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CERCLA Cleanup 2019.09.06 Comment on Navy FYR Addendum on Soil

Golden Gate University School of Law

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Environmental Law and Justice Clinic

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Via e-mail and U.S. mail

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Re: Comments from Greenaction for Health and Environmental Justice Regarding Navy's Draft Addendum to Five-Year Review (Evaluation of Radiological Remedial Goals for Soil, Hunters Point Naval Shipyard)

Dear Mr. Robinson:

On August 8, 2019, the Department of the Navy issued a Draft Addendum to the Five-Year Review, enclosing an Evaluation of Radiological Remedial Goals for Soil at the Hunters Point Naval Shipyard ("HPNS"), and provided a 30-day period for both the public and regulatory agencies to review and comment on the document. This letter, submitted on behalf of Greenaction for Health and Environmental Justice ("Greenaction"), contains comments regarding the Navy's Draft Addendum. In its Fourth Five-Year Review, the Navy stated that it would issue a Draft Addendum to evaluate the long-term protectiveness of the Remediation Goals for soil, and would prepare responses to regulatory agency comments and a responsiveness summary to comments from the public. NAVFAC's Final Fourth Five-Year Review at 7-3 (July 2019) (hereafter "Fourth FYR"). We request the Navy to provide a written response to these comments when it finalizes the Draft Addendum.

I. BACKGROUND

A. Statutory and Regulatory Framework

1. Five-Year Review

Section 121(c) of the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA") requires the Navy, as the lead agency for HPNS, to prepare a review of the remedial action at HPNS "no less often than each 5 years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented." 42 U.S.C. § 9621(c). Pursuant to the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"), the lead agency must conduct a five-year review "[i]f a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure." 40 C.F.R. § 300.430(f)(4)(ii).

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The "purpose of a five-year review is to evaluate the implementation and performance of a remedy in order to determine if the remedy is or will be protective of human health and the environment." Comprehensive Five-Year Review Guidance at 1-1, OSWER No. 9355.7-038-P, EPA 540-R-01-007 (June 2001) (hereafter "Comprehensive FYR Guidance"). For federal facilities such as HPNS subject to 42 U.S.C. § 9620, five-year reviews are conducted by the Federal agency or department that has jurisdiction over the site, "but EPA retains final authority over whether the five-year reviews adequately address the protectiveness of remedies." Comprehensive FYR Guidance at 2-5.

2. Acceptable Exposure Levels for Remedial Actions

As the D.C. Circuit explained: "[w]hen EPA develops objectives for a remedial action at a site, it selects a remedial goal that 'establish[es] acceptable exposure levels that are protective of human health." State of Ohio v. U.S. E.P.A., 997 F.2d 1520, 1533 (D.C. Cir. 1993) (citing NCP at 40 C.F.R. § 300.430(e)(2)(i)). According to the NCP:

> For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between 10^{-4} and 10^{-6} using information on the relationship between dose and response. *The 10^{-6} risk level shall be used as the point of departure for determining remediation goals for alternatives* when ARARs are not available or are not sufficiently protective because of the presence of multiple contaminants at a site or multiple pathways of exposure.

40 C.F.R. § 300.430(e)(2)(i)(A)(2) (emphasis added). "A 10^{-4} risk subjects the surrounding population to an increased cancer risk of 1 in 10,000. A 10^{-6} risk subjects the surrounding population to an increased cancer risk of 1 in 1,000,000." State of Ohio, 997 F.2d at 1533.

In the Preamble to the NCP, EPA stated: "By using 10^{-6} as the point of departure, EPA intends that there be a preference for setting remediation goals at the more protective end of the range, other things being equal." 55 Fed. Reg. 8,666, 8,718 (March 8, 1990). EPA explained the resulting process as follows:

> The use of 10^{-6} expresses EPA's preference for remedial actions that result in risks at the more protective end of the risk range, but this does not reflect a presumption that the final remedial action should attain such a risk level. Factors related to exposure, uncertainty and technical limitations may justify modification of initial cleanup levels that are based on the 10^{-6} risk level. The ultimate decision on what level of protection will be appropriate depends on the selected remedy, which is based on the criteria described in [40 C.F.R.] § 300.430(e)(9)(iii).

55 Fed. Reg. at 8,718.

B. The Navy's Fourth Five-Year Review and Draft Addendum

As the Navy acknowledged, a five-year review is required in this case because ongoing and completed remedial actions have left contaminants in place at HPNS above concentrations that would allow for unlimited use and unrestricted exposure. Fourth FYR at 1-2. In the Fourth FYR, the Navy stated that "a significant portion of the radiological survey and remediation work completed to date was not reliable because of manipulation and/or falsification of data by one of its radiological contractors." Id. at 7-3. Consequently, the Navy did not complete a long-term protectiveness evaluation of the radiological Remediation Goals in the Fourth FYR. Id. Instead, the Navy proposed to issue this Draft Addendum to evaluate the long-term protectiveness of the Remediation Goals for soil using two models: (1) RESRAD-ONSITE ("RESRAD"); and (2) EPA's Preliminary Remediation Goal ("PRG") Calculator for radiation risk to human health. Id.[1]

The Draft Addendum enclosed a Battelle report dated August 7, 2019, which was entitled "Hunters Point Naval Shipyard - Estimated Excess Cancer Risks and Dose Equivalent Rates from Resident Exposures to Radionuclide-Containing Soils Report" (hereafter "Battelle Report"). Table 1 of the Battelle Report lists current soil Remediation Goals from the 2006 HPNS Action Memorandum for 11 Radionuclides of Concern. Battelle Report at 3. Footnote 2 to Table 1 states that the current soil Remediation Goal for Radium-226 "is 1.0 pCi/g above background based on an agreement with the EPA." Id. at 3, Table 1, n.2.

The Battelle Report claims that the Remediation Goals presented in Table 1 were intended to be "the most conservative available and are added to the site- and radionuclide-specific background." Id. at 3. These Remediation Goals "were derived considering the 1991 Environmental Protection Agency (EPA) decay-corrected preliminary remediation goals (PRG) (EPA, 1991), past action memoranda, an agreement with EPA for radium (Ra)-226 (^{226}Ra) and the 2004 Historical Radiological Assessment (HRA)." Id.

II. SUMMARY OF COMMENTS

The Draft Addendum to the Fourth FYR, which is intended to evaluate and determine if the HPNS remedy is and will be protective of human health and the environment, comes at an opportune moment. The Navy has recently determined that a significant portion of the radiological survey and remediation work completed to date at HPNS was not reliable because one of its radiological contractors manipulated

[1] A lead agency should complete a five-year review addendum for a remedy when the protectiveness determination was deferred in a prior five-year review in order to collect additional information. See Five-Year Reviews, Frequently Asked Questions (FAQs) and Answers at 2, OSWER 9355.7-21.

and/or falsified data. This HPNS survey and remediation work will now need to be redone by the Navy and its new contractors. In its comments on the draft Fourth FYR, EPA emphasized the need for the Navy, as part of the protectiveness determinations required in the Fourth FYR, to conduct an updated review of the remedial goals in the Record of Decision ("ROD") for each Parcel to determine whether the remedy, upon completion, will be protective of human health. Therefore, the Draft Addendum to the Fourth FYR affords the Navy the opportunity to reevaluate its remedial goals to determine whether they are protective.

Instead, the Navy has ignored this opportunity to chart a new course for the HPNS remedy. The Navy failed to conduct an evaluation of the ROD's radiological remediation goals for soil. As a consequence, the Draft Addendum simply accepted, without any further review or evaluation, the Remediation Goals adopted in the Navy's 2006 Action Memorandum. The Navy failed to consider adoption of EPA's current Preliminary Remediation Goals for radionuclides, which are 897 times more protective than the Navy's Remediation Goal for Radium-226, a primary radionuclide of concern at HPNS. Furthermore, in the risk calculations included in the Draft Addendum, the Navy failed to take into account that radionuclide risks are not estimated based on an individual radionuclide or radionuclide decay chains, but are instead the sum of the risks from all radionuclides. Moreover, the Navy also failed to consider the risk posed by the consumption of homegrown produce. Despite ignoring this risk, the Navy's own calculations show that the combined risk of exposure to Radium-226 and Thorium-232 exceeds the upper bound lifetime cancer risk to an individual of 1×10^{-4} established under the NCP to protect human health. If the risks from the consumption of homegrown produce are included, the combined exposure to Radium-226 and Thorium-232 would subject future residents at HPNS to an increased cancer risk of 1.52 in 1,000, which exceeds the NCP's protective standard by an order of magnitude.

Under these circumstances, the Navy's Remediation Goals are not protective of human health. Consequently, consistent with the NCP and EPA guidance, Greenaction urges the Navy to: (1) adopt EPA's current Preliminary Remediation Goals for the 11 Radionuclides of Concern at HPNS; and (2) amend the RODs for HPNS Parcels to ensure that the remedies can meet the revised, more protective remediation goals. In addition, Greenaction requests that the Navy stop its unwarranted reliance on soil covers and land use restrictions in the remediation of soil contaminated with radiological waste. Instead of leaving contaminated soil on site, the Navy must conduct a thorough radiological survey at HPNS, and remove and properly dispose of HPNS soil contaminated with radiological waste. Finally, Greenaction requests the Navy to revise its Protectiveness Determinations in its Fourth FYR to properly characterize the protectiveness of its remedies.

III. DISCUSSION OF COMMENTS

A. <u>The Navy Should Revise Its Soil Remediation Goals to Adopt EPA's Current Residential Preliminary Remediation Goals for Soil</u>.

In the preamble to the final NCP, EPA stated its policy that it will not reopen remedy selection decisions contained in a ROD unless a "new or modified requirement calls into question the protectiveness of the selected remedy." 55 Fed. Reg. at 8,757. The preamble explained that "a policy of freezing ARARs at the time of ROD signing will not sacrifice protection of human health and the environment because the remedy will be reviewed for protectiveness every five years, considering new or modified requirements at that point, or more frequently, if there is reason to believe that the remedy is no longer protective of health and environment." Id. at 8,758. In order to assess the protectiveness of a remedy in a five-year review, the lead agency should examine whether "the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection [are] still valid." Comprehensive FYR Guidance at 4-1. For an assumption based on a clean-up level, the lead agency should ask the following two questions: "What is the basis for each cleanup level identified in the ROD (e.g., risk-based or promulgated standards as ARARs)? Have there been changes to the basis of the cleanup levels?" Id. at 4-5.

In the Fourth FYR, the Navy stated:

> The Navy is planning to evaluate the radiological RGs identified in the RODs using current guidance to ensure the long-term protectiveness of the radiological remedies (see further information in Section 7). As part of this evaluation, the Navy will identify any relevant changes in toxicity or other contaminant characteristics that may result in post ROD changes.

Fourth FYR at 6-12. In Section 7 of the Fourth FYR, the Navy stated that it "is in the process of conducting a long-term protectiveness evaluation of the ROD radiological RGs." Id. at 7-3. In its comments on the draft Fourth FYR, EPA emphasized that "the protectiveness determinations requires an updated review of the remedial goals in the ROD to determine whether the remedy, upon completion, will be protective of human health." Letter from Lily Lee, EPA's RPM, to Derek Robinson, Navy's BRAC Environmental Coordinator, dated May 25, 2019, at 2, ¶4. However, in the Draft Addendum, the Navy did not conduct an evaluation of the ROD's radiological remedial goals for soil. Instead, the Draft Addendum simply reiterated, without any further review or evaluation, the Remediation Goals adopted in the 2006 Action Memorandum. Battelle Report at 3, Table 1.

According to the Navy's own calculations, which exclude the risk posed by consumption of homegrown produce, the excess cancer risk from exposure to both Radium-226 and Thorium-232 at the Navy's Remediation Goals exceeds the upper bound lifetime cancer risk to an individual of 1×10^{-4} established under the NCP to protect human health. See Section A.1. below. If the Navy had included the consumption of homegrown produce as a risk pathway in its risk calculations, the combined risk from Radium-226 and Thorium-232 would exceed the upper bound lifetime cancer risk by an order of magnitude. See Section A.2. below. Under these circumstances, the Navy's Remediation Goals are not protective of human health.

EPA's current residential Preliminary Remediation Goals for soil are substantially more stringent than the Navy's soil Remediation Goals, which were derived from EPA's 1991 Preliminary Remediation Goals. See Section A.3. below. Because the calculated risk associated with the Navy's soil Remediation Goals is outside of EPA's risk range under CERCLA, the Navy should adopt EPA's more protective residential Preliminary Remediation Goals for soil, and should amend the RODs for Parcels at HPNS to adopt remedies that can meet the more protective Remediation Goals. See Section A.4. below.

1. The Navy's Remediation Goals for Soil Are Not Protective of Human Health.

In the Draft Addendum, the Navy used two models to evaluate the long-term protectiveness of the soil radiological remedial goals: RESRAD and EPA's PRG Calculator. Draft Addendum at 3-4. For both of these calculations, the Navy excluded the risk posed by the consumption of homegrown produce at HPNS. Battelle Report at 6 (RESRAD modifications); 9 (PRG Calculator modifications). According to the Battelle Report, the total risks, without considering the risk posed by the consumption of homegrown produce, were calculated as follows:

TABLE 1 – NAVY's ESTIMATED EXCESS CANCER RISKS
(Excluding Risk of Homegrown Produce)

Radionuclide	**Total Risk (RESRAD)**[2]	**Total Risk (PRG Calculator)**[3]
Americium-241	7.34E-07	5.95E-07
Cesium-137	3.22E-06	1.98E-06
Cobalt-60	1.74E-06	1.09E-06
Europium-152	5.57E-06	3.36E-06
Europium-154	7.88E-06	4.87E-06
Plutonium-239	5.99E-07	6.71E-07
Radium-226	1.25E-04	7.87E-05
Strontium-90	8.38E-08	7.87E-08
Thorium-232	2.75E-04	1.72E-04
Tritium (H-3)	1.16E-08	9.61E-06
Uranium-235	1.72E-06	1.00E-06

The Battelle Report concluded that the resultant risks under either RESRAD or the PRG Calculator "for *individual radionuclides or radionuclide decay chains* are protective for residential exposures to site soils that are uniformly contaminated at the remedial goal levels." Battelle Report at 8, 11 (emphasis added). However, radionuclide risks are not estimated based on an individual radionuclide or radionuclide decay chain. As EPA has explained: "The total incremental lifetime

[2] Battelle Report at 7-8 (Table 3).
[3] Battelle Report at 11 (Table 5).

cancer risk attributed to radiation exposure is estimated as *the sum of the risks from all radionuclides* in all exposure pathways." See "Radiation Risk Assessment at CERCLA Sites: Q & A" at 25 (Q28), EPA 540-R-012013 (May 2013) (emphasis added) (hereafter "Radiation Risk Assessment Q&A"). In fact, "excess cancer risks from both radionuclides and chemical carcinogens should be summed to provide an estimate of the combined risk presented by all carcinogenic contaminants." Id. (Q29).

As EPA stated in its comments regarding the Navy's draft Fourth FYR, "EPA's guidance for radiological cleanup states that generally 1 x 10^{-4} excess cancer risk is an upper bound for risk management decisions." Letter from Lily Lee, EPA's RPM, to Derek Robinson, Navy's BRAC Environmental Coordinator, dated May 25, 2019, at 4, ¶11. According to the Navy's own calculations based on RESRAD, the excess cancer risk from Radium-226 (1.25E-04) and Thorium-232 (2.75E-04) both exceed 1 x 10^{-4}; the excess cancer risk from both radionuclides totals 4.0 x 10^{-4}. See Table 1 above; Battelle Report at 8. Similarly, based on the Navy's calculations using the PRG Calculator, the excess cancer risk from Thorium-232 alone exceeds 1 x 10^{-4}, and the excess cancer risk from both Radium-226 and Thorium-232 totals 2.5 x 10^{-4}. See Table 1 above; Battelle Report at 11. These excess cancer risks, calculated by the Navy under either RESRAD or the PRG Calculator, exceed the upper bound lifetime cancer risk to an individual of 1 x 10^{-4} established under the NCP to protect human health. 40 C.F.R. § 300.430(e)(2)(i)(A)(2).

2. The Navy's Risk Calculations Understate the Risk of Excess Cancers by Omitting the Risk from Consumption of Plants.

The Battelle Report explained the inputs selected by the Navy to calculate excess cancer risks using RESRAD:

> Deed restrictions will be implemented to restrict the growth of plants in HPNS soils that are intended for consumption. Residents are therefore not anticipated to consume plants, meats, milk, aquatic foods or drinking water produced on HPNS and these pathways were turned off.

Battelle Report at 6. Similarly, the Report described the following modification made by the Navy to an input for the PRG Calculator:

> The *Toggle All* box was unchecked to deselect produce for inclusion in the risk estimates based on stated restrictions on the use of homegrown produce using HPNS soils.

Id. at 9 (italics in original).

In its comments regarding the Navy's draft Fourth FYR, EPA addressed the need for the Navy to perform an updated evaluation of long-term protectiveness related to cleanup levels, recommending that the Navy's "technical memorandum assess and show the concentrations that would be associated with 1 x 10^{-4} excess

cancer risk in an unrestricted scenario." Letter from Lily Lee, EPA's RPM, to Derek Robinson, Navy's BRAC Environmental Coordinator, dated May 25, 2019, at 4, ¶11. Instead of responding to EPA's recommendation, the Navy chose to exclude the homegrown produce risk from its risk calculations. Notably, the Navy's exclusion of the risk from homegrown produce is flatly inconsistent with the Navy's own statements about cleanup actions for radiological contaminants. At a Citizens Advisory Committee meeting at HPNS on August 26, 2019, the Navy provided a fact sheet to the public entitled "Facts About Durable Covers and Protecting Health at Hunters Point." See Attachment 1. In the fact sheet, the Navy stated: "The cleanup actions for radiological contaminants do not rely on the durable cover; instead *the cleanup goals for these contaminants assume the durable cover is not present.*" Emphasis added. The Navy cannot represent to the public that its cleanup actions for radiological contaminants do not rely on durable covers at the same time that the Navy's risk calculations for radionuclides intentionally exclude the risk from homegrown produce based on the unsupported assumption that "deed restrictions will be implemented to restrict the growth of plants in HPNS soils that are intended for consumption." Battelle Report at 6.

In fact, the Institutional Controls selected for Parcels at HPNS do not fully support the Navy's assumption. For example, the Explanation of Significant Differences ("ESD") for Parcel G, which contains language similar to other HPNS RODs, established the following Institutional Control:

> The following activities are prohibited throughout Parcel G:
>
> > Growing vegetables, fruits, or any edible items in native soil for human consumption. *Plants for human consumption may be grown if they are planted in raised beds (above the CERCLA-approved cover) containing non-native soil.* Trees producing edible fruit (including trees producing edible nuts) may also be planted provided they are grown in containers with a bottom that prevents the roots from penetrating the native soil.

Parcel G ESD at 8 (April 18, 2017) (emphasis added).[4] Therefore, the Institutional Controls for Parcel G and some other HPNS Parcels expressly permit residents to grow plants for human consumption in raised beds.

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[4] The Covenant to Restrict the Use of Property for Parcels UC-1 and UC-2, which was recorded by the San Francisco Assessor-Recorder at the Navy's request on September 16, 2015, contains the same Institutional Control language as the ESD for Parcel G. Similarly, the Parcel E ROD contains the same Institutional Control language as the ESD for Parcel G. Record of Decision for Parcel E (December 2103) at 2-56. We note that the Amended ROD for Parcel B does prohibit "growing vegetables or fruits in native soil for human consumption." Amended Parcel B Record of Decision (January 14, 2009) at 12-11.

Moreover, plants grown in raised beds will expose residents to any contaminants in the HPNS soil. In an August 2019 report entitled "Plant Uptake of Radionuclides and Toxic Chemicals from Contaminated Soils Below a Shallow Soil Cover," William Bianchi, PhD, a retired USDA soil physicist, concluded:

> The extensive depth of roots, uptake of contaminants into plants, and various mechanisms of hydraulic redistribution allow vegetation to access materials such as toxic chemicals and radionuclides deep within soil layers. Once accessed, plants are capable of transferring those materials through their roots to the surface, providing several pathways for human exposure.

Bianchi Report at 1 (at http://committeetobridgethegap.org/publications/.)

Because the current Institutional Controls in place in the RODs for Parcels at HPNS expressly allow residents to grow and consume their own produce, the Navy should have included the risk from homegrown produce in its risk calculations. As the risks in Table 2 below illustrate, if produce consumption is included as a risk pathway under the PRG Calculator, the total risks are substantially higher for Radium-226 and Thorium-232.

TABLE 2 - COMPARISON OF ESTIMATED EXCESS CANCER RISKS
(PRG Calculator - Assessing Risk of Consumption of Homegrown Produce)

Radionuclide	**Total Risk Excluding Homegrown Produce**[5]	**Total Risk Including Homegrown Produce**[6]
Radium-226	7.87E-05	5.48E-04
Thorium-232	1.72E-04	9.74E-04

Significantly, according to the PRG Calculator, including produce consumption as a risk pathway results in a total excess cancer risk of 1.52×10^{-3} from both Radium-226 and Thorium-232. Consistent with EPA's guidance, the total risk represents the sum of the risks from both radionuclides. See Radiation Risk Assessment Q & A at 25 (Q28). This total risk exceeds - by an order of magnitude - the upper bound lifetime cancer risk to an individual of 1×10^{-4} established under the NCP to protect human health. 40 C.F.R. § 300.430(e)(2)(i)(A)(2).

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[5] Battelle Report at 11 (Table 5). Note: these calculations exclude the risk from consumption of homegrown produce.

[6] United States Environmental Protection Agency: Preliminary Remediation Goals for Radionuclide Contaminants at Superfund Sites (date accessed 8-31-19). See https://epa-prgs.ornl.gov/cgi-bin/radionuclides/rprg_search. Note: this risk calculation is based on the same inputs as the Battelle Report at page 9 except that the risk calculation includes the consumption of homegrown produce.

3. EPA's Current Residential Preliminary Remediation Goals for Soil Are Substantially More Stringent than the Navy's Soil Remediation Goals.

Pursuant to 42 U.S.C. § 9620(a)(2), all guidelines, rules, regulations, and criteria that are applicable to remedial actions at facilities at which hazardous substances are located shall also be applicable to federal facilities such as HPNS. "No department . . . of the United States may adopt or utilize such guidelines, rules, regulations, or criteria which are inconsistent with the guidelines, rules, regulations, or criteria established by" EPA under CERCLA. Id. In a 2006 Action Memorandum for this site, the Navy adopted Remediation Goals for soil that were derived considering the 1991 EPA preliminary remediation goals. Battelle Report at 3. According to the PRG Frequently Asked Questions, "the PRG database is updated when new toxicity values are presented by the EPA. This is generally done monthly; however, there may be times when more than one month passes without the release of updated toxicity values." PRG FAQ #7; see https://epa-prgs.ornl.gov/radionuclides/faq.html. The Navy has not explained why it chose in 2006 to use EPA's soil preliminary remediation goals from 1991 rather than using the soil preliminary remediation goals that existed in 2006. As shown in Table 3 below, however, EPA's current residential Preliminary Remediation Goals for soil applicable in 2019, calculated at a 10^{-6} risk level, are up to two orders of magnitude more stringent (i.e., more protective) than the Navy's Remediation Goals. For example, EPA's residential Preliminary Remediation Goal for Radium-226 is 897 times more protective than the Navy's Remediation Goal. See D. Hirsch et al., Hunter's Point Shipyard Cleanup Used Outdated and Grossly Non-Protective Cleanup Standards at 5 (at http://committeetobridgethegap.org/publications/) (hereafter "Hirsch, Non-Protective Cleanup Standards"). Similarly, EPA's current standard for Thorium-232 is 971 times more protective than the Navy's Remediation Goal. Id.

TABLE 3 – COMPARISON OF SOIL REMEDIATION GOALS

Radionuclide	**Navy's Residential Soil Remediation Goals (pCi/g)**	**EPA's 2019 Residential Preliminary Remediation Goals for Soil (pCi/g)[7]**
Americium-241	1.36	0.0104
Cesium-137	0.113	0.0303
Cobalt-60	0.252	0.00806
Europium-152	0.13	0.0208
Europium-154	0.23	0.0195
Plutonium-239	2.59	0.00615
Radium-226	1.0	0.00182
Strontium-90	0.331	0.00361
Thorium-232	1.69	0.00174
Tritium (H-3)	2.28	0.0612
Uranium-235	0.195	0.00623

[7] United States Environmental Protection Agency: Preliminary Remediation Goals for Radionuclide Contaminants at Superfund Sites (date accessed 8-28-19). See https://epa-prgs.ornl.gov/cgi-bin/radionuclides/rprg_search.

4. The Navy's Five-Year Review Should Recommend the Adoption of EPA's More Protective Residential Soil Preliminary Remediation Goals and ROD Amendments to Meet the More Protective Remediation Goals.

The Battelle Report stated that the Remediation Goals for soil "were intended to be the most conservative available." Battelle Report at 3 and Table 1. On the contrary, these Remediation Goals are far from the "most conservative available." In fact, the Navy's Draft Addendum shows that the Remediation Goals are not protective of human health. Even if the Navy excludes the risk of consumption of homegrown produce, calculations from both RESRAD and PRG Calculator demonstrate that the Navy's Remediation goals are not protective because the combined risks from both Radium-226 and Thorium-232 exceed the upper bound lifetime cancer risk to an individual of 1×10^{-4} established under the NCP. Id. at 7-8 (Table 3); 11 (Table 5). Furthermore, if the Navy had properly accounted for the additional risk of consumption of homegrown produce, the Navy's Remediation Goals would pose a total excess cancer risk of 1.52×10^{-3} for Radium-226 and Thorium-232 combined. See Table 2 above - Comparison of Estimated Excess Cancer Risks (PRG Calculator – Assessing Risk of Consumption of Homegrown Produce).

When the proposed remedy is no longer protective, EPA guidance provides the following path forward for the Navy:

> For example, based on revised risk information for a specific chemical, a new standard (e.g., more stringent MCL for a chemical) may result in a situation where the cleanup level to be achieved by the original remedy would pose a 10^{-3} cancer risk. In that circumstance, the five-year review could recommend that a new cleanup level based on the new standard be adopted and, if necessary, that the remedy be modified.

Comprehensive FYR Guidance at 4-6, 4-7. EPA's guidance also sets out a flowchart to evaluate changes in standards. Id. at G-4, Exhibit G-1. If the new currently calculated risk associated with an old standard is not within EPA's risk range, the "old standard is considered not protective" and the "newly revised (protective) standard should be adopted." Id. Moreover, the lead agency should determine whether the remedy in the ROD can meet the new standards and recommend follow-up actions. Id.; see also State of Ohio, 997 F.2d at 1535 (EPA asserting that a five-year review may result in a new remedial action "when the review reveals that the remedy is *no longer* protective") (emphasis in original).

Adoption of EPA's current Preliminary Remediation Goals for soil is particularly appropriate at HPNS for several reasons. First, the Navy has determined that a significant portion of the radiological survey and remediation work completed to date was not reliable because of its contractor's manipulation and/or falsification of data. Fourth FYR at 7-3. As a result, extensive survey and remediation work will need to be redone at HPNS. Id. This Fourth Five-Year Review requires the Navy and

EPA to conduct a long-term protectiveness evaluation of the RODs' radiological Remediation Goals. Id.; see 42 U.S.C. § 9621(c); 40 C.F.R. § 300.430(f)(4)(ii). The Navy now has the opportunity to push the "reset button" on the remediation of HPNS in order to regain the public's trust in this process. Second, if the Navy had included the risks associated with the consumption of homegrown produce, the PRG Calculator reveals that the use of the Navy's Remediation Goals would pose a total excess cancer risk of 1.52×10^{-3}, i.e., an increased cancer risk of 1.52 in 1,000, which exceeds EPA's uppermost risk range by an order of magnitude. Because the Navy's Remediation Goals are not protective, the Navy should adopt EPA's current, more protective Preliminary Remediation Goals. Third, the Navy's Remediation Goals, which were adopted in a 2006 Action Plan, were inexplicably derived from EPA's preliminary remediation goals from 1991. Battelle Report at 3. In other words, the Navy's current soil Remediation Goals *in 2019* are based on a 2006 Action Plan that was derived from outdated risk exposure factors from 15 years earlier. If the Navy seeks to assure the public that its Remediation Goals for soil are "intended to be the most conservative available," it should not cling to outmoded, unprotective standards from 1991 to guide the extensive survey and remediation work that remains to be done at HPNS. Finally, the Battelle Report states that the current soil Remediation Goal for Radium-226 of 1.0pCi/g above background "is based on an agreement with the EPA." Id. at 3, Table 1, n.2. However, neither the Navy nor EPA has provided any additional information regarding the basis for this agreement; neither the Navy nor EPA has shown the public that this Remediation Goal for Radium-226 is protective of human health.[8] Significantly, EPA's current residential Preliminary Remediation Goal of 0.0018 pCi/g for Radium-226 in soil is 897 times more protective than the Navy's Remediation Goal of 1.633 pCi/g. See Table 3 above - Comparison of Soil Remediation Goals; Hirsch, Non-Protective Cleanup Standards at 5.

In determining revised remediation goals for soil, the Navy should use the 10^{-6} risk level "as the point of departure." 40 C.F.R. § 300.430(e)(2)(i)(A)(2). The most protective end of the NCP's risk range is particularly appropriate for HPNS given that the State of California has identified Bayview as a disadvantaged community "disproportionately affected by environmental pollution and other hazards that can lead to negative public health effects, exposure, or environmental degradation." See https://calepa.ca.gov/wp-content/uploads/sites/6/2017/04/SB-535-Designation-Final.pdf; https://oehha.ca.gov/calenviroscreen/sb535 (OEHHA's disadvantaged communities map). Accordingly, the Navy's Fourth FYR should recommend: (1) the adoption of EPA's more protective residential soil Preliminary Remediation Goals (see Table 3 above); and (2) after consideration of the nine evaluation criteria established by 40 C.F.R. § 300.430(e)(9)(iii), the amendment of RODs for HPNS Parcels to select remedies that can meet the more protective Remediation Goals.

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[8] Notably, the ROD for Parcel E identifies Radium-226 as a primary radionuclide of concern. ROD for Parcel E (December 2013) at 2-16.

B. The Navy's Remediation at HPNS Should Not Rely on Institutional Controls Such as Soil Covers and Land Use Controls for Long-lived Radionuclides of Concern.

In a fact sheet entitled "Facts about Durable Covers and Protecting Health at Hunters Point" presented to the public at a Citizens Advisory Committee meeting at HPNS on August 26, 2019, the Navy stated: "The cleanup actions for radiological contaminants do not rely on the durable cover; instead the cleanup goals for these contaminants assume the durable cover is not present." See Attachment 1. Contrary to the approach announced in the fact sheet, however, the Navy has taken a completely different tack in its remedy selection for IR-07/18, which is a part of Parcel B, and for Parcel E.

In the Navy's Fourth FYR, the Navy described the remediation of IR-07/18, in which radiological waste will be left in place in soils below one foot and a cover will be an essential part of the remedy:

> In 2010 a MARSSIM Class 1 survey was completed for the entire surface of IR-07/18, and the top 1 foot of soil was remediated to levels specified in the Amended ROD to ensure a radiologically clean surface before the cover remedy was applied. The constructed cover over the portion of IR-07/18 (within the radiological ARIC) prevents exposure to radionuclides in accordance with the RAOs. CDPH completed further surface scans at IR-07/18. CDPH concluded that there was no evidence or indication of radiological health and safety concerns based on surface gamma radiation in the surveyed areas of IR-07/18 (CDPH, 2013). *Soil data at this site was not evaluated because residual radiological contamination is assumed to be present in deeper soils, the protective cover was designed to address that residual contamination,* and the design and integrity of the final soil cover was verified by CDPH.

Fourth FYR at 6-7 (emphasis added). Thus, the Navy intends to prevent potential exposure to radionuclides in soil within IR-07/18 by "access restrictions," enclosing the site with a fence with locked gates, maintaining a durable cover to prevent contact with underlying soil, and relying on land use restrictions that will be incorporated into a covenant to restrict the use of the property. Id. at 6-8.

Similarly, the remedy selected for radiological impacted media for Parcel E calls for the removal of soil, sediment, or debris with radioactive contamination exceeding remediation goals, with soil excavation depth at IR-02 and IR-03 on Parcel E generally limited to the upper one foot. ROD for Parcel E (December 2013) at 2-39. The Navy intends to construct a two-foot soil cover to prevent exposure to remaining contaminants and will impose Institutional Controls to limit the use of land or restrict activities that take place within the area. Id. The Navy will conduct "deeper soil excavation at IR-02 and IR-03, if necessary, to ensure that the residual radiological risk (i.e., the incremental excess cancer risks from exposure to radionuclides in soil) at

the final ground surface (following installation of a demarcation layer and soil cover) is acceptable." Id. at 2-53.

Because the Navy's chosen remedy does not allow for unlimited use and unrestricted exposure at the site, the NCP requires the Navy to conduct this five-year review. 40 C.F.R. § 300.430(f)(4)(ii). "When an IC [Institutional Control] is a component of a remedial action, the current and long-term effectiveness of that IC should be evaluated and relevant information about that IC should be included as part of the effectiveness determination." See "Recommended Evaluation of Institutional Controls: Supplement to the 'Comprehensive Five-Year Review Guidance,'" at 2, OSWER Directive 9355.7-18 (September 13, 2011) (hereafter "Recommended IC Evaluation"). The five-year review may also "recommend the need for additional evaluation and/or follow-up actions included as highlighted issues and recommendations." Id.

In an August 2019 report entitled "Bioturbation, Erosion, and Seismic Activity Make Shallow Soil Covers Ineffective at Isolation Contamination," Howard G. Wilshire, PhD, a former Senior Geologist at the U.S. Geological Survey, addressed whether placing two or three feet of clean soil across large portions of the HPNS site could effectively prevent exposure of contaminants to future residents and users of the site. Wilshire Report at 1 (at http://committeetobridgethegap.org/publications/). He concluded: "there is strong evidence that suggests thin soil covers are incapable of withstanding certain processes such as bioturbation, erosion, and seismic activity which, over time, could potentially compromise their efficacy and durability." Id. In particular, Dr. Wilshire listed both burrowing animals and ant species common in the Bay Area that could cause extensive damage to soil covers. Id. at 4-5, 7-8. This type of damage is not hypothetical; it has been documented at other contaminated sites including the Hanford Nuclear Reservation, Rocky Flats Plant, Los Alamos National Laboratory, and the Idaho National Engineering Laboratory. Id. at 3.

In addition, as the Navy stated in the Historical Radiological Assessment for the Hunters Point Shipyard ("HRA"), the HPNS lies between two major faults, the San Andreas and the Hayward faults, which "are considered active and likely to experience a major event (Richter of magnitude 6.7 or greater) within the next 200 years." HRA at 3-3, 3-4. Consequently, HPNS "is situated in a fault zone that can be expected to experience violent ground shaking and possible liquefaction of the fill material on which much of the shipyard was constructed during a large magnitude earthquake on any one of the surrounding faults." Id. at 3-4. In the case of a seismic event, Dr. Wilshire stated this concern: "intense shaking and possible liquefaction could very well expose contaminated soils beneath the thin soil cover." Wilshire Report at 10.

Furthermore, an EPA report has documented erosion as a significant problem for a number of cover systems. Id. Dr. Wilshire noted that erosion may present a particular problem at HPNS, which consists of substantial fill material. Id. Finally, plant root intrusion can both transport and disperse waste out of a disposal site, and cause physical damage to a cover barrier. Id. at 9.

As part of analyzing Institutional Controls in making the protectiveness determination in the five-year review, the Navy "should keep in mind that ICs are generally protective when they are implemented and effective in the long-term." Recommended IC Evaluation at 3. At Parcel E, the ROD identified, based on soil sample results, two primary radionuclides of concern: Cesium-137 and Radium-226. ROD for Parcel E (December 2013) at 2-16. According to the Navy's HRA, Cesium-137 has a half-life of 30.1 years and Radium-226 has a half-life of 1,599 years. HRA, Table 4-2 at 1, 2.

David J. Kappelman, an EPA health physicist, filed a declaration in support of the United States' supplemental sentencing memorandum regarding the actions of defendant Justin Hubbard at HPNS. In his declaration, Mr. Kappelman stated:

> *Because of the possible adverse health effects from ionizing radiation and the long decay periods (half-lives) for many radionuclides, removal and off-site disposal is considered the most effective option for most of the radioactive contaminants found at HPNS.* For example, the half-life of radium-226, the radionuclide left behind by Mr. Hubbard on the North Pier is 1,600 years. Physical removal of radioactive materials ensures that the potential for diffuse radioactivity is reduced to levels that meet or are below clean up goals.

Declaration of David L. Kappelman in Support of Government's Supplemental Sentencing Memorandum re: Lack of Sentencing Disparity and Risk of Harm, ¶8 (emphasis added); see Attachment 2 (hereafter "Kappelman Decl."). Physical removal and proper off-site disposal of radioactive waste located at HPNS is particularly necessary given climate change and the threat of rising sea levels, which would inundate radioactive waste left in place at HPNS.

New York State has issued guidelines providing that the use of a clean soil cover may be acceptable as part of a remedy for soil contaminated with short-lived isotopes, "assuming that restrictions to land use are used until the radionuclides no longer pose a threat." Wilshire Report at 1. That New York State guideline would likely rule out the use of a soil cover in this case, in which the soil is contaminated with long-lived radionuclides. Id. Similarly, the NCP lists "long-term effectiveness and permanence" as a critical factor in selecting a remedy: "Alternatives shall be assessed for the long-term effectiveness and permanence they afford, along with the degree of certainty that the alternative will prove successful." 40 C.F.R. § 300.430(e)(9)(iii)(C). In particular, the NCP requires the lead agency to consider the "[a]dequacy and reliability of controls such as containment systems and institutional controls that are necessary to manage treatment residuals and untreated waste." Id. at § 300.430(e)(9)(iii)(C)(2); see also Recommended IC Evaluation at 6 (in the five-year review, EPA should consider the long-term effectiveness and enforceability of Institutional Controls).

Given the risks posed to the Navy's proposed two-foot soil cover by bioturbation, seismic activity, plant intrusion, erosion, and rising sea levels, the Navy and EPA should reject the use of a soil cover because it will not prevent exposure to soil contaminated with radiological waste in the long term. Considering that Radium-226, a primary radionuclide of concern at Parcel E, has a half-life of 1,599 years, the proposed use of a two-foot soil cover will not protect human health against the effects of radioactive contamination at HPNS in the long term. Furthermore, with respect to the enforceability of the Institutional Controls to restrict land uses, the California Department of Toxic Substances Control does not have an unlimited budget for inspectors to monitor and enforce land use controls at HPNS. Even if it did, the concept that a land use covenant at HPNS could afford effective and enforceable protection in the long term, i.e., for the next two millennia, strains credulity. Because the Navy cannot demonstrate the long-term effectiveness of a soil cover to prevent human exposure to long-lived radionuclides in the soil at HPNS, the Navy should not rely on soil covers and proprietary controls as part of the radiological remedy. As Mr. Kappelman declared, "removal and off-site disposal is considered the most effective option for most of the radioactive contaminants found at HPNS" to ensure that "the potential for diffuse radioactivity is reduced to levels that meet or are below clean up goals." Kappelman Decl., ¶8. Instead of leaving radioactive, contaminated soil on site at HPNS, the Navy must conduct a thorough radiological survey at HPNS, and remove and properly dispose of HPNS soil contaminated with radiological waste.

C. The Navy Should Revise the Protectiveness Determinations in Section 8 of Its Fourth Five-Year Review.

In its Fourth FYR, the Navy included a Protectiveness Statement in Section 8 for each site or parcel at HPNS where the remedial action is either currently underway or is demonstrated to be complete. Fourth FYR at 8-1 to 8-9. The Navy concluded that the remedy is "protective" at IR 07/18, "will be protective" at Parcels B-1, B-2, C, E, and E-2, and is "short-term protective" at Parcels D-1, D-2, G, UC-1, UC-2, and UC-3. Id. As detailed below, the Navy should revise its Protectiveness Statement in the Fourth FYR to be consistent with EPA's guidance. 42 U.S.C. § 9620(a)(2).

In 2012, EPA issued a guidance entitled "Clarifying the Use of Protectiveness Determinations for Comprehensive Environmental Response, Compensation, and Liability Act Five-Year Reviews," OSWER 9200.2-111 (9-13-12) (hereafter "Protectiveness Determinations Guidance"). To assess the protectiveness of the remedy, EPA reiterated that the reviewing agency needs to answer the following three questions:

> Question A: Is the remedy functioning as intended by the decision documents?
>
> Question B: Are the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy still valid?

> Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

Id. at 2.

EPA explained that a determination of "protective" is typically used when the answers to the questions A, B, and C "provide sufficient data and documentation to conclude that the remedy is functioning as intended and all human and ecological risks are currently under control and are anticipated to be under control in the future." Id. at 2-3. The determination of "will be protective" is appropriate for remedies where construction activities are ongoing, the answers to the questions A, B, and C "provide sufficient data and documentation to conclude that the human and ecological exposures are currently under control and no acceptable risks are occurring," and "the remedy under construction is anticipated to be protective upon completion and no remedy implementation or performance issues have been identified." Id. at 3-4. A determination of "short-term protective" is typically used when the answers to the questions A, B, and C "provide sufficient data and documentation to conclude that the human and ecological exposures are currently under control and no unacceptable exposures are occurring. However, the data and/or documentation review also raise issues that could impact future protectiveness or remedy performance but not current protectiveness." Id. at 3. EPA's guidance recommended that the following language be used by a lead agency when drafting a protectiveness determination of "short-term protective" in a five-year review report:

> *The remedy at OU X currently protects human health and the environment because (describe the elements of the remedy that protect human health and the environment in the short-term). However, in order for the remedy to be protective in the long-term, the following actions need to be taken (describe the actions needed) to ensure protectiveness.*

Id. at 3 (italicized in original).[9]

In its Fourth FYR, the Navy stated that "a significant portion of the radiological survey and remediation work completed to date was not reliable because of manipulation and/or falsification of data by one of its radiological contractors." Fourth FYR at 7-3. Under these circumstances, the Navy does not have reliable data to respond to Questions B and C with respect to the remedies that the Navy selected for each site or parcel at HPNS. Accordingly, the Navy should follow EPA's

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[9] For some Parcels at HPNS, the Navy could also determine that "protectiveness deferred" is appropriate if the available information to answer the questions A, B, and C "does not provide sufficient data and documentation to conclude that the human and ecological exposures are currently under control and no unacceptable exposures are occurring." Protectiveness Determinations Guidance at 4.

Protectiveness Determinations Guidance and revise its protectiveness statement for all sites and Parcels at HPNS to properly characterize the protectiveness of the remedy.

IV. CONCLUSION

The Navy's own calculations demonstrate that the Navy's Remediation Goals are not protective of human health. Because the calculated risk associated with the Navy's soil Remediation Goals is outside of EPA's risk range under CERCLA, the Navy should adopt EPA's more protective residential Preliminary Remediation Goals for soil, and should amend RODs for Parcels at HPNS to adopt remedies that can meet the more protective Remediation Goals. The Navy should stop relying on soil covers and land use restrictions in its remediation of soil contaminated with radiological waste at HPNS. Rather than leaving this hazardous waste in place in HPNS soils to expose future residents and visitors to the hazards of radiation, the Navy should conduct a thorough radiological survey at HPNS, and remove and properly dispose of hazardous and radioactive waste located at HPNS. Finally, the Navy should revise the Protectiveness Determinations in the Fourth FYR to properly characterize the remedy at each Parcel.

Thank you for your consideration of these comments. If you have any questions, you can reach me at (415) 442-6675 or by email at rmullaney@ggu.edu.

Sincerely,

Robert D. Mullaney
Environmental Law and Justice Clinic
Golden Gate University School of Law

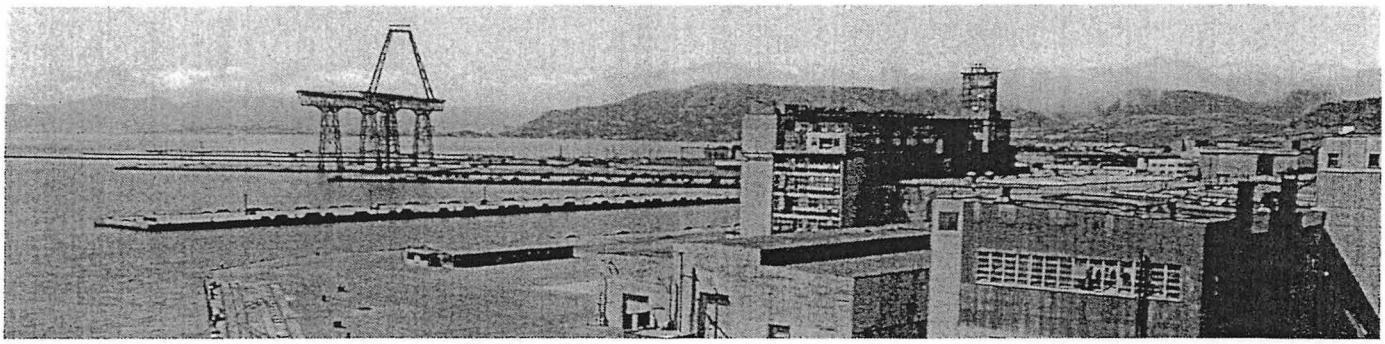
Attorneys for Greenaction for Health and Environmental Justice

ATTACHMENT 1

NAVFAC's "Facts About Durable Covers and Protecting Health at Hunters Point"
Hunters Point Naval Shipyard / August 2019

Facts About Durable Covers and Protecting Health at Hunters Point

Hunters Point Naval Shipyard | August 2019



Public health and safety is the Navy's first priority in the cleanup at Hunters Point Naval Shipyard (HPNS). The Navy works closely with federal, state and city agencies to ensure the safe transfer of HPNS to the City of San Francisco. The Navy develops a specific work plan for every parcel at HPNS, and each undergoes regulatory review.

The Navy has successfully remediated and transferred bases across the country and leverages its expertise to implement protective solutions for each individual facility, including Hunters Point.

One solution used to protect public health and the environment is called a "durable cover." Environmental and civil engineers determine the correct type of cover – usually pavement or soil – and the cover thickness required to ensure public safety. Soil cover designs also take into account local seismic stability factors to ensure integrity during earthquake events.

The use of durable covers was determined to be protective for certain Hunters Point parcels and approved as part of the regulatory process defined by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Public meetings were held to present proposed remedial plans, and the selected remedies were then documented in the Records of Decision for each Parcel.

Durable cover solutions are in place at Parcels B, C, D-1, D-2, E, G, UC-1, UC-2 and UC-3 as permanent protective measures to ensure public safety by preventing exposure to naturally occurring asbestos, metals and any remaining contamination in soil. The cleanup actions for radiological contaminants do not rely on the durable cover; instead the cleanup goals for these contaminants assume the durable cover is not present.

To ensure that the covers are not disturbed and remain protective, the Navy monitors and maintains them through regular inspections of soil and pavement conditions, cracks in building foundations, settlement, accumulation of surface water, signs of erosion, the condition of survey benchmarks and signs of vandalism. The durable covers are also assessed as part of the Five-Year Review process under CERCLA to ensure that they will continue to be protective of human health and the environment.

After property is transferred to civilian control, the city can develop the property in accordance with regulatory procedures and controls that take the durable covers into account. Additionally, the requirement to inspect and maintain the durable covers continues after property conveyance and development.

FAQ

Is the Navy's use of covers new at Hunters Point?

Durable covers have been used for many years at HPNS. These covers were approved as part of the standard regulatory process that includes community input before decisions were finalized.

Once homes are built, could residents' gardens and plants bring contamination from underground to the surface?

No. When HPNS parcels are transferred and developed, gardening and other intrusive activities into the durable cover will be prohibited in a binding land use control legal covenant.

What happens if a cover is damaged due to animal or seismic activity?

Covers are inspected regularly by the Navy. Whenever problems are found, they are corrected. After property transfer, the inspection and maintenance requirement will continue with the city, developer or other associations depending on the location.

More information about the Navy's cleanup work at Hunters Point is available at bracpmo.navy.mil/hpnsrc.

ATTACHMENT 2

Declaration of David J. Kappelman in Support of Government's Supplemental Sentencing Memorandum re: Lack of Sentencing Disparity and Risk of Harm

IN THE UNITED STATES DISTRICT COURT

FOR THE NORTHERN DISTRICT OF CALIFORNIA

SAN FRANCISCO DIVISION

UNITED STATES OF AMERICA, Plaintiff, v. JUSTIN E. HUBBARD, Defendant.	Case No. CR 17-278 JD DECLARATION OF DAVID J. KAPPELMAN IN SUPPORT OF GOVERNMENT'S SUPPLEMENTAL SENTENCING MEMORANDUM RE: LACK OF SENTENCING DISPARITY AND RISK OF HARM Date: March 21, 2018 Time: 10:30am

1. I make this declaration in support of the Government's Memorandum Regarding Sentencing Disparity.

2. I am a health physicist with the United States Environmental Protection Agency ("EPA"). I have been so employed since March 1995. I have a Bachelor of Science degree in Electrical and Electronic Engineering from the California State University of Sacramento. I have worked as a Nuclear Engineer or Health Physicist since March 1992. I have training and experience in radiological detection and quantification. I have performed Gamma Spectroscopy on environmental matrices (soil, water, air, etc.) and on performance evaluation samples while employed by the EPA National Air and Radiation Environmental Laboratory and was the Deputy Team Commander of the Radiological Emergency Response Team responding to radiation emergencies nationwide. I currently work for the EPA Environmental Response Team assisting EPA regions with Superfund radiological emergency response, site investigations, cleanups, and oversight nationwide. I have been assisting EPA Region 9 with reviewing prior documentation and new U.S. Navy work plans to verify that the Navy's radiological

cleanup meets the release criteria specified in the EPA Record of Decision for Hunters Point Naval Shipyard.

3. Hunters Point Naval Shipyard, (HPNS), is a Superfund site located in southeastern San Francisco, California, and was first listed on the National Priorities List (NPL) in 1989. The NPL is a list of Superfund Sites that are given national priority for cleanup, based upon an assessment of the level of threat posed to human health or the environment from known or threatened releases of hazardous substances or pollutants at the site. The HPNS is currently owned by the U.S. Navy, which is the lead agency responsible for the cleanup. In addition to serving as a repair facility for the U.S. Navy, the HPNS Superfund Site was the location for the Naval Radiological Defense Laboratory (NRDL), operated by the Navy, from 1948 to 1969. The work at NRDL included radiological decontamination of ships exposed to atomic weapons testing as well as research and experiments on radiological decontamination and the effect of radiation on living organisms and materials.

4. The Superfund investigation and cleanup of contamination at HPNS is a multi-phase project that has been on-going for more than 20 years. After a comprehensive historical assessment, the Navy identified 84 areas that either were contaminated or had the potential to be contaminated by radiological materials. The radionuclide contaminants at the Site that pose a threat to human health and the environment include, among others, radium-226, plutonium-239, strontium-90, and cesium-137. The Navy addressed each area through a time critical removal action to immediately identify and remove the radioactive contamination in soil, debris, and buildings base-wide. Tetra Tech, EC Inc. (TtEC) was the contractor hired by the Navy to perform this portion of the cleanup. TtEC provided radiological investigation and remediation services to the Navy at Hunters Point Naval Shipyard from 2003 to 2014.

5. The Agency for Toxic Substances and Disease Registry (ATSDR) provides the following information on radium-226, plutonium-239, strontium-90, and cesium 137, the radionuclides of concern:

a. Radium-226 is one of the two main isotopes of radium found in the environment. Radium is a radioactive substance formed from the breakdown of uranium and thorium. Radium has been shown to cause effects on the blood (anemia) and eyes (cataracts). It also has been shown to affect the teeth,

causing an increase in broken teeth and cavities. Exposure to high levels of radium results in an increased incidence of bone, liver, and breast cancer. The EPA and the National Academy of Sciences, Committee on Biological Effects of Ionizing Radiation, have stated that radium is a known human carcinogen.

b. Plutonium is a radioactive material that is produced in nuclear reactors; only trace amounts occur naturally. The most common plutonium isotope is plutonium-239. The main health effect from exposure to plutonium is cancer which may occur years after exposure. The types of cancers most likely to develop are cancers of the lung, bones, and liver. The Department of Health and Human Services (DHHS), International Agency for Research on Cancer (IARC), and the EPA's Office of Air and Radiation (OAR) consider plutonium to be a human carcinogen.

c. Strontium-90, a radioactive isotope of strontium, is formed in nuclear reactors or during the explosion of nuclear weapons. Radioactive strontium generates beta particles as it decays. Exposure to stable or radioactive strontium occurs from ingesting contaminated food or drinking water or breathing contaminated air. High levels of radioactive strontium can cause anemia or cancer. The International Agency for Research on Cancer (IARC) has determined that radioactive strontium is a human carcinogen.

d. Two radioactive forms of cesium, including cesium-137 are produced by nuclear explosions or the breakdown of uranium in fuel elements. Cesium binds strongly to moist soils and does not travel far below the surface of the soil. One can be exposed to radioactive cesium by eating food that was grown in contaminated soil, or by coming near a source of radioactive cesium. Exposure to large amounts of radioactive cesium damages cells from the radiation. Acute radiation syndrome can occur, which includes nausea, vomiting, diarrhea, bleeding, coma, and even death in cases of very high exposures.

6. During the relevant period, Justin Hubbard and Stephen Rolfe were two Tetra Tech Radiological Task Supervisors who oversaw all the field sampling necessary to determine the scope and extent of radiological contamination under the Navy's and Tetra Tech's work plans. Justin Hubbard was responsible for overseeing sampling at numerous locations, including the North Pier. Historically, Berth

6, 7, 8, and 9 at the North Pier were used for berthing ships associated with radiological activities, including Operation Crossroads, NRDL experimental and waste disposal barges. Operation Crossroad ships were contaminated by radioactivity during atomic bomb testing at the Bikini Atoll in 1946. Hundreds of ships became contaminated, the most heavily impacted of which were sent to HPNS for decontamination.

7. Justin Hubbard admitted to falsifying samples taken at the North Pier on May 31, 2012, from four separate survey units. The total number of samples falsified from these four survey units was approximately 80. These were samples taken for the final survey, meaning, if the sample dirt passed the standard for release, the area was deemed "clean" freeing it up for eventual release by the Navy to civilian authorities. It was only the action of the Navy catching the falsification that caused the areas to be re-sampled. Re-sampling determined that excessive levels of radiation remained after fraudulently being deemed clean by Tetra Tech employees, including Justin Hubbard. One of the survey units deemed clean by Justin Hubbard, Survey Unit 1, required multiple additional survey sampling and two additional dirt removals before it finally met the release criteria for radium-226, that is 1 pico curie per gram or less.

8. Because of the possible adverse health effects from ionizing radiation and the long decay periods (half-lives) for many radionuclides, removal and off-site disposal is considered the most effective option for most of the radioactive contaminants found at HPNS. For example, the half-life of radium-226, the radionuclide left behind by Mr. Hubbard on the North Pier is 1,600 years. Physical removal of radioactive materials ensures that the potential for diffuse radioactivity is reduced to levels that meet or are below clean up goals.

DATED: March 21, 2018

DAVID J. KAPPELMAN
Health Physicist
United States Environmental Protection Agency