samples) will be analyzed "if adequate individuals from each species are not collected." Since fillet portions are generally used to assess human health risks, and whole fish are generally used for ecological risk assessment purposes, the statement suggests that the sampling results will be used for health risk assessment purposes.

b. If the intent is to use these data for human health risk assessment, the list of exposure pathways should also include exposure from consumption of biota.

Recommendation: Expand the section 1.2.2 "exposure pathway list" to include human health risks from consumption of biota.

3. Page 1-19, section 1.2.2 (Potential Migration and Exposure Pathway)

Comments:

a. Preliminary (generic) exposure pathways are listed in bullet form. The exposure scenarios listed do not distinguish between current and potential future exposures. Since exposure pathways for these two scenarios (i.e., current and future) are not separated, we cannot conclusively agree with the pathways listed. For example, a residential scenario is listed for soil pathways. This scenario is likely of concern only for future potential residents since the site being addressed is not currently used as a residential area.

b. Current and future scenario pathway models should be presented separately, based on information currently known about the sites. Separation of current and potential future scenarios facilitates review by regulators and is also advantageous in setting up the format for reporting risk estimates.

c. Reference (a) states that "a future residential scenario should be assumed unless there is strong reason to do otherwise (e.g., highly industrial areas, wetlands)." If a future residential scenario is not probable, justification for its omission should be provided.

d. Neither the SAAP nor the WP present information regarding future land use. Also, the exposed populations, which have been identified as "worker, resident and recreational users," are not defined:

(1) Site-specific information to characterize potentially exposed populations with regard to size and characteristics is not provided.

(2) Sensitive populations (e.g., infants and children, elderly people, hospitals, etc.) and their locations in reference to the specific sites are not addressed (e.g., nursing homes and child care facilities).

Recommendations:

a. Separately list the exposure pathways applicable to current and future exposure scenarios.

b. Include a future residential exposure pathway unless sufficient justification is available for its omission. If a future residential scenario is not probable, provide the justification for its omission.

c. Address future land uses for each of the sites.

d. Provide site-specific information to characterize exposed populations with respect to: location relative to the site, activity patterns, and the presence of sensitive populations.

e. Identify any distant exposed populations, such as public water supply consumers or consumers of fish, shellfish or agricultural products impacted by the site.

4. Page 1-19, section 1.2.2 (Potential Migration and Exposure Pathway); and page 2-2, Table 2-1 (Conceptual Site Model and RI/FS Objectives for Operable Unit No. 10...)

Comments:

a. Section 1.2.2 lists preliminary (generic) exposure pathways in bullet form; Table 2-1 lists "potential exposure migration pathways." Neither section 1.2.2 nor Table 2-1, adequately present potential air pathway exposures. However, the first "exposure pathway" bullet of section 1.2.2 states: "Military personnel and civilian contractors transversing through the area could be exposed to surface soil and standing water." An air pathway could be implied by this statement, especially if the soil and standing water contain volatile organic compounds (VOCs).

b. Table 2-1 indicates that exposure to VOCs "may occur due to volatization from surface water;" however, an air pathway does not seem to be further considered. Since many of the spills that are being addressed are related to fuels, the air pathway may substantially contribute to human health risks. Contaminants of potential concern include semivolatiles and inorganics, as well as volatiles. Reference (a) states that semivolatiles and inorganics "should be assumed to be airborne via suspended dust particles." If the climate and/or geologic conditions at Marine Corps Base (MCB), Camp LeJeune preclude consideration of a fugitive dust pathway, data or information should be presented to justify its exclusion.

c. During remediation efforts, air concentrations may be a substantial concern. The SAAP and the WP should address the dust air pathway, as well as exposure to airborne volatiles. Air pathway omission should be substantiated in the text (e.g., the contribution from suspended particulates is dependent on the degree of site vegetation, average humidity levels, etc.).

Recommendations:

a. Evaluate all potential air pathways in the baseline risk assessment (e.g., volatiles and dust) or provide sufficient justification for their elimination.

b. Include semivolatiles and inorganics in the evaluation of fugitive dust pathways of exposure.

5. Page 1-20, section 1.2.3 (Preliminary Public Health and Environmental Health Impacts); and page 1-22, section 1.2.4.2 (Risk Assessment)

Comment: The text states that "a preliminary risk evaluation of Site 35 has concluded that there may be potential

human and ecological risks at this site." No information is provided concerning the risk evaluation. Section 1.2.4.2 states that "no previous investigation performed to date has included the performance of a quantitative baseline human health risk assessment." From this limited information, we cannot determine if the "risk evaluation" was based on preliminary remediation goals (PRGs) or whether some other methodology was used. The risk evaluation should be described.

Recommendation: Provide details of the preliminary risk evaluation. Specifically state the methodology used to evaluate risks and provide specific results of the evaluation.

6. Page 1-22, section 1.2.4.2 (Risk Assessment)

Comments:

a. Section 1.2.4.2 states that fish and benthic samples are needed from "various locations" along Brinson Creek for use in the ecological risk assessment (ERA). Selection procedures for the "various locations" are not provided.

b. The text does not state whether the "various locations" include known harvest areas. Reference (b) states: "Sampling stations should generally be located in known harvest areas." If planned sampling locations are known harvest areas, it should be specifically stated; if they are not, other locations should be considered.

Recommendations:

a. State whether or not the selected fish sampling areas are known harvest areas.

b. If they are not known harvest areas, select alternate areas.

7. Page 3-4, section 3.2.1 (Surface Soil Sampling), paragraph 1

Comments:

a. The first sentence states that a minimum of 14 **surface soil** samples will be collected. The next sentence defines **shallow soil** samples "as so being obtained from the interval between the ground surface and six inches below the ground surface. The term "surface soil" is used repeatedly in this section; the term "shallow soil" is only used in the above sentence. A consistent format should be used when reference is made to "surface soil."

b. The collection of surface soil samples at depths of 0 to 6 inches is consistent with EPA guidance as presented in

documents such as the *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part A*, December 1989 (RAGS manual). However, it is inconsistent with the Agency for Toxic Substances and Disease Registry (ATSDR) *Public Health Assessment Guidance Manual*, 1992 (PHA manual), which defines surface soil samples as "soil samples taken from depths of 0 to 3 inches."

c. The guidance reflects ATSDR's position that depths greater than three inches do not accurately reflect surface soil conditions. Under the Comprehensive Environmental Response, Compensation and Liability Act, ATSDR is mandated to perform a public health assessment (PHA) of any site which is placed on the National Priorities List. In developing PHAs at DOD facilities, ATSDR uses environmental data collected during installation restoration investigations. ATSDR summaries may reflect "no samples" taken for surface soil based on the fact that samples were taken at depth intervals greater than three inches.

d. To facilitate correlation between PHAs and health risk assessments, and in order to minimize costs associated with redundant sample collection and analysis, we encourage the adoption of "0 to 3 inches" as the norm for surface soil sample collection for future site investigations. Adoption of this sampling protocol will not be in controversy with current EPA guidance, since the RAGS manual does direct that surface soil samples be collected "at the shallowest depth practical" in order to accurately reflect the potential surface soil exposure pathway.

Recommendations:

a. Change the term "shallow soil" to "surface soil." Use a consistent format when referring to surface soil.

b. Collect surface soil samples at 0 to 3 inch depths wherever this is achievable.

8. Page 5-15, section 5.3 (Groundwater Sample Collection), #9

Comment: The text states that "[Ground water] Samples will be collected for total (unfiltered) and dissolved (filtered) metal analysis." Neither this SAAP nor the WP state which samples will be used for assessing human health risks.

a. Reference (a) states that "unfiltered groundwater data should be used to determine the exposure point concentration."

b. We recommend using both types of samples in the health risk assessment. Although the regional EPA guidance requires use of unfiltered sample results in the quantitative health risk

assessment (HRA), if risk estimates for both filtered and unfiltered samples are developed, both values can be discussed in the HRA. Since some heavy metals absorb strongly to soil/sediment particles, the differences between the resultant risk estimates from filtered and unfiltered sampling results can be large. Providing comparison values can therefore be very useful in demonstrating that the risk estimates from unfiltered ground water samples is overly conservative.

Recommendations:

a. Specifically state that unfiltered ground water will be collected and used to determine the exposure point concentration, for the HRA calculations.

b. Develop risk estimates for both filtered and unfiltered ground water samples, and discuss both values in the HRA.

9. Page 5-16, section 5.4 (Surface Water Sample Collection), paragraph 2

Comments:

a. The text states that "Care will be taken when collecting samples for analysis of volatile organic compounds (VOCs) to avoid excessive agitation that could result in loss of VOCs." It then states that VOC samples "will be taken prior to the collection of samples for analysis of other parameters" and that "sample bottles will be filled in the same order at all sample locations."

b. Section 4.2.1.1 ("Purgeable Organic Compounds Sampling (VOA)") of reference (c) provides specific guidance regarding the type of vial (i.e., 40 milliliter septum vial); the type of cap (i.e., screw-on cap with teflon-silicon disk); the filling procedure (i.e., to fill the vial by pouring down the side and to completely fill the container leaving no head space); and the need to perform a bubble check when collecting surface water samples. These procedures are not stated in the SAAP.

Recommendation: Specifically state that the Region IV procedures, listed above, will be adhered to for surface water sample collection for VOC analyses.

10. Page 5-22, section 5.6 (Biological and Fish Sample Collection), subsection 5.6.2 (Fish Collection)

Comment: The first paragraph states that fish will be collected at designated stations. The text does not specifically state whether the designated stations are known harvest areas. If they are, this should be stated. If they are not, other locations should be considered.

Recommendation: State whether or not the projected fish sampling locations are known harvest areas. If not, select alternate areas.

11. Page 5-24, section 5.6.2.1 (Analysis of Fish Species)

Comments:

a. The last paragraph of this section states: "At least ten individuals from each species, if available, will be composited and analyzed for whole body burdens of chemicals. In addition, fillets of at least ten individuals, if available, from each edible species will be composited and analyzed for chemical constituents. If adequate individuals from each species are not collected for whole-body analysis and fillet analysis, only the fillets will be analyzed."

b. Reference (b) states that composite sampling has certain advantages over single samples, such as cost-effectiveness and a more efficient estimate of the mean; however, compositing samples from several fish to a single sample precludes statistical analysis. The guidance manual further states "The benefits of compositing individual samples from a single station within a given sampling period often outweigh the disadvantages just discussed."

c. We understand that the number of samples depends primarily on the fishing success rate; however, we are justifiably concerned that sufficient samples be collected from which to make any type of risk-based decision. (We have recently reviewed several fish studies in which an insufficient number of composite samples was collected to make any type of risk-based decision.)

d. Neither the WP nor the SAPP state that fish control samples (background samples) will be collected. The "Exposure Assessment" chapter of reference (b) recommends background sampling to facilitate comparison. The guidance states: "Include samples from a relatively uncontaminated reference or control area to help define local contamination problems." Background sampling is also recommended and discussed in the RAGS manual. It states that "reference stations should closely match the characteristics of known harvest areas."

e. The ATSDR published notice of a draft guidance document entitled *Environmental Data needed for Public Health Assessments* in the March 3, 1993 Code of Federal Regulations (58 FR No. 40). The ATSDR guidance recommends the following when biota studies are performed:

(1) A sample size of "at least 20 individuals per species, per episode."

(2) Analysis of edible portions only.

(3) Analysis of individual ("grab") rather than composite samples.

(4) A control population of at least 20 individuals from a comparable uncontaminated location, for background levels.

(5) A copy of the protocol used, including how each species was harvested; how representative samples were selected; what portions were sampled and analyzed; special specimen handling procedures; contaminants analyzed for; methods used and their detection limits; etc.

Recommendations:

a. State whether samples will be composited between sampling stations.

b. Ensure that a sufficient number of composite and/or single samples are collected so that a risk management decision can be reached.

c. Include sampling in a relatively uncontaminated or reference control area. If reference stations(s) are not available (i.e., if reference stations closely matching the known characteristics of the known harvest areas do not exist), it should be so stated.

d. In developing sampling plans, address ATSDR environmental data needs.

12. Page 5-24, section 5.6.2.1 (Analysis of Fish Species)

Comments:

a. The last paragraph of this section states that "fish fillet and whole-body analysis will be performed" if adequate individuals from each species are caught. Neither the WP nor the SAAP address the fish parts that will be used to assess "whole body" analysis (i.e., whether only the edible portions of the fish will be used or whether whole fish, including viscera, will be used).

b. Neither the WP nor the SAAP provide a characterization of the potentially exposed population with respect to general method(s) of food preparation and parts of fish eaten. It is likely that the majority of MCB, Camp Lejeune and/or local fish consumers consume only the fish fillet. However, this should be determined. There are populations that consume all edible portions of the fish, or prepare fish in such a way that contaminants in other portions of the fish are of concern (e.g.,

some populations remove the viscera and boil the rest of the fish). Another issue that should be determined is whether or not the skin is taken off, or left on, the fillets.

c. The ATSDR PHA manual states that public health assessments (PHAs) should be based on measurements of the contamination in the "edible portions" of the relevant aquatic species. However, the manual also states that assessors should consider the specific dietary habits of the potentially affected population and notes that "if that information is not available, the assessor should state that an acceptable evaluation of this exposure pathway cannot be made without the information." Although the term "edible" is not specifically defined, the general discussion in the manual indicates that this is eviscerated fish, as opposed to fish fillets.

d. Optimally, the concentrations of contaminants in all edible portions of the fish and in the fillets should be determined.

Recommendations:

a. Further define the fish parts that will be included in the "whole body" samples.

b. Characterize the potentially exposed populations with respect to method of food preparation and parts of fish eaten.

c. If feasible, collect and analyze both "edible portions" and "fillets" of the fish.

WORK PLAN

13. Page 5-15, section 5.5 (Task 5 - Data Evaluation)

Comment:

a. This section consists of one paragraph which provides a cursory discussion of how data will be used, once it is received from the laboratory and is validated. Neither this nor other sections of the report address tables to be incorporated in the baseline risk assessment report.

b. Exhibit 9-1 ("Suggested Outline for a Baseline Risk Assessment Report") of the RAGS manual (pages 9-4 to 9-8) should be used as a guide for the health risk assessment (HRA) report format. Exhibit 9-1 is fairly extensive and indicates the need to incorporate a considerable amount of specific information in the report.

c. Exhibit 8-2 ("Example of Table Format for Cancer Risk Estimates") and Table 8-3 ("Example of Table Format for Chronic Hazard Index Estimates") of the RAGS manual, illustrate sample tables which present information in a specific format. The use of these formats enables reviewers to easily compare the variables in risk assessment equations. (Data presentation in some of the documents that we have reviewed effectively precludes analytical review.)

d. Reference (a) states that data summary tables should contain the frequency of detection, range of **detects**, average concentration and background concentration.

Recommendations:

a. Address the HRA format and include a requirement to follow the format in Exhibit 9-1 of the RAGS manual. Identify information that should be included in the HRA report.

b. Address the format for presenting analytical and risk summary data and include a requirement to follow Exhibits 8-2 and 8-3 of the RAGS manual.

c. When applicable, include the frequency of detection, range of **detects**, average concentration and background concentrations on data summary tables.

14. Page 5-15 to 5-17, section 5.6 (Task 6 - Risk Assessment)

Comments:

a. Section 5.6 is a short, generic summary of the risk assessment task. The text basically states that risk assessments will be performed in accordance with EPA guidelines as presented in risk assessment documents such as the RAGS manual. However, specific information is lacking.

b. Work plans should contain a separate human health risk assessment section which specifically describes the type of information that will be included in the risk assessment. Some of the types of information that should be included are:

(1) Identification of all potentially exposed populations; site-specific descriptions of tasks related to exposure pathways; present and potential future land use; media that are or may be contaminated; locations of actual and potential exposure and present concentrations at appropriate exposure points.

(2) The equations, calculations, and default assumptions used to determine exposures for all exposure scenarios (e.g., off-base, on-base, children, adults, current

land use, future land use).

(3) Parameters used to estimate exposure point concentrations (e.g., arithmetic mean, geometric mean, 95th percentile).

(4) The reference doses (RFDs) and cancer slope factors (CSFs) used to determine exposures.

(5) A discussion concerning the selection of data to be used for the risk assessment (e.g., the use and nonuse of "U", "J", and "UJ" qualified data).

(6) The selection criteria to be used to determine "compounds of concern" (e.g., comparison to background and frequency of detection statistics).

(7) An "uncertainty" section that addresses significant differences between actual site conditions and required default assumptions to determine risk. (For example, to discuss the risk associated with a potential shallow ground water ingestion scenario, or the risk associated with proxy values being used for non-detection data.)

(8) A discussion concerning the use of unfiltered ground water data to determine the exposure point concentration per guidance set forth by reference (a).

Recommendation: Discuss and/or present the information addressed above.

15. Page 5-15, section 5.6 (Task 6 - Risk Assessment)

Comment: The risk assessment section of the WP should provide specific information on the presentation of results. Section 5.6.1.2 ("Data Summary") states that "tables will be developed for each medium sampled and will indicate the frequency of detection, observed range of concentration, the means and the upper 95th percent confidence limits for each chemical detected in each medium." The following data table types should also be addressed:

a. The format of the data summary tables should be specified in advance (e.g., the summary tables should list sampling numbers on the horizontal axis and provide the analytical result of all detections on the vertical axis); this section could reference an appendix which provides the specific format of the tables.

b. The method by which proxy values will be annotated on the data summary tables should be described (e.g., the use of 1/2 the SQL is generally adopted as the proxy value for non-detects).

These data should be specifically annotated. Parentheses may be used to indicate substitute values, i.e., in addition to a "U" validation qualifier. (Note: reference (a) states that non-detects should not be incorporated into the average concentration.)

c. The methodology and the specific sampling results used to "group" data (e.g., to derive average and upper-limit concentration values) should be clearly identified and/or shown on individual tables in the remedial investigation (RI) report; this section should state that this information will be provided.

d. The text should specify that all equations used to derive intermediate parameters of the risk equations will be provided; and that all default assumptions used in the individual risk equations will be provided/listed.

e. The text should state that the risk summary tables will be presented in the format recommended in the RAGS manual (e.g., see Exhibits 8-3 and 8-4 on pages 8-8 and 8-9 of the RAGS manual.

f. In addition to the above information, the risk assessment section should specifically state that risk estimates for current and future exposure scenarios will be presented separately.

Recommendation: Expand this section to include the specific information suggested in (a) through (f), above.