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May 11, 2001

Naval Facilities Engineering Command
10 Industrial Highway, Mail Stop #82
Lester, PA 29223-2090

RE: Nomans Land Island Disposal Site – CHILMARK, MA
RTN 4-13390
Phase II Comprehensive Site Assessment Comments

Dear Mr. Warner:

The Massachusetts Department of Environmental Protection (DEP) has received and reviewed the Phase II Comprehensive Site Assessment Report for the Nomans Land Island Disposal Site. A Comprehensive Site Assessment, as defined in 310 CMR 40.0835, requires sufficient information to support conclusions and opinions regarding the source, the nature, and the extent of contamination, and the potential impacts of releases of oil and/or hazardous materials. It also requires an assessment of the risk of harm posed by the disposal site to health, safety, public welfare, and the environment in order to determine whether to conduct remedial actions at the disposal site.

The Navy acknowledged in the report that supplemental investigations and further risk characterization are warranted. DEP concurs with this determination.

To assist the Navy in its assessment, DEP has identified several elements that require more investigation. DEP, community members, and the various stakeholders have supplied the Navy with a number of noteworthy comments regarding disposal site history, nature and extent of contamination, fate and transport of contaminants, and disposal site ecological risk characterization, which, among other issues, have raised public concern. DEP anticipates that the Navy will perform any future Supplemental Phase II Site Assessment work in a way that will adequately address these comments and public concerns.

The DEP realizes that the challenges at this disposal site are numerous. However, we are confident that the United States Navy has the ability to address these challenges successfully. As always, we offer our assistance to help you in these efforts so our common goal of protecting public health, welfare, and the environmental can be achieved.

The attachment to this letter sets forth DEP's comments on the Phase II Comprehensive Site Assessment. If you have any questions regarding the comments provided, please contact me at 617-292-5659, or the Project Manager, Mr. Robert Campbell, at 617-292-5732.

Very truly yours,

D. Chaffin for
Anne M. Malewicz
Chief, Federal Facilities Section

AM/RC/rc

Cc: DEP File RTN 4-13390/Data Entry
Stakeholder list (attached)

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Aquinnah, MA 02535
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Chilmark, MA 02535-0119
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Attention: Mr. Stan Chin

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MADEP Review and Comments on
Phase II Comprehensive Site Assessment
Nomans Land Island Disposal Site

General Comments

The Phase II Comprehensive Site Assessment does not meet the minimum requirements of the Comprehensive Site Assessment Performance Standard. In summary, the assessment needs additional attention to adequately meet the following Performance Standards:

I. Disposal Site History [310 CMR 40.0835 (4)(b)&(c)]
II. Site Hydrological Characteristics [310 CMR 40.0835 (d)]
III. Nature and Extent of Contamination [310 CMR 40.0835 (f)]
IV. Environmental Fate and Transport [310 CMR 40.0835 (e)]
V. Exposure Assessment [310 CMR 40.0835 (g)]
VI. Risk Characterization [310 CMR 40.0835 (h)]

Specific Comments

I. Disposal Site History

Section 2.5 Release History and Previous Environmental Assessments

Range Operations

In accordance with the requirements associated with these components of a Phase II Comprehensive Site Assessment, a detailed disposal site map, updated from the Phase I Report, must be provided, and the disposal site history must include updated, supplemented, or modified information. This information would help identify potential oil and/or hazardous material source areas not addressed during Phase I investigations.

The Navy states that range use changed and that live bombing ceased at about the time the Navy acquired Nomans Land Island ("the island") by eminent domain in 1952. The practice of live bombing, and whether or not it was discontinued in the 1950s, or whether it was interspersed for an extended period with inert ordnance, is uncertain. An August 1971 aerial photograph obtained by DEP from the University of Massachusetts, and eyewitness information conveyed to DEP by long-time residents on nearby Martha's Vineyard, offer evidence of the historic use of the island for live bombing after 1952. The use of the Navy's 1955, 1967, and 1994 target manuals as authoritative references for prescribed range practices may not be reliable as sources of information for what were *de facto* range practices. The 1971 photograph clearly shows distinct bomb craters, as depicted by spherical depressions caused by detonation, and by the symmetrical, halo-like deposits at the rims of

the craters. Impacts by inert ordnance result in less symmetrical and smaller depressions, commonly known as bomb graves. Detonation residues left in the bomb craters and in the debris halos associated with detonation fallout constitute potential sources of chemical contamination. In the course of Phase II investigations, the Navy did not adequately evaluate chemical residues in the areas outside the designated target areas, where the photograph shows that heavy bombardment occurred. According to DEP records, non-target areas have not been adequately evaluated for chemicals of concern.

The Navy evaluated a number of low angle photographs, concurrent with recent response actions, to demonstrate an understanding of current land use on the island. According to its own account, the Navy reviewed a single overhead aerial photograph taken circa May 1982 during its Environmental Baseline Survey (EBS) Phase I Report. This photograph was not included in the report for review. No other historical overhead photographs were cited for subsequent environmental assessments during the Phase I Site Assessment, the two Release Abatement Measures (RAMs), the Phase II Ecological Screening Report, or the Phase II Comprehensive Site Assessment. A single overhead photograph cannot determine bomb range use patterns over a span of fifty years. The Navy has been unable to find a sequence of overhead photographs that would show range use over time. DEP has found two such photographs, the 1971 photograph and another from 1952, obtained from publicly available sources. The Navy has not adequately searched its archives, public sector records for overhead aerial photographs, or conducted wide-ranging interviews that could have focused assessment activities on all areas of potential concern. Because of this oversight, significant areas of potential concern have not been assessed.

Ordnance Used

The identification of materials likely to be found in potential source areas is important in formulating a site-specific sampling plan. Spotting charges, in use with otherwise inert ordnance, have been linked to releases of incendiary white phosphorus at other Navy ranges. The Navy states it did not use white phosphorus at the island, but acknowledged that spotting charges initiated fires on the island, as noted in the EBS Phase I Report (pp. 244). The EBS Report also notes that fires were occasionally initiated by the use of flares and spent rocket propellants during range activities. The list of contaminants of concern (COCs) does not include constituents associated with these ordnance items. The chemical constituents of the spotting charges, colored smoke flares, and similar munitions are not identified. Several examples include perchlorate, a chemical constituent commonly associated with rocket propellants, and the dyes and active incendiary agents in smoke flares. The exact composition of spotting charges were not identified or included in the list of contaminants of concern. Other ordnance-related chemical residues may have also been omitted. Items removed during the 1998 surface clearance noted numerous ordnance and munitions objects in excess of 50 lbs.

The use of the island was not limited to naval aerial bombardment. As noted in the Phase II Report, over the course of its historic range use, the island was also used as a

gunnery range and was strafed with aircraft submunitions, particularly 20-millimeter and 50-caliber ammunition. In addition, the island was used for Navy S.E.A.L. training. The report should include information about this training that frequently made use of small arms, smoke grenades, mines, counterinsurgency munitions, and other explosive devices and ordnance delivery systems. During site reconnaissance, and after the ordnance surface clearance, expended shell casings and projectiles deposited during training were found in relative profusion. The contaminant load of munition residues and spent ordnance in soil, and possibly in groundwater, has not been fully assessed. To date, the focus of remediation has been on larger, primarily aerial ordnance and some of the associated chemical contaminants, and not on expended submunitions.

The island's use was not restricted to naval bombardment and gunnery use. According to a Navy document*, published to commemorate the history of South Weymouth Naval Air Station (SOWEYNAS), "...As many as twelve military installations over the years from the northeast have used [Nomans] as a bombing range, with B-52 bombers, FB-111s, F-15s, A-4s and A-10s among the types of aircraft." Other military service branches, reportedly the Air National Guard and the Air Force, also used the island for target practice. The types of ordnance expended by these groups may have differed from ordnance expended by the Navy. The Navy has not produced a full accounting of all of the ordnance types, their component parts, including spotting charges, propellants, and the chemicals associated with their manufacture and use. In the absence of such an inventory, the list of contaminants of concern must be considered incomplete.

Previous Environmental Assessments

The Navy has referenced a number of previous assessment and remediation activities as support for its Phase II Site Assessment. This previous work was limited in scope. A careful examination of this work supports DEP's determination that additional assessment is needed. A brief summary of some of the work that was conducted prior to the Phase II work is discussed below.

* The Defender's History – A Historical Account of Naval Air Station South Weymouth, Mass. "Home of New England's Naval Air Reserve", September 1997, p. 79.

Environmental Baseline Survey (EBS)

The EBS was a study of the environmental conditions of Navy-controlled properties and proposed acquisitions/tranfers associated with SOWEYNAS, focusing on hazardous substances or other regulated hazards. The EBS was undertaken as part of Base Reallocation and Closure (BRAC) activities in part to separate Nomans Land Island from other BRAC

activities at SOWEYNAS and ultimately, to transfer the island to the U.S. Fish and Wildlife Service. The EBS was used to document existing environmental information related to the storage, release, treatment, or disposal of hazardous substances or petroleum products on the property. This information was used to determine the presence or likely presence of a release or threatened release of any hazardous substance or petroleum product. The EBS was also used to determine whether a threat or hazard to human health or the environment was present, such as the presence of petroleum products and their derivatives, and ordnance and explosive materials. Although the EBS for SOWEYNAS contained only a modest section on Nomans Land Island, it concluded that the Environmental Condition of the Property required further evaluation and outlined a number of areas of concern. Based on the limited information evaluated for the EBS, it is noteworthy that had a more extensive archive search been performed, a more comprehensive list of the areas of concern could have been generated.

It is noted that EBS activities are not related to environmental assessment for the purposes of remediation and risk management. Rather, an EBS is used to support disposing of real estate. Although the information gathered during an EBS may be useful in supplementing subsequent assessment work, it cannot be used alone as a substitute for environmental assessment geared toward validating a Conceptual Site Model (CSM) or for evaluating environmental risk and site remediation. Consequently, since the EBS served as a basis for the subsequent scopes of work for the Phase I Limited Site Investigation, and to a greater extent, the Phase II Comprehensive Site Investigation, the scopes of work were not broad enough to answer the questions these investigations are required to address.

Phase I Limited Investigation

In addition to information provided by the EBS, certain sampling decisions regarding sample locations and sampling density were linked to the concentration of materials removed during the surface clearance performed under a Release Abatement Measure (RAM) in 1998. The selection of these locations, while a commendable first step, did not consider several factors associated with past use of the island and the practices of the range managers during range operation. The Navy has indicated that during active range use, Navy Construction Battalion personnel (Seabees) periodically cleared ordnance items and staged these materials in fixed areas for later disposal. The nature of the disposal activities conducted by the Seabees may have included detonation in place, removal, deactivation, burial, or staging for later disposal. Wherever these activities were conducted would be highly desirable places to sample for chemical residues. As mentioned in the comments addressing disposal site history, locations that received significant bombardment would also have been logical places to collect samples, even if the Navy had not identified them as targets for Phase II investigation. The identification of these "non-target" areas is important in that the resulting investigation excluded them from consideration. Subsequent work during the Phase II Comprehensive Site Assessment focused largely on the areas sampled during Phase I work and not on these other areas.

Release Abatement Measure (RAM) – Ordnance Debris Removal

In 1998, the Navy conducted a RAM for ordnance debris removal. In this RAM activity, the Navy prepared the surface of the island by executing two prescribed burns of vegetation, to reduce cover and to make surface removal by visual identification of the ordnance possible. The prescribed burns were incomplete. The percentage of the burned vegetation and the commensurate acreage of unburned and potentially uncleared acreage need to be included in the Phase II report. The abatement measure did achieve a reduction of surface ordnance and debris, and cleared several well traveled trails and the unimproved roads for field personnel safety.

The RAM did not extend to subsurface ordnance debris in areas away from the road and trails, including shallow ordnance and explosive materials that are likely to emerge over time through frost heaving or erosion. Several areas were inaccessible to man-carried magnetometers. Some areas were accessible but not assessed. These areas included most of the subsurface soil (except where ordnance protruded from the surface, in which case it was removed, and where sampling areas were cleared for the safety of field personnel), bogs, ponds, near-shore shallow anchorages, deeper waters, and other areas that were physically difficult for the ordnance and explosives survey teams to penetrate.

II. Site Hydrological Characteristics

In the course of a Phase II Investigation, site hydrogeological characteristics must be adequately described, including details of subsurface investigations conducted at the disposal site, together with a comprehensive description and depiction of site hydrogeological conditions. The hydrogeological characteristics are a key component in identifying the nature and extent of contamination. According to 310 CMR 40.9835 (d), these must include a variety of empirical measurements and evaluations, which were not presented in the Phase II report.

Section 3.1.2 Site-Specific Hydrology

This section of the report is exclusively narration. For example, the first sentence of this section describes the island's surface water bodies as spring-fed; more likely, these surface water bodies are artifacts of perched water tables deriving their origin from meteoric water, infiltration, and groundwater recharge. Because no rock outcrops have been identified, and no subsurface investigation to identify the overburden/bedrock contact has been conducted, the assumption that the surface water bodies are spring-fed is unsubstantiated. Except for a relatively few widely scattered piezometric measurements, none of the basic parameters for evaluating site hydrology has been measured.

The empirical data supporting the narration is sparse and is not cited in this section. For example, piezometric measurements are too few and statistically unrepresentative. Soil

conductivity and permeability measurements, analysis of infiltration rates, and other useful data have not been collected. The report defines site-specific hydrology by the observation of physiographic characteristics and by inference of groundwater flow from topographic elevation. In hydrological studies where gauged data are unavailable, physiographic characteristics are used to estimate hydrologic parameters. This methodology is appropriate to fill data gaps when sufficient data are known from direct measurement or when it is otherwise impossible to obtain. It is inappropriate for use when direct measurements can be made.

Despite the similarities between the island and other glacially derived land forms, site-specific conditions with regard to the impoundment of water tables, local groundwater flow, surface morphology, and other innumerable factors may be quite different from what has been assumed by observation. Because of the hilly geomorphology, and lacking accurate and representative groundwater elevation data extending over time to evaluate seasonal variation, a groundwater flow pattern that mirrors surface topography is not proven. For example, in spring when groundwater elevations are higher, variations in local groundwater flow directions can occur as a result of local mounding of the groundwater table, diversion of groundwater divides, erosion effects, as well as other conditions, which would not be present at other times of the year.

The narrative presented in this section lays out basic assumptions that are crucial in developing a Conceptual Site Model, but it does not provide empirical data to support or to validate and/or revise the model.

Section 3.1.3 Site-Specific Hydrogeology

As discussed in comments for section 3.1.2, the description of site-specific hydrogeology is largely narrative. It vests high reliance on a limited suite of piezometric data and draws conclusions from the data that are not adequately supported. In the accumulation of Phase II information, four rounds of groundwater elevation data spanning nine months were collected. Data were obtained from seven wells installed during Phase I investigations and from eight wells installed during Phase II work. The placements of the wells, the density of well installations, and the depth of the wells are poorly integrated to provide the kind of correlation that would sustain a defensible conclusion regarding site hydrogeology.

The groundwater monitoring wells, installed by hand, were sited within surface topographies that are sufficiently isolated from each other to reasonably suspect that they are not hydrologically linked. The distance between the wells is sufficiently great and the number of wells sufficiently small to question their use in correlating local groundwater flow directions. The depths of the wells from ground surface to water table do not exceed 6 feet on average and are unlikely to be useful in describing deeper groundwater flow.

Without the benefit of a well-described stratigraphy of the overburden soils, an accurate description and understanding of the geologic subsurface, including groundwater flow paths, cannot be made with certainty. There is simply a lack of the necessary information to validate the Conceptual Site Model or to substantiate the description of the hydrogeology provided in this section.

III. Nature and Extent of Contamination

The specific requirements for determining the nature and extent of contamination appear in 310 CMR 40.0835 (f). These requirements include a characterization of the source, nature, and vertical and horizontal extent of contamination at the disposal site, and among other parameters, a characterization of background concentrations of oil and/or hazardous material at the disposal site.

Section 4.0 Nature and Extent of Contamination

A variety of soil, surface water, sediment, and groundwater samples were collected. However, these were too limited in number of samples, in the sample density distribution, and frequency, and were not sufficiently representative of the depositional environment. For example, Phase II soil sampling included six samples from a maximum depth of eighteen inches. The island portion of the disposal site occupies a land area of just under a square mile; the number of samples collected does not approach the kind of representative sampling density necessary to characterize the nature and extent of contamination for an area this large.

The Navy initially conducted Phase II sampling for ecological risk screening. This sampling occurred in four sampling events during the nine month period from September 27, 1999 through July 14, 2000. According to the statement in the Phase II Report, the intent of the Phase II field investigation was to further characterize the nature and extent of contamination. However, rather than delineate the nature and extent of contamination, the scope of sampling did not extend significantly beyond those areas investigated during Phase I sampling and merely sought to confirm preliminary conclusions formulated during Phase I work. The relatively few samples collected, from all media, were not adequate to characterize the nature and extent of contamination. Further characterization is warranted.

For example, EPA Method 6010 and/or the 7000 series analysis largely confined the investigation of the nature of contamination in soil samples to priority pollutant metals analysis. Certain explosive nitrous aromatic compounds were analyzed under EPA Method 8330. Soil analysis for pesticides was also conducted. However, the locations of Phase I samples were roughly approximate to the locations where composite soil samples were collected for Phase II work. Consequently, the scope of Phase II sampling and analysis was narrowed and other potential source areas were eliminated from consideration.

Less obvious soil contaminant residues, such as perchlorate (rocket propellant), white phosphorus, and titanium tetrachloride (smoke grenades and signal flares) were never evaluated. Some of the transformation products of trinitrotoluene (TNT), such as 3,5-dinitroanaline (DNA); 2,6-diamino-4-nitrotoluene (2,6-DANT); and 2,4-diamino-6-nitrotoluene (2,4-DANT) that could have been identified in the Method 8330 analysis, were not reported. The nature and quantity of TNT transformation products can indicate the existence of oxidation/reduction mechanisms that may result in the formation of breakdown products important in assessing residue toxicity in various media and potential exposure to ecological receptors.

Analysis of the Phase I soil samples did not show contaminants in the only round of composite soil samples collected during the Phase I investigation. Based on detection results from this single round of Phase I samples, Phase II soil sampling eliminated many analytes from the analytical suite. These Phase II samples were collected a year after Phase I samples and represent a sampling bias unsuited to a comprehensive site assessment. In addition, when most of the soil samples were collected, they were composite surface samples. Analysis of these residues showed low concentrations or no detections in these surface soil samples. The likelihood of detection of explosive residue contaminants in this soil horizon in a composite sample is greatly diminished if the goal of the chemical analysis is to identify a nitrous aromatic compound that undergoes photolysis and leaching at the ground surface. Detection of compounds is further impaired if the sample analysis does not include all transformation products. Leachate residues from surface contamination, a neutral *in situ* redox potential and natural insulation from photo degradation, are conditions that would be more favorable for preserving contaminant residues and their transformation products in this deeper soil horizon. In addition, contaminants that issue from the degraded remains of subsurface ordnance and explosive materials, if present, are also more likely to be detected in this horizon.

Other analytical biases were developed in the sampling of groundwater over the course of Phase II work. When a given analyte showed a non-detect reading, it was eliminated from successive groundwater sampling rounds. Therefore, the opportunity to observe the possible recurrence of a contaminant, or to gauge any changes in contaminant levels associated with seasonal fluctuations of groundwater, was lost.

As mentioned in the comments on Section 3.1.2 Site Hydrogeology, the groundwater monitoring wells were quite shallow. Furthermore, the well locations may not correlate with the locations of surface soil samples or the prevailing groundwater flow pattern. In addition, because of their relatively shallow placement, the wells may not have been favorably located in potential contaminant migration pathways.

The determination of the extent of contamination was limited to the target areas identified and to a few selected areas identified by the quantity of surface ordnance/debris removed during the Ordnance Debris Removal RAM. It omitted from consideration most areas outside the target zones (including areas of significant historical bombardment and

other areas acknowledged to contain higher amounts of ordnance and explosive material debris), the intertidal zone and the near-shore shallow anchorages (where many potential ordnance and explosive material exposures could occur), and the deeper offshore areas (where significant sea bottom fishing occurs).

These omissions, in combination with an inadequate description of the disposal site boundaries, further limit the objective of determining the nature and extent of contamination from this Phase II investigation and undermine the validation of a Conceptual Site Model.

A comprehensive sampling strategy is needed to adequately assess the environmental impact of 50 years of bombardment to support a statistically defensible risk assessment, or to establish the extent of residual ordnance and explosive material contamination. Background conditions and concentrations will also need to be established.

IV. Environmental Fate and Transport

According to 310 CMR 40.0835 (4)(e)1. & 2., the identification and characterization of existing and potential migration pathways of oil and/or hazardous material at and from the disposal site must include, as appropriate, air, soil, groundwater, surface water, sediment, and food chain pathways.

Section 5.0 Environmental Fate and Transport of Oil and/or Hazardous Material

Determination of environmental fate and transport is inextricably linked to a solid understanding of site hydrology and hydrogeology, and by extension, to the determination of the nature and extent of contamination. The discussion in Section 5.0 notes contaminants of concern as priority pollutant metals, volatile organic compounds, pesticides, and extractable petroleum hydrocarbons. It does not describe the likely fate and transport of metal and explosive residues leachate in groundwater. The mechanisms for the transport of potential leachates through groundwater are not adequately discussed. The transport and discharge of potential leachate compounds into pond sediments and surface water, and the fate of these compounds after discharge into these receptors is not adequately discussed.

The description of environmental fate and transport provided in this section is too generic and focuses on what is commonly referenced in the scientific literature as background information for a discussion of fate and transport. This approach of describing environmental fate and transport would be appropriate if a perfect understanding of site hydrology, hydrogeology, and contaminant chemistry existed, and if a sufficient body of data was available to support the summary opinion. The Conceptual Site Model could not be validated because the site-specific conditions were not well defined by the limited scope sampling and analysis.

Reliable estimates from ordnance industry and military research sources report that a percentage of the total expended ordnance fails to detonate. Ordnance and explosive material poses a potential source for chemical release through degradation during burial, and a potential threat of imminent harm if disturbed or exposed by erosion. The report does not adequately address the fate and transport of explosive ordnance material in the environment, with discussion of explosive residues and leachate generated during degradation of these materials.

V. Exposure Assessment

As described in 310 CMR 40.0835(g), exposure assessment includes identifying and characterizing all potential human and environmental receptors that could be impacted by oil and/or hazardous material at or migrating from the disposal site. In addition, the quantification of exposure of oil and/or hazardous materials to these materials under current and foreseeable site conditions must be evaluated.

Exposure assessment did not include trespassing exposures to upland surface water and sediments for adults and children, or subsistence consumption of fish that inhabit the ponds. When trespassing occurs, trespassers may wade, swim, or fish in the upland ponds and thereby be potentially exposed to contaminants through dermal contact and ingestion.

Exposure assessment did not include exposures to soil via excavation for a variety of potential trespassing activities, which may include digging a fire pit, setting up wildlife observation sites, prospecting for souvenirs, or other related activities.

Exposure assessment did not include potential exposures and safety issues associated with near surface ordnance and explosive material, or the effectiveness of institutional controls to limit this potential exposure. Exposures to ordnance and explosive materials and to munitions residues resulting from the effects of weather and climate, which uncover buried ordnance and explosive materials, present potential future conditions that must be evaluated for exposure risk and safety issues.

As mentioned in previous commentary, nature and extent of contamination and fate and transport determinations lacked sufficient empirical data to conclusively support the Navy's position. Similarly, without an expanded and more representative database, exposure assessments cannot be made with confidence. Exposure assessment with impacts to ecological receptors, such as benthic and lacustrine organisms, and their shellfish and crustacean predators, has not been adequately considered.

VI. Risk Characterization

Risk characterization is noted in 310 CMR 40.0835 (4)(h) and is expanded upon in 310 CMR 40.0900. These parts of the Massachusetts Contingency Plan focus on whether a level of No Significant Risk exists or has been achieved at the disposal site.

Section 6.1.6. Uncertainty Analysis

The Phase II Comprehensive Site Assessment correctly identifies and acknowledges sources of uncertainty to modify its risk characterization. Significant uncertainty exists for at least three of the criteria that were used to quantify risk:

- Adequacy of site characterization
- Adequacy of the sampling plan
- Quality and treatment of the data

As previously mentioned, the quality of subsequent exposure and risk evaluation rests on the adequacy of the site characterization. This characterization must include all potential source areas. The adequacy of the sampling plan and the appropriate use of the data derived are also important. Very limited data were applied in interpreting the nature and extent of contamination, in discussing fate and transport, and in evaluating human and ecological risk. Sufficient uncertainty resides in these criteria to cast doubt on the subsequent conclusions in the Phase II Report.

Summary Comments

Despite the accumulation of some site-specific data, DEP finds that the Phase II Comprehensive Site Assessment is not adequate.

To ensure that future investigations fulfill the requirements of the Phase II investigation, DEP believes the Navy needs to incorporate the following elements into its proposed supplemental Scope of Work:

1. Additional Site History

   Perform a detailed comparison of aerial photographs that show variations of range use over time, in time spans of no greater than ten years. The purpose of this exercise would be to identify areas suspected of being sources of contaminants, and to correlate this information with the sampling plan to ensure a representative sampling of potential source areas.

2. Nature and Extent of Contamination Determinations

Conduct an aerial and marine magnetometer survey of the disposal site with concurrent application of the Global Positioning Satellite System for correlation. Include all upland areas, ponds, wetlands, and beaches, landing areas, and anchorage areas on the northerly approaches to the island. Such a survey will help validate the Conceptual Site Model, identify areas likely to contain contaminant residues and to have higher densities of ordnance and explosive materials, and contribute to developing a truly representative sampling plan.

3. Contaminants of Concern

Provide a comprehensive inventory of all munitions and ordnance items used and a detailed list of chemical constituents and breakdown products of all items. Expand the list of Contaminants of Concern accordingly and include all transformation products of traditional munitions, as well as include chemicals associated with non-explosive or low-energy munitions and ancillary ordnance and munitions materials.

4. Contaminant Source Delineation

Based on information obtained from the prior steps, reformulate the sampling plan to encompass a larger venue, one more likely to detect contaminants across the entire site over time, or provide technical justification why this activity is not necessary. Ensure that the sampling plan is sufficient in scope to establish representative background conditions and delineate the vertical and horizontal extent of contamination through seasonal variation. Concurrently, collect the necessary physical parameters to define site hydrology and hydrogeology so that the Conceptual Site Model can be validated and/or revised.

5. Exposure Assessment

Reevaluate risk exposure to include foreseeable future use including trespasser scenarios.

6. Risk Characterization

Reevaluate risk characterization to include current and future exposures to ordnance and explosive materials, especially for human health and safety, and for potential ecological exposure pathways.