Review

of

THE NAVY'S DRAFT ADDENDUM TO THE FIVE-YEAR REVIEW: EVALUATION OF RADIOLOGICAL REMEDIAL GOALS FOR SOIL, HUNTERS POINT NAVAL SHIPYARD, SAN FRANCISCO, CA

by
Daniel Hirsch
Maria Caine
Haakon Williams
Taylor Altenbern

Committee to Bridge the Gap
www.committeetobridgethegap.org
committeetobridgethegap@gmail.com
(831) 336-8003

September 8, 2019

Key Points

After long delays, the Navy has finally released a draft evaluation of the protectiveness of its radiological remedial goals for soil at the Hunters Point Naval Shipyard (HPNS) Superfund Site. In the draft Addendum to the Five-Year Review, the Navy calculates risk using both RESRAD and EPA's PRG calculator, changing the default inputs in each.

The draft Addendum is fundamentally flawed, but even so, it demonstrates that the Navy's Remediation Goals (RGs) for HPNS are outside EPA's CERCLA risk range. When the errors are corrected, the risks from contamination at the RG levels are far outside the acceptable level of risk.

Key problems with the draft Addendum include:

- The Navy's own RESRAD estimate of incremental risk from one radionuclide alone (Th-232) is 2.75×10^{-4}, nearly three times the level EPA generally sets as the upper limit of the acceptable risk range. The Navy's own PRG calculator estimate of incremental risk from Th-232 alone is 1.72×10^{-4}, also exceeding the upper limit of 1×10^{-4}.

- Under CERCLA, risks are to be calculated by summing the risks of the individual contaminants. The Navy appears to be violating the normal sum-of-the-fractions rule at HPNS. The risks from multiple radionuclides are to be summed. When combining just the Th-232 and Ra-226 and using the Navy's own RESRAD estimate of risk for those two radionuclides alone, the risk is 4×10^{-4}, four times the upper limit of risk, and 2.517×10^{-4} based on the Navy's PRG calculation.

- Additionally, the risks from chemical contaminants are to be included as well. Many of the chemical action levels are set at 5-10 times, and even 100 times the screening levels, and there are many toxic chemicals present. When the risks from HPNS radionuclide and chemical contaminants are summed, the risk far exceeds the upper limit of the risk range.

- The Navy falsely claims its RG values are the increment above background, rather than the total concentration of the radionuclide. While this is true for radium-226, it is not true for any of the others. Furthermore, EPA practice is to include the full measured value of a radionuclide (i.e., including background) in the risk calculation. Just including the radium background increases the combined risk for Ra-226 and Th-232 to 4.8×10^{-4} and 3×10^{-4} based on the Navy RESRAD and PRG calculations respectively. When the total rather than just net concentrations of the ROCs other than Ra-226 are included in the risk calculation, as required, the risks are substantially higher.

- The Navy also discloses in the draft Addendum that it has been using its RGs as average values, rather than "not to exceed" limits. This is inconsistent with EPA CERCLA guidance, which says one should not average in any situation (such as residential end-land-uses) where exposures can't be guaranteed to be random. Thus, the Navy's figures for risks for contamination at the average levels at RG concentrations further

underestimate true risks, because this means some locations would significantly exceed RGs.

- Finally, although the HPNS radionuclide RGs were established based on inclusion of the garden pathway, the Navy, for both its current RESRAD and PRG calculations, has now turned off the default garden input. This can result in up to a three order-of-magnitude lowballing of risk for individual radionuclides, depending on the radionuclide. As we have demonstrated in prior reports, growing of produce at HPNS is allowed and thus turning off that exposure pathway in the risk calculations is inappropriate. Two parcels (A and D-2) were released with no restrictions whatsoever. The others merely bar growing produce in *native* soil, with no restriction on planting edible plants in the clean cover above the native soil. In three cases (Parcels E, UC-1 and -2) growing plants for human consumption is expressly permitted if planted in a raised bed above the cover. As we have demonstrated in our most recent report and the companion paper by Dr. Bianchi, retired director of a USDA research station, roots of such plants grow far deeper than the 2-3 feet of cover and 1-8 inches of raised bed, thus penetrating into the contaminated soil and incorporating contamination into the produce. Turning off the garden pathway in the calculations is inappropriate and results in a dramatic understatement of risk.

- There are several other questionable aspects of the draft Addendum (e.g., handling of Option 2 in the PRG calculator for radionuclides like plutonium-239) which are explained in more detail in the discussion that follows.

Even without correcting any of the errors, the Navy's own risk estimates exceed the upper limit of acceptable risk generally employed by EPA. Correcting the errors and inconsistencies with EPA CERCLA guidance would result in risks likely to be an order of magnitude outside the acceptable risk range, even without the garden pathway, and even higher with it. EPA should reject the draft Addendum and require adoption of new, fully protective remediation goals.

DETAILS OF REVIEW
OF THE NAVY'S DRAFT ADDENDUM
("HUNTERS POINT NAVAL SHIPYARD: ESTIMATED EXCESS CANCER RISKS AND DOSE EQUIVALENT RATES FROM RESIDENT EXPOSURES TO RADIONUCLIDE-CONTAINING SOILS REPORT," DATED AUGUST 7, 2019)

Failure to Be Consistent with EPA CERCLA Guidance

CERCLA§120(a)(2) requires that an NPL site for which a federal agency is the Responsible Party must be cleaned up pursuant to standards that are not inconsistent with EPA's CERCLA guidance. The Navy's draft Addendum, however, demonstrates in numerous ways such inconsistency. These inconsistencies result in risks exceeding EPA's acceptable risk range.

1. Averaging and Failure to Follow Sum of the Fractions Rule Violate EPA CERCLA Guidance and Increase Risk Over the Upper End of the Acceptable Risk Range

The draft Addendum states: "These [HPNS CERCLA response] actions are conducted to ensure **average**, **radionuclide-specific** radioactivity concentrations in residual soil do not exceed the remediation goals (RGs) stated in the 2006 Action Memorandum (AM) (NAVFAC, 2006)." (p. 3, emphasis added) This single sentence discloses multiple inconsistencies with CERCLA guidance, all of which result in an underestimation of risk by the Navy.

a. Averaging

EPA guidance states that **one does not use averaging** for end-land-uses like residential where exposures can't be guaranteed to be random; one uses a "not to exceed" approach (i.e., no soil sample is allowed to exceed the cleanup level.) See "EPA Radiation Risk Assessment at CERCLA Sites: Q&A," OSWER 9285.6-20, June 13, 2014, Q3, pp 8-9. The rationale is that if there is contamination above RGs in one location that is heavily utilized it is inappropriate to average it with lower concentrations in other parts of the area that may be less frequently utilized and thus fail to clean up the soil found to be over the RGs.

In the draft Addendum, the Navy admits that it has not been cleaning up soil found to be above RGs but instead has been averaging soil with elevated concentrations with other soil in the area with lesser levels. This is contrary to EPA CERCLA guidance, compounds the safety problems associated with the Tetra Tech data fabrication, and results in an understatement of risk.

b. Failure to Follow the Sum-of-the-Fractions and Unity Rule

When more than one contaminant is present, one must adjust the allowable concentration of each downward so that collectively they do not exceed the target risk for the cleanup. This is particularly true when the RGs for individual radionuclides approach the upper limit of the risk range, as is the case here.

As EPA told the Navy in August 14, 2018, comments on the draft Parcel G Retesting Plan:

> Cleanup goals **should include an analysis of the sum of fractions and the unity rule** to ensure total risk to the Reasonably Maximally Exposed (RME) individual posed by multiple ROCs in soil or buildings does not exceed the CERCLA risk range of **1 x 10^{-4} to 1 x 10^{-6}**.
>
> (emphasis added)

The sum of the fractions and unity rule is that if multiple contaminants are present (say Th-232, Ra-226, and Sr-90), one does not allow each contaminant to approach its individual RG, but rather calculates for each radionuclide what fraction of its RG it is and adds those fractions together, and performs cleanup if the sum exceeds 1 (unity). Nonetheless, the Navy discloses in the draft Addendum that it has not been following this rule. Cleanup has only occurred when an individual radionuclide's concentration exceeds its "radionuclide-specific" RG, even when multiple radionuclides are present and the sum of the fractions of their RGs exceed unity.

c. Failure to Sum Radionuclide Risks

Similarly, when calculating risk, one sums the risks of all the radionuclides. However, in its draft Addendum, the Navy merely estimates the risks if a single radionuclide is present. Using RESRAD, it estimates the risk for each radionuclide individually. But if Th-232 and Ra-226 were both present, the risk would be the sum of their risks – 4 x 10^{-4} according to the Navy RESRAD calculation and 2.51 x 10^{-4} according to its PRG calculations, even with all the alterations of inputs to otherwise artificially lower the estimated risk.

d. Failure to Include the Chemical Risks

In addition to failing to sum the risks from different radionuclides, there is no consideration of the additional risks from the chemically toxic materials also contaminating HPNS. Under CERCLA, one is required to sum all the carcinogens. There is a wide array of toxic materials polluting HPNS, and if one added in their risks, as required, the estimated risk would be far higher than that presented by the Navy.[1]

e. The Navy is Exceeding the CERCLA Risk Range of 1 x 10^{-4} to 1 x 10^{-6}

As EPA explicitly and repeatedly noted in its comments on the Navy's draft Parcel G retesting plans cited above, one is not to exceed, with all contaminants summed, the CERCLA risk range of 1 x 10^{-4} to 1 x 10^{-6}. To make it clear that 1 x 10^{-4} is the upper end of the acceptable risk range, EPA added, "Please note that 'Consistent with existing Agency guidance for the CERCLA remedial program, . . . **EPA generally uses 1 x 10^{-4}** in making risk management decisions.'[8]

[1] Note that in its most recent Five Year Review, the Navy has failed, for virtually all of the chemicals at HPNS, to perform a protectiveness evaluation. It only addressed three of the dozens of COCs, and the RG for only one of those was risk-based in the first place. This is a fundamental failure of the Five Year Review.

[ellipse in original, emphasis added; footnote 8: OSWER Directive 9200.4-40, EPA 540-R-012-13, May 2014, Q34, p. 27.]

The Navy's own estimate of risk with just one radionuclide, Th-232, exceeds the upper level of the risk range. With other radionuclides and chemicals added in, averaging taken into account, background included (see below), and other errors corrected, the risk far exceeds the acceptable risk range.

2. Failure to Include Background is Inconsistent with EPA Guidance and the HPNS RODs and Makes True Risks Even Further Above the Risk Range

The draft Addendum states on p.3: "The RGs presented in Table 1 were intended to be the **most conservative available** and **are to be added to site- and radionuclide-specific background**." (emphasis added) This is false, and thus is another factor underestimating risk.

a. Aside from Ra-226, the approved RGs in the RODs are the total amount of the radionuclide present, not the incremental amount above background.

In the 2006 Action Memorandum and all RODs setting RGs thereafter, only radium-226 is to be the value in excess of background.[2] For all others, the RG is the total value measured. This is consistent with EPA practice and guidance—the RG is the total concentration, not the net or incremental above background. (If background is greater than the RG, then one cleans up to background; but if the RG is greater than background, one cleans up to the RG.)

The Navy has recently been trying *post hoc* to sneak through changes to its own Remediation Goals established in the RODs, which it cannot do without in fact amending the RODs. In recent documents such as the Parcel G retesting plan, the Navy has added a new footnote that does not appear in the actual RG tables from the 2006 Action Memorandum and subsequent RODs, trying to slip through a change to make it so that all RGs, not just for radium, are in excess of background.[3] The draft Addendum continues this pattern, falsely asserting that the RGs "were intended" to be added to background. The phrase about its supposed intentions—as opposed to the actual language of the RGs—signals that the Navy recognizes that the RGs as adopted don't actually include background.

The Navy is thus trying unilaterally, outside of the ROD process, to weaken standards already set and approved by the regulators. EPA must not allow the approved cleanup standards to be weakened by such underground redefinition of the existing RGs.

---

[2] See RG Table I in the Action Memorandum, footnote "g," which applies only to radium. The same RGs and footnote are included in the subsequent RODs.

[3] See RG Table 3-5 in the June 2019 "Final" Parcel G retesting plan, footnote "a," which states that "**All** RGs **will be** applied as concentrations above background." (emphasis added) As indicated above, the footnote in the actual RGs from the RODs applies only to radium. The Navy implicitly recognizes that it is trying, via this new footnote in the retesting plan with the phrase "will be" that they are trying to change the practice going forward from what is required in the RODs.

b. The Navy's estimated risks at the RG levels must therefore be increased by the risk of the background component, which the Navy left out. This pushes risk even further above the risk range.

For example, the Navy has been using a background value of 0.633 pCi/g for radium-226, making its actual radium RG 1.633 pCi/g.[4] The Navy estimates RESRAD risks from radium at 1 pCi/g as 1.25 $x10^{-4}$ and using the PRG calculator as 7.87 x 10^{-5}; if one includes background, the risk for radium alone rises to 2.04 x 10^{-4} and 1.29 x 10^{-4} respectively, not counting any other radionuclide or chemical that might be present. With Th-232 added, but not even including thorium background, the Navy's own RESRAD and PRG estimates rise to 4.79 x 10^{-4} and 3.01 x 10^{-4}.

When chemical risks and background for radionuclides other than Ra-226 are included, one is likely well into the 10^{-3} range. The impacts of having used the RGs as average rather than not-to-exceed cleanup levels would push the actual risk even higher. As discussed further below, the inappropriate turning off of the garden default in both the RESRAD and PRG programs means true risks are even higher.

3. Despite the Navy claim, the RGs were not the most conservative available, nor consistent with EPA guidance.

The PRG calculator sets values that are more conservative/protective than the Navy's RGs, and the Navy did not use then-current PRGs when setting RGs in the various RODs. As the draft Addendum states, "[The RGs] 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 (226Ra) and the 2004 Historical Radiological Assessment (HRA)."

Even when the 2006 Action Memorandum was written, it made no sense to use 1991 EPA PRGs instead of then-current ones. RODs in subsequent years merely repeated the use of the 1991 PRGs instead of, as they should have, using current EPA PRGs, which are generally more protective. The Navy has thus for years violated the requirement of CERCLA 120(a)(2) to use standards that are not inconsistent with EPA guidance.

4. The Navy Has Set No RGs for the Majority of HPNS Radionuclides of Concern, Allowing Unlimited Concentrations

Additionally, the HRA identified several dozen radionuclides of concern (ROCs) at HPNS with half-lives long enough to be still present at HPNS.[5] Nonetheless, RGs are provided only for a third of the ROCs, allowing unlimited concentrations of the majority of the ROCs, a major risk not evaluated in the draft review. Note that the primary source of fission and activation products

[4] Parcel E Record of Decision, p. 2-34, PDF p. 46

[5] 2004 Historical Radiological Assessment Table 4-3

and fissionable material at HPNS was fallout contamination on naval ships during nuclear weapons tests and weapons debris brought back from the tests. It is therefore likely that if any the ROCs for which there are RGs were present as contamination, it could be intermixed with some of the nearly two dozen ROCs for which there are no RGs and which the Navy has therefore allowed to avoid cleanup no matter what the concentration. The failure to have cleanup levels for the great majority of radionuclides acknowledged in the HRA as ROCs and a major failure of the draft Addendum and results in potentially large underestimation of risk.

5. The Navy Inappropriately Turned Off the Garden Pathway in the Risk Calculations

In EPA's PRG calculator, the garden pathway is a default. Although the Navy included the garden pathway in setting the RGs[6] that are being examined in this draft Addendum, it has now quietly turned off the garden exposure pathway. **This single act has the effect of substantially understating the actual risk.**

In summarizing the changes it made to the PRG calculator defaults, the Navy states: "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**." (p. 9, emphasis added) Note, critically, that the Navy is not talking about some possible new restriction or prohibition in the future, but the **"stated"** restrictions, i.e., restrictions in existing documents. So, what are the "stated restrictions" regarding "homegrown produce using HPNS soils?"

The assumptions on which the Navy has based the removal of the PRG garden inputs are false. First of all, Parcels A and D-2 have **no restrictions on gardening whatsoever** and must therefore be subject to PRG calculations that include the garden pathway, regardless of the plans for the other parcels.

For the rest of the parcels, growing produce for human consumption is not banned. There is no such prohibition in any of the parcels' RODs. The "stated" restrictions as described in each of these RODs specifically only prohibit "growing vegetables or fruits **in native soil** for human consumption."[7] Thus, such gardening is barred solely in **native soils**, but not in the non-native soil that makes up the covers.

---

[6] The Navy's 2006 radionuclide HPNS RGs, subsequently re-adopted in each ROD thereafter, were based on EPA PRGs that included the garden pathway. This can be seen by comparing the HPNS RGs with early EPA PRGs with the garden pathway included as a default. Additionally, the Navy has repeatedly stated that its RGs for COCs included the garden. See, e.g., United States Department of the Navy, Naval Facilities Engineering Command, "Final Explanation of Significant Differences, Parcel B, San Francisco, Hunters Point Shipyard Site," May 4, 2000, Attachment A: Original and Revised Parcel B Soil Cleanup Levels, https://www.envirostor.dtsc.ca.gov/public/deliverable_documents/4623766839/Parcel%20B%20ROD%20ESD_5-4-2000.pdf, PDF pp. 5, 37-9

[7] RODs for Parcels B, G, D-1 and UC-1, UC-2, E-2, and UC-3, emphasis added. The Parcel C ROD uses slightly different language: "Growing vegetables, fruits, or any edible items in native soil for human consumption."

This is made clear in the only Covenant to Restrict Use of Property (CRUP) issued to date:[8]

> The following activities are prohibited:
>
> a. Growing vegetables, fruits, and 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.

The draft Addendum summarizes only the first sentence. The next sentence of the CRUP expressly **allows** ("may be grown") growing plants for human consumption if planted in raised beds, which generally add only 1-8 inches of soil to the surface.[9]) The only exception has to do with trees producing edible fruits and nuts, which must be grown in containers with a bottom that prevents the roots reaching the contaminated native soil. There is no such requirement for all other edible plants, aside from growing in a raised bed.

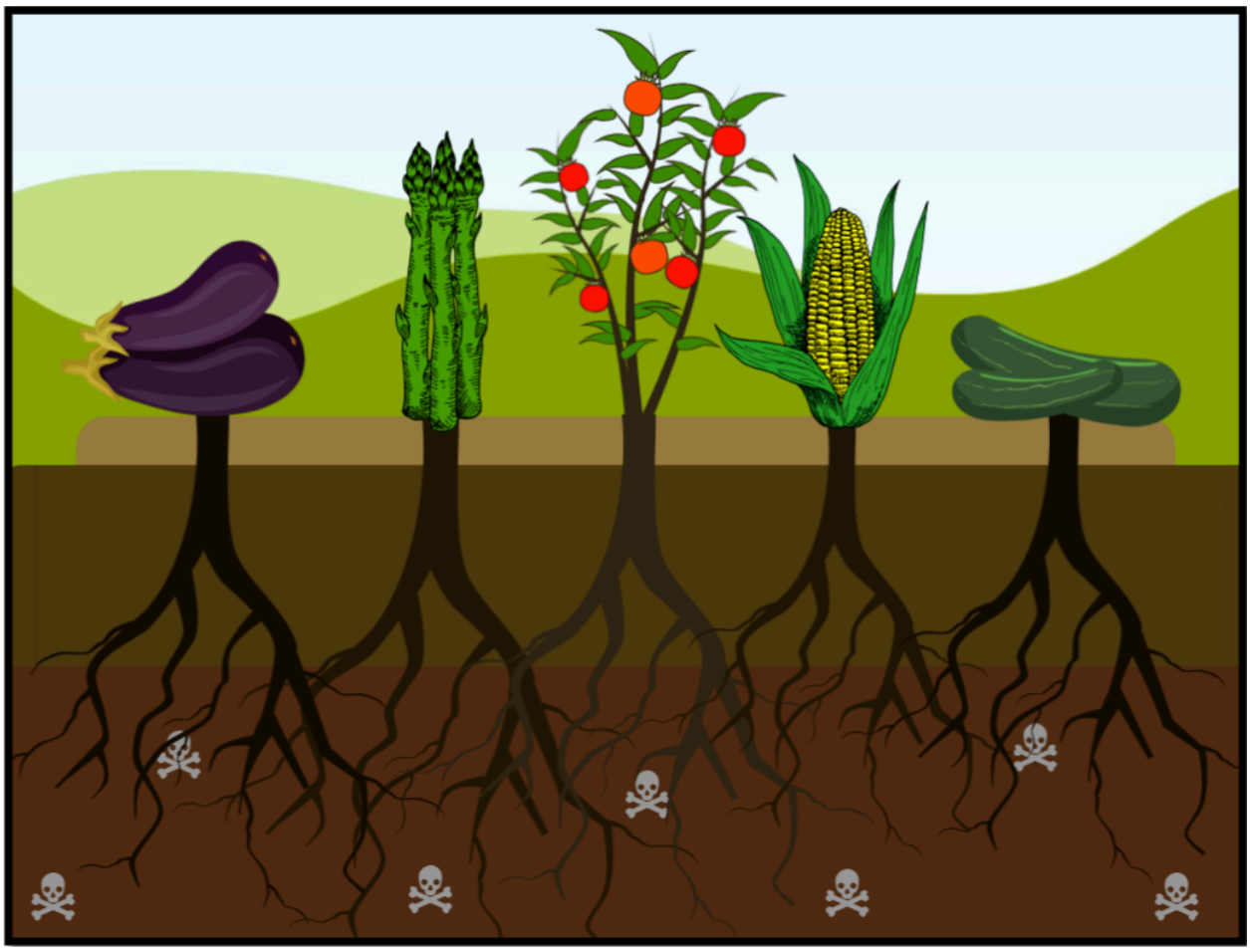
Essentially the entire HPNS site is to rely on covers, much of which will be soil covers.[10] Soil covers are to be generally two feet thick. Planting edible plants in the "clean" soil covers overlying the contaminated native soil is not barred. And, as we have demonstrated in our recent report, FROM CLEANUP TO COVERUP: How the Navy Quietly Abandoned Commitments to Clean Up Hunters Point Naval Shipyard and is Instead Covering Up Much of the Contamination, such covers are ineffective at isolating contaminants. As the companion paper by Dr. William Bianchi, a soil physicist and retired director of a US Dept. of Agriculture research station, demonstrates, USDA data show that many vegetables and non-tree-fruits have roots that would go far deeper than a raised bed and two feet of soil cover. See Bianchi, Plant Uptake of Radionuclides and Toxic Chemicals from Contaminated Soils Below a Shallow Soil Cover.

---

[8] Parcels UC-1 and UC-2 Covenant to Restrict Use of Property, Sept. 2015, p. 8, emphasis added.
[9] See From Cleanup to Coverup, footnote 118
[10] See From Cleanup to Coverup, pp. 15, 24, footnote 142

Crop	Maximum Root Depth (ft)	Crop	Maximum Root Depth (ft)
Artichoke	3	Melons	5
Asparagus	6	Parsnip	3
Beans (dry)	3	Peas	3.5
Beets	3.5	Peppers	3.5
Berries	4	Pumpkin	4
Cantaloupe	4	Soybeans	4.5
Carrots	3.5	Squash	3
Chard	3.5	Sunflower	5
Corn (sweet)	4	Sweet potatoes	5
Cucumber	4	Tomatoes	5
Eggplant	4	Turnip (white)	3
Grapes	6.5	Watermelon	5

Source: USDA data, cited by William Bianchi in "Plant Uptake of Radionuclides and Toxic Chemicals from Contaminated Soils Below a Shallow Soil Cover," p.2 (see also related data on p. 3 therein)



Thin covers as employed at HPNS are ineffective for numerous other reasons as detailed in "From Cleanup to Coverup" and the companion paper by Dr. Wilshire, retired Senior Geologist at USGS, "Bioturbation, Erosion, and Seismic Activity Make Shallow Soil Covers Ineffective at Isolating Contamination." Rather than repeat the points made in those three reports, which are directly relevant to the issue at hand, the reader is referred to those papers.

Other Matters About the Draft Addendum

- The Navy has manually manipulated inputs in the PRG calculator in ways that EPA should critically examine. In one such instance, it has used Source and Decay Option 2 in the calculator for estimating risks for radionuclides such as plutonium-239, but didn't alter many of the half-lives for progeny. This may have had the result of creating risk estimates for Pu-239, one of the most dangerous of all radionuclides, that are markedly lower than would be the case had they used Option 1 or used Option 2 while appropriately modifying the progeny half-lives. It appears that the Navy may have arbitrarily cut off the hazardous period for radionuclides at 1000 years, even though the half-life of Pu-239 is 24,000 years. It would be appropriate for EPA to review carefully the modifications the Navy made to the PRG calculator inputs.

- RESRAD inputs appear to have been "cherry picked" or "massaged" to drive down risk estimates. For example, ignoring EPA direction to assume 420 acres as the contaminated area, the Navy in its RESRAD calculation assumed only 3 acres for most radionuclides and a mere 484 m^2 (a tenth of an acre) for Th-232. Since Th-232 is identified by the Navy as the top risk-driver, use of a more reasonable contaminated area would produce an even higher risk than the Navy estimated.

  Despite having been told by EPA Region 9 to use 420 acres as the contaminated area, in its RESRAD runs the Navy dramatically shrunk the presumed contaminated area to 3 acres for all Radionuclides of Concern except Th-232, which it limited to ~1/10th of an acre.[11] The reasoning provided does not withstand scrutiny. The draft Protectiveness Evaluation asserts that all contamination is "localized" and that localized "historically" has meant less than 3 acres. The nearly two-decade old document cited for that purpose does not in fact support such a claim, and one has learned a lot more about contamination at HPNS since 2001.

  The draft Protectiveness Evaluation also asserts that Th-232 contamination was limited to areas around three buildings, relying solely on a 2004 document. Again, this is not defensible, as we showed in our report, "The Great Majority of Hunters Point Sites Were Never Sampled for Radioactive Contamination And the Testing That Was Performed Was Deeply Flawed." Furthermore, all radioactivity sampling at HPNS has now been called into question by the Tetra Tech data fabrication. Because the Navy identifies Th-232 as the greatest risk driver, with risks alone (not counting other radionuclides or chemicals and without including background) above the risk range, shrinking the presumed area of contamination creates an impression of trying to artificially drive down the worst number of its own estimates.

- The Navy changed the RESRAD default for time outside from 25% to 7.3% No site-specific basis was provided. There are to be parks and sports areas and dog runs which result in a site-specific Reasonably Maximally Exposed individual being outside far more than 7.3% of the day. If the Navy used RESRAD's own default the calculated risks would likely be higher than those estimated in the draft Addendum.

- We note that the Navy also appears to be using in its RESRAD calculations conversion factors from dose to risk that date back a quarter century, rather than current radiation risk conversion factors from the National Academy of Sciences and EPA (e.g., BEIR VII and the "Blue Book") which would produce risk estimates thirty percent higher. Further, it is not clear that the dose-response relationship for children was used in the calculation; children are considerably more radiosensitive than adults.

- Additionally, the Navy has used a particle emission factor (PEF) that grossly downplays the amount of contamination that may become suspended in air at HPNS and available for inhalation and other exposures. The Navy is declining to clean up much of the

[11] draft Addendum, p. 6

contamination at HPNS and instead leaving it there, under covers of a few inches of asphalt or a couple of feet of soil. In order to undertake what is to be the largest redevelopment project in San Francisco since the 1906 earthquake, for many years, if not decades, there will be excavation tearing up the covers and digging up the contaminated soil beneath. That will put into the air large amounts of contamination; minimal dust management programs (spraying areas of construction) will still leave large amounts of contamination in the air. It is thus non-conservative to use a PEF for undisturbed soil instead of site-specific values based on the intense construction in the contaminated soil that will in fact occur at HPNS.

- Numerous other factors that result in underestimating risks were ignored by the Navy in the draft Addendum. We have described many of those problems in our series of reports on HPNS, and incorporate them herein by reference:

- **Report 1: Hunters Point Naval Shipyard: The Nuclear Arms Race Comes Home**
- **Report 2: The Great Majority of Hunters Point Sites Were Never Sampled for Radioactive Contamination — And the Testing That Was Performed Was Deeply Flawed**
- **Report 3: Hunters Point Shipyard Cleanup Used Outdated and Grossly Non-Protective Cleanup Standards**
- **FROM CLEANUP TO COVERUP: How the Navy Quietly Abandoned Commitments to Clean Up Hunters Point Naval Shipyard and is Instead Covering Up Much of the Contamination**
- **Plant Uptake of Radionuclides and Toxic Chemicals from Contaminated Soils Below a Shallow Soil Cover**
- **Bioturbation, Erosion, and Seismic Activity Make Shallow Soil Covers Ineffective at Isolating Contamination**
- **Critique of the Navy's Draft Five Year Review**
- **Critique of the Work Plan for Retesting of Parcel G Hunters Point Naval Shipyard**
- **Attachment – CBG Detailed Comments on Parcel G Retesting Work Plan**

CONCLUSION

The Navy's own risk estimates for its radionuclide remediation goals exceed the upper limit EPA generally uses for acceptable risk. However, the Navy made numerous errors and used assumptions that are inconsistent with EPA's CERCLA guidance. When those mistakes are corrected, the risk is likely to be about an order of magnitude above the CERCLA acceptable risk range, without the garden pathway, and even higher with it.

Therefore, EPA should reject the draft Addendum and require the development and use of new remediation goals that are fully protective. Indeed, the RGs should be revised in such a way as to result in risks in the lower end of the acceptable risk range, so as to provide a margin of safety for new developments over time. The retesting plans need to be revised to assure the ability to

detect contaminants at the new, more protective RGs, and the cleanup requirements for HPNS altered so as to require cleanup at those levels.

New RGs need to be adopted, in a public process involving formal revision of the RODs; those new RGs need to be at the risk level promised by the Navy when it adopted the RODs—10^{-6}. We are not in a situation where cleanup has been completed, performed correctly, and all that is needed is to determine that the cleanup is still protective. Instead, because the cleanup was botched, with 90-97% of survey units showing evidence of falsification according to the regulatory agencies, the Navy is now having to start all over again. Therefore it should do so with new RGs that are based on current EPA PRGs and the risk level promised in the original RODs.