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DEPARTMENT OF THE NAVY
ATLANTIC DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
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NORFOLK, VA 23511-2699

TELEPHONE NO:
(757) 322-4587

IN REPLY REFER TO:
5090
18221:RMJ:swj
MAY 28 1998

Commonwealth of Virginia
Department of Environmental Quality
Attn: Mr. Devlin M. Harris
629 East Main Street
Richmond, Virginia 23219

Re: ARARs for Site 2, NM Slag Pile, Naval Base, Norfolk, Virginia

Dear Mr. Harris:

The three attached tables provide information on the initial screening of alternatives for the Feasibility Study for Site 2. In addition to commenting on these tables, I would like to request that VDEQ identify the substantive chemical-, location-, and action-specific requirements of the State environmental laws that you believe are potential applicable or relevant and appropriate requirements ("ARARs") for this Site, in accordance with the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"), at 40 C.F.R. 300.400(g), 300.430 (e)(9), 300.515(d), and 300.515(h)(2). In order to adequately consider the appropriateness of these requirements, specific citations to statutory and regulatory sections are needed. The preamble to the NCP states as follows:

> [T]he language of CERCLA section 121(d)(2)(A) makes clear, and program expediency necessitates, that the specific requirements that are applicable or relevant and appropriate to a particular site be identified. It is not sufficient to provide a general "laundry" list of statutes and regulations that might be ARARs for a particular site. The state and EPA if it is the support agency, must instead provide a list of requirements with specific citations to the section of law identified as potential ARAR, and a brief explanation of why that requirement is considered to be applicable or relevant and appropriate to the site.
> 55 Fed. Reg 8666, 8746 (March 8, 1990). See Also, 40 C.F.R. 300.400(g)(5).

Re: ARARs for Site 2, NM Slag Pile, Naval Base,
Norfolk, Virginia

Please submit this information, in writing, within thirty working days. In addition, please identify any advisories, criteria, or guidance which would be appropriate for inclusion in the "to be considered ("TBC") category.

If you have any questions concerning this request, please contact the Remedial Project Manager, Randy M. Jackson, at (757) 322-4995. Thank you for your assistance in this matter.

Sincerely,

N. M. Johnson

N. M. JOHNSON, P.E.
Head
Installation Restoration Section (North)
Environmental Programs Branch
Environmental Division
By direction of the Commander

Attachments

Copy to:
COMNAVBASE Norfolk (Mr. Tim Reisch: Code N45)
EPA Region III (Mr. Harry Harbold, 3HW50)
Administrative Record File (Naval Base, Norfolk)

Table 3-1
PRELIMINARY SCREENING OF REMEDIAL TECHNOLOGIES FOR SOIL
NM SLAG PILE (SITE 2), NAVAL BASE, NORFOLK, NORFOLK, VIRGINIA

General Response Action	Remedial Action or Technology	Process Options	Description	Screening Action: Retain	Screening Action: Reject	Screening Comments
No Action	None	Not applicable	No action.	X		Retain as a baseline alternative, as required by the National Contingency Plan (NCP).
Institutional controls	Access restrictions	Fence site	Fence site to restrict access to the contaminated area.	X		Potentially applicable at Site 2.
		Warning signs	Placement of warning signs to prohibit certain activities on the property.	X		Potentially applicable at Site 2..
	Administrative restrictions	Land use restrictions	Land use restrictions incorporated into the Navy planning documents.	X		Potentially applicable at Site 2.
	Monitoring	Long-term Monitoring	Monitoring to assess the temporal variation in the levels of contamination at the site.	X		Potentially applicable at Site 2. Long-term monitoring is required in conjunction with the institutional controls general response action.
Intrinsic Remediation	Natural Attenuation	Volatilization	Contaminants released from one media to another; in nonequilibrium conditions, the rate of net movement of a chemical from one phase to another depends on how far the system is away from equilibrium as well as the magnitude of the overall mass transfer coefficient.		X	Not feasible at Site 2. Metals are not amenable to volatilization. In addition, natural attenuation alone is not a viable option in situations where there are risks to potential receptors, which is the case at Site 2.
		Biodegradation	Naturally occurring microorganisms use contaminants as the food and energy source they need to grow. The rate of degradation is influenced by the specific contaminants present, moisture, oxygen supply, pH, temperature, nutrient supply, bioaugmentation, and cometabolism.		X	Not feasible at Site 2. Metals are not amenable to biodegradation. In addition, natural attenuation alone is not a viable option in situations where there are risks to potential receptors, which is the case at Site 2.
		Adsorption	Contaminants are absorbed to other contaminants or environmental media.		X	Not feasible at Site 2. There is no evidence from the Phase II results that suggests that the inorganic concentrations have naturally attenuated over time. In addition, natural attenuation alone is not a viable option in situations where there are risks to potential receptors, which is the case at Site 2.

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PRELIMINARY SCREENING OF REMEDIAL TECHNOLOGIES FOR SOIL
NM SLAG PILE (SITE 2), NAVAL BASE, NORFOLK, NORFOLK, VIRGINIA

General Response Action	Remedial Action or Technology	Process Options	Description	Screening Action		Screening Comments
				Retain	Reject	
		Chemical reactions with the subsurface	Chemical reactions occur between the contaminants and the subsurface materials, thereby converting hazardous contaminants into nonhazardous constituents.		X	Not feasible at Site 2. There is no evidence from the Phase II results that suggests that the inorganic concentrations have naturally attenuated over time. In addition, natural attenuation alone is not a viable option in situations where there are risks to potential receptors, which is the case at Site 2.
Containment	Capping	Soil cap	Vegetated 1-foot-thick cover of compacted soil cap with no permeability requirements.	X		Technically feasible.
		Clay cap	2-foot-thick low-permeability clay cap with vegetated soil cover and drainage layer.		X	Not applicable since reduction of infiltration is not a remedial action objective (RAO).
		Synthetic cap	Synthetic membrane cap and drainage layer with a vegetated soil cover.		X	Not applicable since reduction of infiltration is not a RAO.
		Multimedia (RCRA) cap	Synthetic membrane and 2-foot-thick low-permeability clay cap with a drainage layer and vegetated soil cover.		X	Not applicable since reduction of infiltration is not a RAO.
		Asphalt or concrete cap	4-inch asphalt or 6-inch concrete cap.	X		Technically feasible.
Removal	Excavation	Standard excavating equipment (e.g. excavator)	Removal of waste for treatment and/or disposal.	X		Technically feasible; will have to include one of the *ex situ* treatment or disposal options, as well.
In-situ Treatment	Physical treatment	Soil flushing	Leaching method using extraction wells and liquid treatment to remove contaminants from soil.		X	Not feasible. During the process of in-situ soil flushing, it can be difficult to control potential contaminant migration through the groundwater. In addition, a single target metal is preferable to multiple target metals for the soil flushing process, due to the added complexity of selecting a flushing fluid that would be reasonably efficient for all contaminants.

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NM SLAG PILE (SITE 2), NAVAL BASE, NORFOLK, NORFOLK, VIRGINIA

General Response Action	Remedial Action or Technology	Process Options	Description	Screening Action		Screening Comments
				Retain	Reject	
		Soil-vapor extraction	Process for removing VOCs from the vadose zone soil. VOCs are volatilized by forcing air through the subsurface using wells screened in the vadose zone.		X	Not applicable. VOCs are not among the contaminants of concern at Site 2.
	Biological treatment	Soil venting	Degradation of organics by injecting oxygen into soil to increase natural microorganism activity.		X	Not applicable. Organic compounds are not among the contaminants of concern at Site 2.
		Aerobic degradation	Microorganisms degrade the organic contaminants under aerobic conditions.		X	Not applicable. Organic compounds are not among the contaminants of concern at Site 2.
		Anaerobic degradation	Microorganisms degrade the organic contaminants under anaerobic conditions.		X	Not applicable. Organic compounds are not among the contaminants of concern at Site 2.
		Enhanced bioremediation	Percolation or injection of uncontaminated water (mixed with nutrients, carbon, and alternative electron acceptors, and saturated with dissolved oxygen) to allow degradation of organic contaminants.		X	Not applicable. Organic compounds are not among the contaminants of concern at Site 2.
		Bioventing	Oxygen provided (typically via air injection) to existing microorganisms to stimulate natural in-situ biodegradation.		X	Not applicable. Organic compounds are not among the contaminants of concern at Site 2.
		Phytoremediation	Uses nature's flora to cleanse soil (by rhizofiltration or phytotransformation)		X	Not feasible. In-situ phytoremediation is feasible if the soil contamination is within the top foot and a half from the ground surface. Inorganic contamination is present to a depth of approximately six feet at Site 2.

Table 3-1
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NM SLAG PILE (SITE 2), NAVAL BASE, NORFOLK, NORFOLK, VIRGINIA

General Response Action	Remedial Action or Technology	Process Options	Description	Screening Action: Retain	Screening Action: Reject	Screening Comments
	Chemical treatment	Stabilization/ solidification	Chemically binds contaminants in-place in a solidified matrix.	X		Applicable. Must achieve complete and uniform mixing of the binder with the contaminated matrix. If treatability studies indicate that in-situ stabilization is feasible at Site 2, the construction debris in the upper 5 feet of the contaminated area would have to be removed during the process in order to achieve complete and uniform mixing.
		Vitrification	An electric current (via electrodes) used to melt earthen materials at 1,600°C to 2,000°C, destroying organic pollutants by pyrolysis. Inorganic pollutants are incorporated within the vitrified glass and crystalline mass. Water vapor and organic pyrolysis products are captured in a hood, which draws off-gases into a treatment system. The vitrified mass resists leaching for geologic time periods.		X	Not feasible for contaminated soil <6 feet below the ground surface.
Ex-situ Treatment	Physical treatment	Soil washing	Leaching method using aqueous-based liquids to concentrate contaminants.	X		Applicable. Treatability studies would be required to determine technical feasibility at Site 2.
	Biological treatment	Phytoremediation	Uses nature's flora to cleanse soil/sediment (by rhizofiltration or phytotransformation).	X		Technically feasible.
		Landfarming	Organically contaminated soils are applied onto the soil surface and periodically turned over or tilled into the soil to aerate the waste.		X	Not applicable. Organic compounds are not among the contaminants of concern at Site 2.
		Composting	The storage of highly biodegradable and structurally firm material (e.g. wood chips) with a small percentage of biodegradable waste, to decompose organic compounds. Must collect leachate and runoff water from the composting beds.		X	Not applicable. Organic compounds are not among the contaminants of concern at Site 2.
		White rot fungus	Moisturized air on wood chips is used in a reactor for biodegradation by white rot fungus (uses lignin-degrading or wood-rotting enzymes).		X	Not applicable. Organic compounds are not among the contaminants of concern at Site 2.

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General Response Action	Remedial Action or Technology	Process Options	Description	Screening Action: Retain	Screening Action: Reject	Screening Comments
		Bioslurry reactor	An aqueous slurry is created by combining soil or sludge with water and other additives. Aerobic bacteria degrade contaminated materials. Batch and continuous flow bioreactors are used to process contaminated sediments.		X	Not applicable. Organic compounds are not among the contaminants of concern at Site 2.
		Anaerobic digestion	Anaerobic microorganisms degrade organic wastes from complex molecules to simpler ones.		X	Not applicable. Organic compounds are not among the contaminants of concern at Site 2.
		Aerobic digestion	Organic wastes are oxidized through the use of a mixed culture of microorganisms under aerobic conditions in a bioreactor.		X	Not applicable. Organic compounds are not among the contaminants of concern at Site 2.
	Chemical treatment	Solvent extraction	Waste and solvent are mixed in an extractor, dissolving into the solvent. The extracted organics and solvent are placed in a separator, where the contaminants and solvent are separated for treatment and further use.		X	Not applicable. The target contaminant groups for solvent extraction are halogenated and non-halogenated semivolatile organic compounds and pesticides; organically bound metals can be extracted along with these target organic pollutants. Organic compounds are not among the contaminants of concern at Site 2.
		Stabilization/ solidification	Chemically binds contaminants in a solidified matrix.	X		Technically feasible; would have to include landfill disposal.
		Dehalogenation (glycolate)	An alkaline polyethylene glycolate (APEG) reagent is used to dehalogenate halogenated aromatic compounds in a batch reactor. Potassium polyethylene glycolate (KPEG) is the most common APEG reagent used.		X	Not applicable. Organic compounds are not among the contaminants of concern at Site 2.
		Dehalogenation (base-catalyzed decomposition)	Contaminated soil is screened, processed with a crusher and pug mill, and mixed with sodium bicarbonate. The mixture is heated at 630°F in a rotary reactor to decompose and partially volatilize the contaminants.		X	Not applicable. Organic compounds are not among the contaminants of concern at Site 2.
	Thermal treatment	Desorption	Desorbs organics from soil at 500°F to 1,000°F (includes brick manufacture,		X	Not applicable. Organic compounds are not among the contaminants of

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General Response Action	Remedial Action or Technology	Process Options	Description	Screening Action: Retain	Screening Action: Reject	Screening Comments
			cement kiln, asphalt batching).			concern at Site 2.
		Incineration (rotary kiln, liquid injection, fluidized bed, and infrared incinerators)	High temperatures (1600°F to 2200°F) are used to volatilize and combust organic constituents in hazardous wastes.		X	Not applicable. Organic compounds are not among the contaminants of concern at Site 2.
		Vitrification	High temperature (2200°F to 2800°F) is used entrain inorganic contaminants in a glass and siliceous melt.	X		Applicable; would have to include landfill disposal.
		Pyrolysis	Chemical decomposition of organic material is induced by heat (above 800°F) and pressure in the absence of oxygen.		X	Not applicable. Organic compounds are not among the contaminants of concern at Site 2.
		Microwave/infrared system	Silicon carbide elements are used to generate thermal radiation beyond the red end of the visible spectrum; materials to be treated are exposed to the radiation.		X	Not applicable. Organic compounds are not among the contaminants of concern at Site 2.
		Plasma-arc furnace	Uses the heat generated from a plasma torch to decontaminate metal and organic waste by melting metal-bearing solids, and, in the process, thermally destroying organic contaminants. The molten soil forms a hard, glass-like non-leachable mass on cooling.	X		Applicable; would have to include landfill disposal.
		Low-temperature thermal desorption	Desorbs organic compounds from soil at 200°F to 600°F.		X	Not applicable. Organic compounds are not among the contaminants of concern at Site 2.
		High-temperature thermal desorption	Water and organic wastes are heated (600°F to 1,000°F) and thereby volatilized.		X	Not applicable. Organic compounds are not among the contaminants of concern at Site 2.
Disposal	Offsite waste management	Nonhazardous waste landfill (offsite)	Transport and dispose of untreated or treated material in a nonhazardous (Subtitle D) waste landfill.	X		Applicable. Only acceptable for soil with a TCLP-lead value less than or equal to 5 mg/L.
		Hazardous waste management facility (offsite)	Transport and dispose of lead-contaminated soil in an approved hazardous (Subtitle C) waste facility (soil would have to be treated first if TCLP-lead value exceeded 5 mg/L).	X		Applicable. Soil with a TCLP-lead value greater than 5 mg/L (RCRA hazardous waste) can only be landfilled after treatment.

Table 3-2
EVALUATION OF REMEDIAL PROCESS OPTIONS FOR SOIL
NM SLAG PILE (SITE 2), NAVAL BASE, NORFOLK, NORFOLK, VIRGINIA

General Response Action	Remedial Action or Technology	Process Options	Effectiveness	Implementability	Relative Cost	Evaluation Action		Screening Comments
						Retain	Reject	
No action	None	Not applicable	None	Very easily implemented	None	X		Retain as a baseline alternative, as required by the National Contingency Plan (NCP)..
Institutional Controls	Access restrictions	Fence site	Deters unauthorized access to the site and prevents direct contact with soil. Not fully protective of ecological resources.	Easily implemented.	Low capital, low O&M	X		May be used in conjunction with other technologies.
		Warning signs	Since no security is involved, warning signs may not be effective	Enforcement of warnings may be difficult	Low capital, low O&M	X		Warning signs would not be effective alone (and enforcement may be difficult), however may be used in conjunction with other process options, such as fencing.
	Administrative restrictions	Land use restrictions incorporated into the Navy planning documents.	Does not reduce contamination. Effectiveness depends on continued implementation.	Moderately Easy	No capital, no O&M	X		May be used in conjunction with other technologies.
	Monitoring	Long-term Monitoring	Effective in evaluating contaminant levels over time	Easily implemented	Low capital, no O&M.	X		May be used in conjunction with other technologies at Site 2.
Containment	Capping	Soil cap	Effective in preventing direct contact with soil contamination, although the contamination would remain in place.	Easily implemented.	Moderate capital, low O&M.		X	Technically feasible, although rejected because an asphalt or concrete cap would be more protective against exposure to contamination at Site 2.

Table 3-2
EVALUATION OF REMEDIAL PROCESS OPTIONS FOR SOIL
NM SLAG PILE (SITE 2), NAVAL BASE, NORFOLK, NORFOLK, VIRGINIA

General Response Action	Remedial Action or Technology	Process Options	Effectiveness	Implementability	Relative Cost	Evaluation Action		Screening Comments
						Retain	Reject	
		Asphalt or concrete cap	Effective in preventing direct contact with soil contamination, although the contamination would remain in place.	Easily implemented.	Moderate capital, low O&M.	X		Technically feasible. An asphalt cap would be more protective of human health and the environment than a soil cap.
Removal	Excavation	Standard excavating equipment (e.g. excavator)	Effective and reliable method of soil removal. May increase short-term exposure.	Easily implemented. Proven technology.	Moderate - high capital, no O&M.	X		Required by the *ex situ* treatment and disposal options described below.
In-situ Treatment	Chemical treatment	Solidification/Stabilization	Effective in reducing the mobility of most inorganic contaminants in soil.	Implementable.	Moderate -high capital, no O&M	X		Potentially feasible. Must achieve complete and uniform mixing of the binder with the contaminated matrix. If treatability studies indicate that in-situ stabilization is feasible at Site 2, the construction debris in the upper 5 feet of the contaminated area would have to be removed during the process in order to achieve complete and uniform mixing.

Table 3-2
EVALUATION OF REMEDIAL PROCESS OPTIONS FOR SOIL
NM SLAG PILE (SITE 2), NAVAL BASE, NORFOLK, NORFOLK, VIRGINIA

General Response Action	Remedial Action or Technology	Process Options	Effectiveness	Implementability	Relative Cost	Evaluation Action		Screening Comments
						Retain	Reject	
Ex-situ Treatment	Physical treatment	Soil washing	Effective for removing metals contamination from soil to the washing fluid. The metals can be extracted from the washing fluid and reused. A treatability study would be required to determine the effectiveness on the Site 2 contaminated subsurface soils.	Implementable.	High capital, no O&M.	X		Potentially feasible. Effectiveness depends on solubility of contaminants in water and permeability of soil. Soil containing a high proportion (>80%) of soil particles >2 mm are desirable for efficient contaminant-soil and soil-water separation, which is not the case at Site 2. The technology is still potentially feasible; a treatability study would be required.

Table 3-2
EVALUATION OF REMEDIAL PROCESS OPTIONS FOR SOIL
NM SLAG PILE (SITE 2), NAVAL BASE, NORFOLK, NORFOLK, VIRGINIA

General Response Action	Remedial Action or Technology	Process Options	Effectiveness	Implementability	Relative Cost	Evaluation Action		Screening Comments
						Retain	Reject	
	Biological treatment	Phytoremediation	Effective for removing metals contamination (especially lead) from soils. Treatability studies typically conducted.	Optimal conditions for phytoremediation of lead contamination is at an average concentration of 2,000 ppm.	Moderate capital, no O&M.		X	Concentrations of lead at Site 2 are greater than 1,000 ppm (between 1,260 to 9,820 ppm), which is well over the optimum average concentration for remediation by phytoremediation. Phytoremediation is feasible, but not practical in this case, due to the length of time it would take for remediation (years).
	Chemical treatment	Stabilization/ solidification	Effective in reducing the mobility of most inorganic contaminants in soil.	Implementable. Many vendors are available.	Moderate to high capital, no O&M.	X		Would have to include landfill disposal.
	Thermal treatment	Vitrification	Effectively immobilizes inorganic material. Reduces the likelihood of contaminants leaching from treated soil, for thousands to millions of years.	Implementable.	Very high capital, no O&M.		X	Rejected because the high cost does not make it viable with stabilization, which also results in the immobilization of the inorganic material. In addition, the moisture content of the media being treated directly influences the cost of treatment since electric energy must be used to vaporize water before soil melting occurs. Part of the excavated soil will be high in moisture content since contaminated soil lies below the groundwater table.

Table 3-2
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General Response Action	Remedial Action or Technology	Process Options	Effectiveness	Implementability	Relative Cost	Evaluation Action		Screening Comments
						Retain	Reject	
		Plasma-arc furnace	Effective in producing a nonleachable, glassy residue which meets the toxicity characteristic leaching procedure (TCLP) criteria.	Implementable.	Very High capital, no O&M.		X	Rejected because the high cost does not make it viable with stabilization, which also results in the immobilization of the inorganic material.
Disposal	Offsite waste management	Nonhazardous waste landfill (offsite)	Effective in removing the contaminated material from the site.	Easily implemented, subject to acceptance by landfill.	Moderate capital, no O&M.	X		Potentially viable. Subject to regulatory constraints.
		Hazardous waste management facility (offsite)	Effective in removing the contaminated material from the site.	Low availability of vendors. Subject to acceptance by landfill.	Moderate -high capital, no O&M.	X		Potentially viable. Subject to regulatory constraints.

Table 3-3. SUMMARY OF SOIL REMEDIAL ALTERNATIVES EVALUATION
NM Slag Pile (Site 2), Naval Base, Norfolk, Norfolk, Virginia
Streamlined Feasibility Study

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Asphalt cap, Administrative Restrictions, and Long-term Monitoring	Alternative 3 Excavation and Offsite Disposal*	Alternative 4 Partial Excavation, and Asphalt cap, Administrative Restrictions, and Long-term Monitoring*	Alternative 5 In-situ Stabilization	Alternative 6 Excavation, Onsite Soil Washing, Onsite Disposal*	Alternative 7 Partial Excavation a In-situ Stabilizatio
Description	No action except land use restrictions will be incorporated in the Navy planning documents and five-year site reviews would be required, since contamination would be left in place.	Includes construction of a wear surface, consisting of asphalt over contaminated soil. Includes incorporation of land use restrictions in the Navy planning documents and five-year site reviews, since contamination would be left in place.	Includes excavation of the contaminated soil, and offsite disposal in either a RCRA Subtitle C landfill (after offsite stabilization of the contaminated material) or disposal in a RCRA Subtitle D landfill, depending on the results of TCLP analyses. Characterization samples (for TCLP analyses) will be collected *in-situ*, or prior to initiation of excavation activities, preferably 90 days before.	Includes excavation of the contaminated soil that a construction worker would be exposed to (i.e. during maintenance of the sewage water main onsite), and offsite disposal of the excavated material in either a RCRA Subtitle C landfill (after stabilization of the contaminated material) or disposal in a RCRA Subtitle D landfill, depending on the results of TCLP analyses. Characterization samples (for TCLP analyses) will be collected in-situ, or prior to initiation of excavation activities, preferably 90 days before. A wear surface also would be constructed over the original area of contamination. Includes incorporation of land use restrictions in the Navy planning documents and five-year site reviews, since part of the subsurface soil contamination would be left in place.	Includes in-situ stabilization of the contaminated soil. Includes incorporation of land use restrictions in the Navy planning documents to prevent disturbance of the stabilized soil and long-term monitoring will be conducted to track future contaminant migration.	Includes excavation of the contaminated soil, onsite soil washing of the excavated soil [to meet the preliminary remedial goals (PRGs)], and onsite disposal of the treated soil.	Includes excavation of contaminated soil dov the water table and in- stabilization of the remaining contaminate soil lying below the w table (eliminates havin dewater the contamina area). Includes incorporation of land u restrictions in the Nav planning documents to prevent disturbance of stabilized soil. Long-t monitoring also will b conducted to track fut contaminant migration

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NM Slag Pile (Site 2), Naval Base, Norfolk, Norfolk, Virginia
Streamlined Feasibility Study

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Asphalt cap, Administrative Restrictions, and Long-term Monitoring	Alternative 3 Excavation and Offsite Disposal*	Alternative 4 Partial Excavation, and Asphalt cap, Administrative Restrictions, and Long-term Monitoring*	Alternative 5 In-situ Stabilization	Alternative 6 Excavation, Onsite Soil Washing, Onsite Disposal*	Alternative 7 Partial Excavation a In-situ Stabilizatio
Protection of Human Health and the Environment	No reduction from present contamination levels, therefore human health and the environment is not protected.	Provides a barrier that insulates the public from direct contact with the soil, however risk to a construction worker (i.e. during maintenance of the sewage water main onsite) remains.	The contaminated material is removed from the site under this alternative, therefore human health and the environment is protected.	Provides a barrier that insulates the public from direct contact with the soil, and the risk to a construction worker (i.e. during maintenance of the sewage water main onsite) is eliminated.	Exposure to contaminated soil is reduced in this alternative.	Contamination is removed from the site under this alternative, therefore human health and the environment is protected.	Exposure to contamina soil is reduced in this alternative.
Compliance with ARARs	Does not meet any chemical-specific ARARs. Location and action-specific ARARs are not applicable since no action occurs.	The alternative would comply with chemical-, location-, and action-specific ARARs.	The alternative would comply with chemical-, location-, and action-specific ARARs.	The alternative would comply with chemical-, location-, and action-specific ARARs.	The alternative would comply with chemical-, location-, and action-specific ARARs.	The alternative would comply with chemical-, location-, and action-specific ARARs.	The alternative would comply with chemical- location-, and action-specific ARARs.
Long-Term Effectiveness and Permanence	The source is not remediated, therefore the risk remains. Since the contaminated material will remain onsite, 5-year site reviews would be required to ensure that adequate protection of human health and the environment is maintained.	Long-term risk to human health and the environment associated with direct contact with contaminated soil would be reduced. Risk to a construction worker during excavation would not be reduced, however. Since the contaminated material will remain onsite, 5-year site reviews would be required to ensure that adequate protection of human health and the environment is maintained.	Long-term risk associated with contact with contaminated soil would be eliminated.	Long-term risk associated with contact with contaminated soil would be reduced. Risk to a construction worker (i.e. during maintenance of the sewage water main onsite) is eliminated, however. Since part of the contaminated material will remain onsite, 5-year site reviews would be required to ensure that adequate protection of human health and the environment is maintained.	Long-term risk associated with contact with contaminated soil would be reduced. Residual risk will be minimized, since the contaminated soil will be stabilized. Contaminants would remain onsite, however.	Long-term risk associated with contact with contaminated soil would be eliminated. Residual risk will be eliminated, since the contaminated soil will be treated to at or below the PRGs.	Long-term risk associa with contact with contaminated soil wou be reduced. Residual will be minimized, sin part of the contaminat soil will be excavated disposed of and part o contaminated soil will stabilized. Some contamination would remain onsite, howeve

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Evaluation Criteria	Alternative 1 No Action	Alternative 2 Asphalt cap, Administrative Restrictions, and Long-term Monitoring	Alternative 3 Excavation and Offsite Disposal*	Alternative 4 Partial Excavation, and Asphalt cap, Administrative Restrictions, and Long-term Monitoring*	Alternative 5 In-situ Stabilization	Alternative 6 Excavation, Onsite Soil Washing, Onsite Disposal*	Alternative 7 Partial Excavation a In-situ Stabilizatio
Reduction of Toxicity, Mobility, and Volume	No reduction of toxicity, mobility, or volume under this alternative. However, the migration of metals contamination to the sediment of the Site 2 drainage channel will be eliminated by stabilization of the west bank of the drainage channel (currently being designed).	No reduction in toxicity or volume of contamination. However, exposure to toxicity is significantly reduced. Migration of metals contamination to the sediment of the Site 2 drainage channel will be eliminated by stabilization of the west bank of the drainage channel (currently being designed).	Toxicity, mobility, and volume of the contaminants would be eliminated onsite. Contaminants would be contained to prevent migration elsewhere.	Partial reduction in toxicity and volume of contamination. Mobility of metals contamination to the sediment of the Site 2 drainage channel will be reduced by stabilization of the west bank of the drainage channel (currently being designed).	Toxicity and mobility of contaminants would be significantly reduced, although contamination would remain onsite. Contaminated soil volume may increase due to bulking during treatment.	Toxicity, mobility, and volume of contaminants would be eliminated onsite.	Toxicity and mobility contaminants would b significantly reduced, although some contamination would remain onsite. Contaminated soil vol may increase due to bulking during the stabilization process.
Short-Term Effectiveness	There is no implementation involved under this alternative, therefore there is no added risk.	Temporary increase in fugitive dust emissions during construction of the cap. Workers would be required to wear personal protective equipment.	Temporary increase in fugitive dust emissions during excavation and offsite transport. Workers would be required to wear personal protective equipment.	Temporary increase in fugitive dust emissions during construction of the cap. Workers would be required to wear personal protective equipment.	Temporary increase in fugitive dust emissions during construction of the cap. Workers would be required to wear personal protective equipment.	Temporary increase in fugitive dust emissions during construction of the cap. Workers would be required to wear personal protective equipment.	Temporary increase in fugitive dust emission during construction of cap. Workers would l required to wear perso protective equipment.

1000 ppm 8' ~8100 yd3 24 000 cyd

Table 3-3. SUMMARY OF SOIL REMEDIAL ALTERNATIVES EVALUATION
NM Slag Pile (Site 2), Naval Base, Norfolk, Norfolk, Virginia
Streamlined Feasibility Study

Evaluation Criteria	Alternative 1 No Action	Alternative 2 Asphalt cap, Administrative Restrictions, and Long-term Monitoring	Alternative 3 Excavation and Offsite Disposal*	Alternative 4 Partial Excavation, and Asphalt cap, Administrative Restrictions, and Long-term Monitoring*	Alternative 5 In-situ Stabilization	Alternative 6 Excavation, Onsite Soil Washing, Onsite Disposal*	Alternative 7 Partial Excavation a In-situ Stabilizatio
Implementability	Alternative 1 would be straightforward to implement as no construction would be required. Land use restrictions will need to be put in place and enforced, and 5-year site reviews would be required.	Materials and contractors are readily available. This alternative is easily implemented.	There are a number of contractors capable of routinely handling dewatering, excavation, and disposal (and offsite stabilization, if applicable) of metals contaminated soil. This alternative would be more involved to implement than that for implementation of Alternative 2. Extreme care would have to be exercised during excavation to avoid contact with the sewage water main located at the site.	Materials and contractors are readily available. This alternative is more involved to implement than that for implementation of Alternative 2, but less involved to implement than Alternative 3. Extreme care would have to be exercised during excavation to avoid contact with the sewage water main located at the site.	A specialty contractor is required for the stabilization process. A treatability study would be required prior to implementation. Extreme care would have to be exercised during stabilization to avoid contact with the sewage water main located at the site.	A specialty contractor is required for the soil washing process. A treatability study would be required prior to implementation. Extreme care would have to be exercised during excavation to avoid contact with the sewage water main located at the site.	A specialty contractor required for the stabilization process. A treatability study is required prior to implementation. Mate and contractors for the excavation are readily available. Extreme ca would have to be exer during excavation and stabilization to avoid contact with the sewag water main located at site.
Cost (present worth)	$0	$387,000	$2,406,000 to $8,162,000**	$710,300 to $1,052,000**	$2,917,000	$5,204,000	$2,414,000 to $6,621,000**

***Alternative Nos. 3,4, and 6: Since part (1.5 to 2 feet) of contaminated soil lies beneath the groundwater table, a component of this alternative would include a form of dewatering. Either an absorbent constituent can be used to adsorb the excess water, i.e. lime, Liquisorb the area can be dewatered using wellpoints; or the soil can be excavated in the July through November time period when the water table is lowest. The cost estimate currently incorporates the cost for wellpoint installation and filtration of the extracted groundwater (conservative approach).**

****The magnitude of the present worth range for Alternative Nos. 3,4, and 7 is dependent on whether the excavated waste is hazardous or not. The higher costs for hazardous waste disposal is due to both the higher transportation and treatment/disposal costs (the cost assumes that either 100% of the waste is either hazardous or nonhazardous).**

For Alternative 3, if the assumption is made that ¼ of the excavated waste is hazardous, ¼ of the excavated waste is nonhazardous, and ½ of the excavated waste can be used as backfill, the present worth cost would be approximately $2,477,000. *If the assumption is made that 1/3 of the excavated waste is hazardous, 1/3 of the excavated waste is nonhazardous,* and 1/3 of the excavated waste can be used as backfill, the present worth cost would be approximately $3,053,000. The costs for these two sub-alternatives incorporate the costs for an extensive in-situ characterization study.