

*Testimony of John P. Wargo
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*Before the
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My name is John Wargo and I am here this morning to provide testimony to evaluate the public health assessments (PHA'S) prepared by the Agency for Toxic Substances Disease Registry (ATSDR) concerning human health risks on the island of Vieques, Puerto Rico. I also hope to provide my thoughts on what might be done to improve the quality of the CDC/ATSDR's public health assessments for communities lying near Superfund National Priority sites.

I have been a professor at Yale University for the past 25 years, and I specialize in the estimation of human exposure to hazardous chemicals with a special focus on children and women's health. I have conducted research in Vieques, Puerto Rico during the past 7 years. I also have provided advice to several EPA administrators, testified in both Senate and House committees, worked with several National Academy of Sciences committees, provided advice to the Vice President's office, the Food and Drug administration, the World Health Organization, the Food and Agriculture Organization, and I have served on EPA's Scientific Advisory Panel and Review Board for nearly 5 years.

My research Vieques is more fully presented in a book titled *Green Intelligence* that includes 4 chapters on the history and toxic aftermath of the Navy's actions on the island. This book was peer reviewed and published by Yale University Press in late 2009, and I am attaching relevant chapters to today's testimony as background for the committee to review.

Response to Congressman Miller's Question 2:

"Describe your assessment of ATSDR's 2003 environmental health evaluations of Vieques which determined that there were no adverse human health effects caused by U.S. military bombing operations there that have left a legacy of environmental contamination on the island."

1. The ATSDR concluded in 2003 that contaminants released by the U.S. and allied forces during the latter half of the 20th century posed no significant health threat to those who live on, or formerly lived on the island of Vieques, Puerto Rico. My own conclusions are that the ATSDR's public health assessments contain serious flaws in scientific methods, analyses and interpretations of evidence, yet the agency consistently concludes that human health risks are insignificant.
 2. In brief, the Agency concluded that the absence of evidence of contamination is sufficient to conclude the absence of significant health threat. However, the poor quality of environmental
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monitoring and surveillance makes it impossible to justify the sweeping declarations of safety made by ATSDR.

3. The Agency routinely relied on studies previously prepared or data collected by others rather than designing new studies that are appropriate for local conditions and problems. The Agency did collect fish and examined them to identify the presence of hazardous chemicals, however their sampling designs were inappropriate and insensitive.
4. The Agency rarely conducted its own research on environmental contamination, human exposure, and disease prevalence, and flaws in any available studies leads them to conclude there is no credible evidence of a causal relation between hazardous materials and disease within communities that lie adjacent to Superfund sites. ATSDR conducted no human testing on Vieques to determine whether hazardous chemicals released by the Navy were present in the tissues of island residents. Nor did the Agency conduct any original epidemiological studies to understand patterns of disease prevalence on the island. These types of data are fundamentally necessary to understand the relations between hazardous chemicals and human illness.
5. I believe the Agency has overlooked the role of food contamination as a source of human exposure in its health assessments on Vieques. Research on food intake in many island communities demonstrates the importance of fish and shellfish as routes of human exposure to methylmercury. The National Academies of Science concluded in 2000 that the most scientifically defensible limit for human intake of methylmercury is 0.1 ug/kg/day. This is also EPA's recommended limit on daily intake. ATSDR throughout most of this final report assumed in 2003 that a level 3 times higher than the NAS and EPA recommendation is the appropriate benchmark.
6. A careful review of the ATSDR public health assessments reveals an agency determined to find no causal relation between the Defense Departments 60 year history of dropping nearly 100 million pounds of weapons on a small island, and the exceptional incidence of human illness among those that lived through this history.
7. Soil Contamination Public Health Assessment: The Navy and ATSDR failed to collect soil contamination data associated with military operations. The absence of these data prevented them and others from understanding when and where soil might pose a public health threat. This could occur from soil particles exploding into the atmosphere, drifting downwind in the atmosphere, eventually settling on plants, soils, and perhaps open cisterns.
8. Grazing Animals and their Products: The Navy, EPA, and ATSDR neglected research on grazing activities by cattle, goats, sheep, pigs and chickens. Their importance to the diet of Vieques population is poorly understood, but could potentially have been a significant additional pathway of exposure. The Navy leased lands to those who grazed their stock, some in close proximity to the Live Impact Area.
9. The Navy has carefully controlled access to the bombing range in a manner that has precluded the conduct of scientific research by independent scientists such as myself. It is reportedly spending

hundreds of millions of dollars in efforts to clear the area of metal wreckage, but little has been spent to understand historical patterns of resident exposure. When the government controls the science, they control the narrative risk to human health. There is a clear need to create an alternative institutional to conduct these health assessments by independent and unbiased scientists.

10. Finally the Agency's public health assessments are not peer reviewed. And I believe that given the limitations I have described in my detailed attachments, they would not withstand peer review in top-tier journals such as *Environmental Health Perspectives*, or the *American Journal of Public Health*.

Response to Congressman Miller's Question 3:

"Given your experience over the past year interacting with ATSDR regarding their commitment to take "a fresh look" at available data regarding potential public health threats from toxic exposures to the Vieques residents what lessons do you believe ATSDR has learned, if any, from their original environmental health evaluations?"

1. *Premature Findings of Safety:* I believe that ATSDR scientists and administrators now realize that their 2003 public health assessments and conclusions of safety were premature, and poorly supported by available evidence.
2. *Fresh Look?* The ATSDR may produce update PHA's based upon additional data collected by other government organizations. It is unclear whether the agency intends to collect original data. During our meeting in the fall of 2009 at CDC headquarters in Atlanta, a group of independent scientists strongly recommended that ATSDR collect original data.
3. *Underlying Cultural Problem:* The ATSDR has, I believe, misperceived its intended mission. The PHA's demonstrate that the agency believes its purpose is to search for conclusive evidence that hazardous chemicals have caused health loss.

Since data necessary to demonstrate the cause of health loss from rarely exist, the agency normally finds "no significant threat to human health", and it declares the safety of surrounding communities. Yet these conclusions are illogical, and scientifically flawed. ATSDR may not have sufficient evidence to conclude community danger, but it similarly does not have sufficient evidence to conclude "safety".

4. *Resource Limitations May be Driving Premature Conclusions:* ATSDR has a budget of nearly \$15 million per year to spend on PHA's. Consider for example that 150 Superfund sites require investigation to understand community health risks. This would allow the Agency to spend \$10,000 per site per year to conduct research. This limited budget would normally preclude the conduct of original research specifically tailored to individual sites. ATSDR appears to

have dealt with its resource constraints by developing generic PHA's that rely on data and analysis previously conducted by others.

5. *Can ATSDR be Expected to Adopt Health Protective Recommendations?* I find this to be unlikely unless additional decision protocols are adopted to guide the agency's data collection, analyses, interpretations, and recommendations. My specific recommendations follow in response to question 4.

Response to Congressman Miller's Question 4:

"Provide any specific recommendations you may have about how ATSDR can help ensure that its future public health products are based on sound science and address critical aspects of potential human health effects of environmental contamination."

Principles for Improving ATSDR Public Health Assessments: ATSDR should:

1. Track the Sources and Movement of Hazardous Chemicals
2. Pay More Attention to Chemical Persistence and Mobility
3. Test Appropriate Media for the Presence of Chemical Residues
4. Understand the Magnitude and Variability of Human Exposures
5. Consider Exposure to Chemical Mixtures
6. Consider Variability in Human Susceptibility: Pregnant Women, Children
7. Conduct Human Tissue Testing
8. Evaluate Disease Prevalence in the Community of Concern
9. Explicitly Evaluate the Quality and Uncertainty of Each Data Source
10. ATSDR's Burden Should be to Prove Safety, Not Significant Risk
11. Establish Rigorous Standards Before Declaring Safety
12. Answer the Question: Is there Reasonable Certainty of No Harm?
13. Recommend Realistic Guidelines for Exposure Reduction.

This concludes my testimony, however I am providing a detailed critique of the 2003 Vieques Public Health assessments in the following four attachments.

Attachment 1: Critique of “Public Health Assessment: Fish and Shellfish Evaluation, Isla de Vieques Bombing Range, Vieques, Puerto Rico”, dated June 27, 2003.

1. *Sampling Design:*

- *Insufficient Sample Sizes:* The size of samples collected and tested for individual species is insufficient to reach any conclusion about the extent and variability in fish contamination among sites. No more than 5 individuals were tested for each species at each site. This small sample size does not permit statistical comparison among locations. Table 7 describes the number of each species collected at each of the 6 sampling sites. For example, only 11 yellowtail Snapper were collected, although they are among the most commonly consumed fish by island residents. At two sites, no Yellowtail were collected, only 1 was collected at another, 2 at another, 3 at another and 5 at the last location. This sampling plan is fundamentally flawed to test the hypothesis that higher concentrations would be found in fish in closer proximity to the Live Impact Area. It also does not take into account intensity or direction of currents, or direction of prevailing winds.
- *Areas Commonly Fished?* ATSDR did not structure its sampling design based upon knowledge of areas commonly fished by Vieques fishermen and residents, nor did it investigate which species are most likely to be consumed on the Island, compared with those sold off-Island.
- *Testing Fish Purchased At Markets?* ATSDR collected fish at the market in Isabel Segunda and tested them for the presence of mercury. Yet the Agency has no knowledge of where these fish were caught. These fish might have originated tens of miles offshore from Vieques.

2. *Vieques Islanders’ Fish Intake:* Before any conclusion may be reached about the hazard posed by fish contaminated at different concentrations, patterns of fish intake should have been carefully studied. Understanding the species most often consumed and the amounts consumed are both necessary to estimate exposure and health risk. Also some groups such as commercial fishermen’s families and subsistence fishermen are likely to have far higher intake of fish than predicted by a random survey of Vieques residents, or by U.S.D.A. national food intake surveys. This has been well demonstrated for Republic of the Seychelles, and other island communities.

3. *Mercury:*

- a. There are important conflicts in the analyses that ATSDR presents to justify its conclusions regarding the safety of consuming fish caught near Vieques.
- b. The key issue is whether mercury exposures exceed the health guidelines recommended by the U.S. National Academy of Sciences (NAS). The NAS concluded in 2000 that the most scientifically defensible limit for human intake of methylmercury is 0.1 ug/kg/day. ATSDR

throughout most of this final report assumes that a level 3 times higher than the NAS recommendation is the appropriate benchmark. See Tables D3 and D4.

- c. Using average concentrations of mercury detected in fish collected at 6 locations, all exceeded the NAS recommended limit by 6-11 times for children, and by 3-5 times for adults.
 - d. In many instances in the report, ATSDR compares exposure estimates to its recommended limit of 0.3 ug/kg/day. If exposures exceed the limit, ATSDR places a star (*) next to the estimate, and the accompanying note states: "Estimated exposure exceeds health guideline..."
 - e. ATSDR presents data on Snapper concentrations (Tables D17 and D18) and *in this case only*, they have changed their recommended limit to be in accordance with the NAS recommendation (0.1 mg/kg/day).
 - f. Even though both the adult and children's estimated exposure to mercury in snapper is 2-4 times higher than the recommended limit, ATSDR does not highlight the estimate with an asterisk and cautionary language.
 - g. If ATSDR had employed the lower, more health protective limit, the threat to children, even average Snapper intake appears to place them at significant risk.
 - h. Given these problems, how can ATSDR conclude: "It is safe to eat snapper every day"?
4. *Cumulative Exposures:* The ATSDR does not address the potential for Vieques residents to exceed safe levels of exposure to contaminants such as methylmercury in fish caught nearby in addition to other sources such as canned tuna fish. ATSDR should explain why it believes that pregnant women and children are safe from typically detected levels of methylmercury in tuna, in addition to mercury detected in Vieques fish. Cumulative exposure should be addressed for other contaminants released by the U.S. military on the island.
 5. *Half-life of Methylmercury:* ATSDR neglected to consider the extended half-life of methylmercury in the human body; estimates range between 40-180 days. Half life is defined as the amount of time necessary to reduce the body's concentration by 50%. Given this extended period, frequent fish consumption can cause concentrations to build in the body. Vieques fishermen often consume fish 5 or more times per week, yet ATSDR did not study their intake patterns, or their tissue Hg concentrations.
 6. *Uncertainty, Error Estimates, and Statistical Significance:* ATSDR does not follow standard scientific practice and report sources and magnitudes of uncertainty – including error – surrounding estimates of exposure? Nor does the Agency present quantitative estimates of the statistical significance of their findings. This would be difficult and damaging to their conclusions due to small sample sizes.
 7. *ATSDR Conclusions:* Despite limitations in sampling design and sample size, the ATSDR reached three aggressive and unsupportable conclusions:
 - "It is safe to eat a variety of fish and shellfish every day."
 - "It is safe to eat fish and shellfish from any of the locations sampled, including from around the LIA and the two sunken Navy target vessels."

- “It is safe to eat the most commonly consumed species, snapper, every day.” (ATSDR 2003 pp. 2-3).
8. *Other Foods:* ATSDR assumes that fish constitute the only significant food that might carry contaminants of military origin to the dinner table. It is well recognized that the Navy leased rights on the Eastern end of the island to graze cattle. Since cattle grazed for years immediately downwind from the Live Impact Area, it seems prudent to consider the potential for metals, explosives, and other contaminants of military origin to be taken up by plants that are in turn consumed by cattle. Due to the propensity of many of these compounds to persist and bioaccumulate, beef and dairy consumption could have been an additional source of exposure. Similarly, other plants used for food and grown in contaminated soils should be considered potentially important pathways for human exposure. The restriction of ATSDR attention to fish seems convenient rather than scientifically justified.
 9. *Conclusions:*
 - a. The Navy admits responsibility for intense release of munitions and other hazardous substances to the Vieques environment – tens of millions of pounds of ordnance – during the last half of the 20th century.
 - b. The ATSDR’s conclusions that fish intake by Vieques residents poses no health threat is not supported by the data the Agency relied upon to reach the finding.
 - c. Mercury levels detected in fish sampled by ATSDR may pose a specific threat to fetuses, infants, and children, depending on their bodyweights, fish intake, and fish contamination levels. This threat is well recognized by many scientists. The level deemed safe has varied among government agencies, including FDA, EPA, ATSDR, and the World Health Organization. EPA’s standards have been the most rigorous.
 - d. Detected mercury concentrations result in ATSDR’s own human exposure estimates that are 2-11 times higher than maximum levels recommended by both the National Academy of Sciences and the Environmental Protection Agency.
 - e. Lead, mercury, cadmium, chromium, arsenic, and uranium have all been released into the Vieques environment by U.S. and allied armed forces. These elements are well recognized to hazardous substances, and they have the potential to be absorbed by plants, wildlife, fish and shellfish.
 - f. The ability of mothers to transfer mercury to unborn fetuses, the low body weight of fetuses and children relative to adults, and the rapid growth and development of fetal and childhood tissues, all combine to make young children especially vulnerable to toxic effects that threaten normal growth and development. Age-related physiological susceptibility is not part of the ATSDR health risk assessment, and it should be fully considered.

Attachment 2: Critique of Vieques ATSDR Water Public Health Assessment

- **The Vulnerable Period:** The 35 year period between 1943 and 1978 (when a public water supply from mainland Puerto Rico was completed) is the most likely time when the island's population might have been exposed to hazardous compounds released to the environment by the Navy via drinking water. Yet this is also a period when government testing of environmental quality on the island was minimal.
- **Absence of Water Quality Testing:** The poor history and quality of water quality testing make it difficult to reconstruct a history of exposure with precision. Water supplies on Vieques were not tested routinely for chemicals that were intensively released to the environment by the Navy.
- **No New Data:** ATSDR did not conduct any tests of its own. Instead, the Agency relied on former studies conducted by the Puerto Rican Department of Health (1999, 1995), the USEPA (1999-2000), the U.S. Geological Survey (1996), and a consulting firm hired by the Navy (1999).
- **Most Likely Routes of Exposure:** The most probable routes of exposure to chemicals released to the Vieques environment by the Navy include 1) contamination of drinking water wells from airborne chemicals that drifted and settled in the watersheds surrounding municipal wells; 2) contamination of cisterns from airborne chemicals that drifted and settled into the tanks; 3) contamination from Naval use of pesticides and herbicides; 4) contamination from fuel releases-both intentional and accidental; and 5) waste disposal practices.
- **No Peer Review:** The ATSDR studies are not peer reviewed, remain unpublished, and are often based upon sampling designs and exceptionally small sample sizes (ranging between 1-12 samples). Degradation products were not tested or reported.
- **No Dose Reconstruction:** The ATSDR did not attempt to reconstruct possible doses experienced by island residents. This normally should be done in a way that accounts for the special vulnerability of fetuses, infants and small children, who normally consume far higher amounts of water per unit of their bodyweight per day. Given uncertainty, simulation modeling would be the most appropriate analytic method to estimate the range of exposures most likely experienced by the island's population.
- **Pesticides and Herbicides Neglected:** The EPA studies cited by ATSDR routinely neglected to test for pesticides and herbicides. The Puerto Rico DOH did test for pesticides and herbicides in 1995. However, the Navy has not disclosed its use of pesticides and herbicides, and this could help guide water quality sampling designs.
- **Cisterns:** ATSDR did not evaluate exposures that may have resulted from contaminated cisterns. It is probable that chemical residues from the explosion of ordnance drifted westerly

with prevailing winds over inhabited areas on Vieques. It is also probable that these residues settled down in open cisterns, leading to human exposures via drinking water consumption. Exposures via this route were likely higher prior to the completion of the public water supply pipeline from the main island in 1978. Cisterns are still used when power is interrupted on the island, or when water pressure drops.

- **Detections of Explosives:** ATSDR also reported the presence of RDX (0.04 ppb) and Tetryl (0.05) in the drinking water supplies of Isabel Segunda (0.5 ppb), and RDX (0.04 ppb) in the drinking water of Esperanza in May of 1978, referencing a Naval Surface Weapons Center report (Hoffsommer and Glover 1978; Lai 1978). Neither the Navy nor the ATSDR provide a plausible explanation for these findings, nor did the Navy follow these findings with additional sampling efforts. This same 1978 study reported detection of RDX above the limit of detection in sea water west of the NAF area. This is significant given the enormous dilution potential of the ocean. Higher concentrations of RDX were then reported in a lagoon, to the west of the NAF, and in surface water runoff from the NAF area. These findings – a declining gradient in concentration of RDX from the bombing range to a nearby lagoon, and then to seawater – suggest a logical pathway of chemical movement from the Live Impact Area to coastal waters.
- **Sampling Design:** The ATSDR conclusion that “public drinking water supplies pose no health hazard” is not supported by a statistically valid sampling design, and discounts exposures that most likely occurred (given the Navy’s findings of RDX and Tetryl in the community water supply) during the third quarter of the 20th century.
- **Nitrate and Nitrite:** The ATSDR found several wells on the island had high nitrate and nitrite levels, and attributed contamination to either agricultural activity or septic system leakage. Nitrate and nitrite are also common components of military ordnance, yet this was not considered by the Agency.
- **Absence of Risk or Absence of Testing?** The studies interpreted by ATSDR do not demonstrate the absence of health threat associated with Naval activities. Instead, they demonstrate the absence of the Navy’s testing of the community’s drinking water supplies.

Attachment 3: Critique of Vieques Air Pathway Evaluation Public Health Assessment

1. *Failure to Collect and Manage Air Pollution Data:* On numerous occasions, the ATSDR concluded that air pollution data was mismanaged by the Navy and therefore provides unreliable information regarding the magnitude and distribution of air contaminants during high activity training periods on the Live Impact Area.

The following excerpts from the *ATSDR Soil PSA* demonstrate this problem:

- a) "Over the last 2 years, ATSDR has identified two documents indicating that PREQB conducted air sampling on Vieques in 1972 (Cruz Pérez 2000; TAMS 1979), but original documentation for this sampling effort apparently cannot be located."
- b) "ATSDR has identified two references suggesting that another air sampling project took place on Vieques in 1978, starting on May 16 and continuing through July (Cruz Pérez 2000; EPA 1999). However, original documentation of this sampling project has not been located."
- c) "The Navy's 1979 Environmental Impact Statement (EIS) for continued use of the bombing range documents results from a 2-month air sampling program (TAMS 1979). ...No information is provided on the sampling methods used or on data quality.... ATSDR finds that the measured concentrations from this sampling effort are of an unknown quality, because no documentation can be found describing the sampling methods used or the quality assurance measures taken."
- d) "ATSDR has identified two accounts of an EPA air sampling project that reportedly took place on Vieques in the 1970s (ViequesLibre 2001, ViequesWar 2001). Neither account cites an EPA document where these findings are published or provides critical information ATSDR would need to interpret this sampling project, such as the number and locations of sampling stations, the sampling methods, and the measured air concentrations."
- e) "Based on the best information available, ATSDR has reason to believe that EPA never sampled air on Vieques in the 1970s. Because valid sampling data form the best basis for evaluating the public health implications of exposure to air pollution, ATSDR encourages any individuals with detailed information on past sampling projects to submit them to the agency for review."
- f) "Because no sampling programs extensively characterized air quality on Vieques during live bombing exercises, ATSDR relied entirely on a modeling study to evaluate this exposure scenario."

Why would ATSDR and EPA fail to collect data during live fire exercises, especially given the intensity of litigation and criticism of these activities by island residents?

2. *Exposures to Releases from Military Training Exercises Using "Live" Bombs*

- a) *Averaging Periods:* The ATSDR has averaged pollution levels over two periods, one year and 24 hours. This may be relevant for chronic respiratory disease prevalence, however it neglects the potential for short term bursts of pollution to exacerbate existing respiratory problems such as asthma, allergies, and chronic bronchitis. Averaging pollution over 24 hours could make short term high intensity releases caused by explosions disappear. However, these episodes may be quite relevant to estimating respiratory distress among the sensitive. This is especially problematic for young children who have immature and narrower airways than adults.
- b) *Particle Size:* As mentioned above, low diameter particles (less than 2.5 microns in size) were not measured. These fine and ultrafine particles stay suspended for longer periods of time, move longer distances, and may become more deeply embedded in the lungs of young children, or others with restricted airway diseases. These finer particles were not measured by ATSDR, the Navy, or EPA. These particles may also act as nuclei for other hazardous VOC's.

3. *Wind Blown Dust:* "ATSDR concludes that wind-blown dust from the LIA on days when bombing did not take place is not a health hazard." Wind blown dust near the LIA is likely to have contained fine diameter particles that are likely to have become airborne under dry and windy conditions. This could have led to range worker exposures to mixtures of chemicals released when weapons exploded and settled to the ground.
4. *Chaff:* "ATSDR can only conclude that the previous chaff usage at Vieques was not greater than 133 tons per year." ATSDR notes that no one has quantified the fate of chaff released above Vieques. Chaff is dropped from aircraft to confuse radar and disguise airborne military operations. "Chaff fibers typically are 25 microns (μm) thick and between 1 and 2 centimeters long". Chaff fibers are visible to the human eye and have the appearance of short, very fine, hair-like fibers. (Naval Research Laboratory 1999)."
 - a. Each year ATSDR estimates that 266,000 pounds of chaff may have been deliberately dropped over or near Vieques.
 - b. Ground level concentrations of chaff were never monitored by the Navy or other government authorities.

5. *African Dust Storms:*

- a) The Navy suggested that the source of metals and other contaminants on Vieques could have been Sub Saharan dust storms thousands of miles away.
- b) It is difficult to understand why this hypothesis generated more credibility with the Navy than a more plausible hypothesis, namely that airborne chemicals released to the atmosphere could move with prevailing winds to reach island villages, only 6-9 miles away.

Attachment 4: Critique of Vieques Soil Pathway Evaluation Public Health Assessment

1. *Failure to Collect and Manage Soil Contamination Data:* The Navy consistently failed to collect soil contamination data associated with training operations. The absence of these data prevented them and others from understanding when and where soil might pose a public health threat. This could occur from soil particles exploding into the atmosphere, drifting downwind in the atmosphere, eventually settling on plants, soils, and perhaps open cisterns.
2. *Grazing Animals and their Products:* The Navy, EPA, and ATSDR neglected research on grazing activities by cattle, goats, sheep, pigs and chickens. Their importance to the diet of Vieques population is poorly understood, but could potentially have been a significant additional pathway of exposure.

“Community members expressed concern over the possibility that livestock are accumulating heavy metals by grazing on contaminated plants. ...To date, ATSDR has not been able to obtain the original data or report that support these findings.”

3. *Plant Contamination:* “ATSDR could not quantify exposures from these reports nor draw any health conclusions about whether consuming plants grown in Vieques would result in harmful health effects.”

Why would ATSDR not test soil, edible plant tissues, and edible animal products for hazardous compounds released to the environment by Navy activities?