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# DEPARTMENT OF ENVIRONMENTAL PROTECTION

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July 3, 1996

Commanding Officer
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RE: Draft On-Shore/Off-Shore Contaminant Fate and Transport Modeling Phase I Work Plan for Portsmouth Naval Shipyard Kittery, Maine, May 1996

Dear Jim:

The Maine Department of Environmental Protection (MEDEP) has reviewed the Navy's Draft Contaminant Fate and Transport Modeling Phase I Work Plan.

As described in our July 1, 1996 letter, the MEDEP cannot accept the modeling approach outlined in the Work Plan. We are, however, complying with the Navy's request to provide specific written review comments prior to a tentatively scheduled July 18, 1996 meeting with the Navy. The MEDEP's comments are provided below.

**General Comments**

Any modeling effort requires validation using actual contaminant analysis of the media involved. The MEDEP believes greater understanding of contaminant transport mechanisms would be derived by focusing on high quality monitoring of groundwater and sediment including monitoring proposed in the interim groundwater monitoring and seep sampling work plans.

The MEDEP believes that the interpretation of geochemical conditions at individual operable units (OUs) using geochemical models may be beneficial. A high degree of physical and geochemical complexity is associated with the migration of inorganic contaminants from the on-shore to the off-shore environment such as:

- mixing of high ionic strength salt water and low ionic strength fresh water;
- mixing of reduced groundwater and oxygenated estuarine water; and

- heterogeneity of fill materials.

The MEDEP suggests the geochemical modeling of groundwater chemistry would provide a more reliable method of assessing the solubility, and therefore the transportability of metal contaminants. Several geochemical models (e.g. MINTEQ; PHREEQUE) should be evaluated for this purpose.

**Specific Comments**

1.) 2.2.1 On-shore Investigations, Page 2-3, Para 2

"Because of questions on previous sampling methods, techniques, and reporting methods..."

Cite the most recent Air Monitoring Report dated June 1996.

2.) 2.3.3 SWMU #8, Page 2-8, Para 3

"The estimated risks associated with the soil contamination were within the U.S. EPA acceptable risk range..."

The State of Maine's acceptable incremental lifetime cancer risk is $1 \times 10^{-5}$. Risks exceeding this level must be considered.

3.) 2.3.4 SWMU #9, Page 2-9, Para 4

"The poured concrete blocks and precast concrete pipes at MBI were excavated and inspected for integrity."

The concrete blocks were never excavated. The soil around the blocks was excavated.

4.) 2.3.6 SWMU #11, Page 2-11, Para 5

"The main contaminant of concern in soil is lead and other contaminants."

Consider rewriting the sentence.

5.) 2.3.6 SWMU #11, Page 2-12, Para 2

"For soils exceedances occurred for PAHs..."

Change "For" to "Four".

6.) 2.3.14 Site #29 - Incinerator Site, Page 2-18, Para 2

"Site 29 will be part of future site investigations. It will not be considered in the Phase I modeling effort, because there is no field data or analysis to support the modeling effort."

There are currently three test boring/monitoring wells (DSB/DW-8, -8B, -9) located in the vicinity of the Incinerator Site Ash Landfill. Subsurface soil samples indicated fill materials located to depths of 20 to 40 feet below ground surface which exceed media protection standards for lead. The MEDEP suggests these test boring/monitoring wells be included in all evaluations of the DRMO.

7.) 3.1 Major Site Characterization Questions, Page 3-1, Para 2

The MEDEP requests the opportunity to review and comment on the Navy's responses to questions 1-8 when responses are developed.

8.) 3.2 Role of The Modeling Study, Page 3-2, Para 3

"Based on the data conditions at the PNS, examples of appropriate model applications are to link and interpret all of the available data, to identify potential data gaps, to evaluate sensitivities of important factors, and support remedial decisions by predicting future conditions with acceptable uncertainties."

The MEDEP agrees there is a need to link and interpret all available data, identify data gaps, and evaluate important factors related to the fate and transport of contaminants. However, the MEDEP will not accept model results alone for determining remedial actions at Operable Units (OUs). Extensive monitoring of both the on-shore and off-shore environments is required to support any remedial decisions.

9.) 3.2 Role of The Modeling Study, Page 3-2, Para 4

"In summary, the modeling study will first interpret the existing data and develop reasonable conceptual models of the hydrogeological conditions and contaminant fate and transport processes at major source areas within the PNS."

The MEDEP requests the opportunity to review and comment on the conceptual models once they are developed.

10.) 3.3 General Modeling Strategy, Page 3-3, Para 3

"Important features of this framework include up-front identification of issues and questions to be answered about the study area, utilization of previous study results, ..."

- Will the models incorporate analytical data from the proposed interim groundwater monitoring and seep sampling programs as they become available? Due to the proposed improvements in sampling (i.e. Low-Flow Sampling), this data should be more representative of groundwater quality.

11.) 3.3.1 Phases of Study, Page 3-3, Para 4

"The primary focuses of the Phase I modeling include COC screening and conservative estimation of baseline impacts to the near-shore receptor locations."

Model estimation of impacts to the near-shore receptor locations is only useful as a comparison to near-shore water and sediment quality monitoring results.

12.) 3.3.2 Levels of Conservatism, Page 3-4, Para 4

"The models will be as realistic and site-specific as can be supported by available data and field observations."

Model results are considered secondary to field and laboratory results.

13.) 4.1 Purpose, Page 4-1, Para 1

"In order to assess the impact of on-shore contamination to the near-shore zone, predicted surface water and sediment concentrations will be compared to surface water and sediment criteria."

Additional sampling and analysis may be required, particularly in the near-shore environment, for comparison to model results.

14.) 4.2 Potential Sources of Preliminary Criteria, page 4-1, Para 2

"Draft off-shore Media Protection Standards (MPSs) are available for surface water and sediment quality based on ecological and human health MPSs."

Draft off-shore ecological MPSs are not available for surface water and sediment quality based on ecological MPSs.

15.) 4.2 Potential Sources of Preliminary Criteria, Page 4-1, Para 3

"These two documents ["Quality Criteria for Water" (USEPA, 1986); "Origin of Human Health" (USEPA, 1991)] represent a comprehensive list of surface water quality criteria for the off-shore COCs."

Maine Ambient Water Quality Criteria must also be considered for off-shore COCs.

16.) 5.2 List of Initial COCs for Screening Model, Page 5-1, Para 3

"First, on-shore contaminant detections will be compared to on-shore Media Protection Standards (MPSs) to determine which contaminants have exceeded MPSs. Second on-shore contaminant detections for groundwater will also be compared to off-shore criteria."

As stated in Section 5.2 of this work plan, on-shore MPSs are based on future land use designations for soil (industrial and residential) and groundwater (residential only). On-shore MPSs were not intended for assessment of off-shore impacts. COCs should include all contaminants that may have a detrimental effect to the off-shore environment. This should include contaminants associated with off-shore human health risks and ecological impacts. The MEDEP requests the opportunity to review and comment on the List of Initial COCs for Screening Model as they are developed.

17.) 5.2 List of Initial COCs for Screening Model, Page 5-1, Para 4

"In order to perform the Phase I modeling in a timely manner, the Phase I modeling will only use existing data (RFI and RFI Data Gap investigations) which is generally considered more conservative."

Groundwater data from the RFI and RFI Data Gap investigations is compromised by sampling artifacts such as high turbidity. These results will not be as representative of aquifer conditions as samples collected using Low-Flow sampling techniques. The MEDEP suggests using analytical results for groundwater samples collected using Low-Flow sampling as they become available.

Understanding of geochemical processes which occur as a result of mixing low-ionic strength, potentially low Eh fresh water with oxygenated, high ionic strength salt water is essential to characterization of these aquifer systems. The interim groundwater monitoring program will provide data more suited to geochemical assessment than previous water quality data. Assessment of Low-Flow groundwater data in combination with proposed seep water and sediment sampling data may provide an understanding of the geochemical transition from areas like the JILF to Clark Cove.

18.) 6.2.1 Site Conditions, Hydrogeology, Page 6-2, Para 4

"Slug test results confirm that overburden materials have hydraulic conductivities that are 1 to 2 orders of magnitude higher than those in the shallow bedrock."

Generally this is true. However, the RFI Data Gap Report reports bedrock wells with hydraulic conductivities as high as 184 feet/day (DW-10B) and overburden wells with hydraulic conductivities as low as 3.8 feet/day (WOT-4). Assessment of aquifer hydrology should be specific to site areas and nested well pairs.

19.) 6.2.1 Site Conditions, Hydrogeology, Page 6-2, Para 5

"Groundwater flow in the bedrock does not seem to be structurally controlled, at least to the depths of the wells at the PNS facility."

What is the basis for this statement. The MEDEP is unaware of any effort to assess bedrock structure at PNS at a scale that would support this statement. A dye test was performed as part of the RFI Data Gap Investigation but assessment of flow directions was not compared to bedrock structure.

Additional work such as a bedrock fracture trace analysis is required to assess groundwater flow within the bedrock aquifer. Based on limited site observations, the MEDEP suspects horizontal anisotropy within the bedrock aquifer with preferential groundwater flow along dominant, vertically dipping, bedrock joints and fractures.

20.) 6.2.1 Site Conditions, Contaminant Fate and Transport, Page 6-4, Para 5

"Dissolved contaminants are transported via advection, dispersion, and retardation in the groundwater. Natural decay of contaminants occurs."

Retardation is not a transport mechanism but rather inhibits transport.

Inorganic contaminants (i.e. metals) do not decay.

21.) 6.2.1 Site Conditions, Contaminant Fate and Transport, Page 6-4, Para 6

"Groundwater in the deep bedrock does not discharge to off-shore surface water and sediment along the PNS facility perimeter."

Tidal survey results reported in Appendix I of the RFI Data Gap Report indicate that water levels at two deep bedrock wells, DW-7DB and FA-01DB, are effected by the tidal cycle. Water levels recorded at DW-7, DW-7B, and DW-7DB indicated a slight upward groundwater flow gradient suggesting migration of deep bedrock groundwater to off-shore surface water.

22.) 6.2.2.1 Source Characterization, Page 6-5, Para 3

"Based on an evaluation of the initial contaminants of concern (discussed in Section 5.0), a list of COCs for soil and groundwater and corresponding on-shore zones of contamination will be defined for the analytical modeling."

The proposed list of COCs should be included with this work plan. Conceptualization of contaminant fate and transport must be based on the geochemical properties associated

with individual contaminants. For example, a conceptual model of lead fate and transport would include the solubility of lead within the context of anticipated Eh/pH aquifer conditions; adsorptive properties of dissolved lead relative to solid and aqueous conditions; and other physical and geochemical processes which would contribute to the migration of lead in groundwater. This conceptual process must be outlined for each individual contaminant of concern in order to justify the validity of the models assumptions.

23.) 6.2.2.1 Source Characterization, Page 6-5, Para 4

"The zone of contamination will be defined both for an area of the facility and the with depth. The depth of contaminated groundwater that can potentially discharge to the off-shore will be estimated based on depths of the Piscataqua River and the Back Channel."

Vertical groundwater flow gradients must be considered at individual sites and nested piezometers to assess potential discharge of contaminated water to the river.

24.) 6.2.2.2 Important Contaminant Pathways, Page 6-5, Para 6

"Because surface soils are either covered with pavement of have insignificant contamination, the transport of contamination via surface run-off or wind dispersal is considered to be insignificant."

The JILF is not covered with pavement and significant sources of contamination are located within the landfill. The soil and vegetative cover over he landfill is presumed to prevent transport of contamination via surface run-off or wind dispersal.

25.) 6.2.2.2 Important Contaminant Pathways, Page 6-6, Para 1

"However, at the DRMO (SWMU #6, fill may have been placed along the shoreline and may be subject to erosion. The analytical model will not consider sediment transport, but the predicted sediment concentrations will be higher without considering sediment transport."

Fill was placed along the shoreline. Visual observation of the shoreline provides ample evidence of erosion. Predicted sediment values must be compared to analytically determined sediment contaminant values.

26.) 6.2.2.2 Important Contaminant Pathways, Page 6-6, Para 2

"Groundwater total suspended solids (TSS) data will be evaluated to ascertain if high levels of TSS are present near the shoreline, which may indicate a potentially significant erosion pathway."

How does the Navy propose to evaluate TSS in groundwater. It is the understanding of the MEDEP this can only be accomplished using Low-Flow sampling techniques. The highest energy in the fill areas adjacent to the river would occur during a storm event. TSS should be evaluated during or soon after a storm event to assess the maximum possible TSS measurements.

27.) 6.2.2.3 Important Contaminant Fate and Transport Processes, Page 6-6, Para 4

"Parameters that are utilized to describe the transport processes in the analytical model (e.g. solid/liquid distribution coefficient) will be estimated with site-specific data if available or literature values."

The following information regarding solid/liquid distribution coefficients (Kd) was extracted from a draft copy of EPA's Technical Background Document for Soil Screening Guidance[1]:

> The soil-water distribution coefficient (Kd) for metals and other inorganic compounds is affected by numerous geochemical parameters and processes, including pH; sorption to clays, organic matter, iron oxides, and other soil constituents; oxidation/reduction conditions; major ion chemistry; and the chemical form of the metal. The number of significant influencing parameters, their variability in the field, and differences in experimental methods result in as much as seven orders of magnitude variability in measured Kd values reported in the literature. This variability makes it much more difficult to derive generic Kd values for metals that for organics.

28.) 7.2.3 Basic Analytical Equations, Page 7-3, Para 4, Bullet 10

"• No cumulative impact from multiple sources."

Please provide further explanation for this aspect of the models assumptions.

29.) 7.2.3 Basic Analytical Equations, Page 7-4, Para 4

"$V_{z0}$ is the vertical seepage velocity (ft/yr)."

What assumptions will be used to determine the $V_{z0}$.

30.) Table 7-1 DEFINITIONS OF THE ON-SHORE MODEL PARAMETERS, Page 7-5

It would be helpful to the reader if the parameter definitions were included on the same page as the model equations.

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[1]EPA, Office of Solid Waste and Emergency Response, Technical Background Document for Soil Screening Guidance, Review Draft, November 1994.

31.) 7.2.5 On-Shore Model Parameter Estimation and Model Application Procedure, Page 7-6, Para 5

"One of the objectives of the Phase I modeling will be the determination of whether the contaminant concentrations at the PNS are in "steady state conditions" (i.e. flushing mode with stable or decreasing groundwater discharge concentrations) or if the contaminant groundwater concentrations are increasing with time."

Due to the large potential variability of Kd values (see Specific Comment 19) and other model parameters, the MEDEP does not feel the model can realistically predict groundwater trends. The most scientifically defensible approach to groundwater contaminant trend analysis is using long term monitoring data and appropriate statistical methods.

32.) Figure 7-1, Basic Onshore Analytical Equations, PNS, Kittery, Maine, Page 7-12

The MEDEP does not believe the analytical model presented in this work plan provides any meaningful contribution toward the characterization of contaminant transport at PNSY. The MEDEP believes the monitoring of groundwater, surface water, and sediment quality required to calibrate and prove the validity of any fate and transport model would in itself provide more value for interpreting contaminant migration. See Specific Comment 19.

33.) 11.0 Proposed Outline, Page 11-2

Sections 2-8 should be provided for the MEDEP's review and comment as they are developed. It's important that the MEDEP is allowed the opportunity to provide input during the process, so that consensus can be reached on crucial elements of the model before the model is completed. It would be helpful if the Navy could provide a timeframe for completion of each report section.

If you have any comments or questions, please call me at 207-287-2651. Thank you.

Sincerely,

Nancy Beardsley

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