PUBLIC HEALTH ASSESSMENT

Air Pathway Evaluation

ISLA DE VIEQUES BOMBING RANGE

VIEQUES, PUERTO RICO

Prepared by:

Federal Facilities Assessment Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

I. SUMMARY

Isla de Vieques (Vieques) is an island in the Commonwealth of Puerto Rico and is located roughly 7 miles east of the main island of Puerto Rico. The United States Navy (Navy) currently owns about half of the land on Vieques and conducts military training exercises on the east side of the island. These exercises include various types of bombing and shelling, which take place at the Live Impact Area (LIA). The residential areas of Vieques are located more than 7.9 miles west of the center of the LIA.

In 1999, a resident of Vieques asked ATSDR to determine whether the Navy's operations on Vieques cause residents to be exposed to levels of environmental contaminants that could present a public health hazard. For the last 3 years, ATSDR has studied this issue extensively and is publishing its findings in a series of public health assessments (PHAs). This PHA addresses the public health implications of exposure to air contaminants potentially released from Navy property.

To characterize air quality at Vieques, ATSDR identified and obtained a wide range of relevant data. Specifically, ATSDR initiated an air sampling study during a recent military training exercise and reviewed relevant studies prepared by the following parties: the Puerto Rico Environmental Quality Board (PREQB), several academic and independent researchers from universities and private organizations in Puerto Rico, the U.S. Environmental Protection Agency (EPA), and the Navy and its contractors.

ATSDR's findings are summarized below. Later sections of this report describe how ATSDR reached these conclusions.

- *Do Navy activities at Vieques release contaminants to the air?* Yes. The Navy's military training exercises at Vieques release contaminants to the air, including dusts,

chemical by-products of explosions, and metals. Even when exercises are not occurring, winds blow the surface soil and their constituent elements, including metals, from the LIA into the air. However, just because air emissions are occurring does not mean that adverse health effects will result among the island's residents. Rather, the key questions for this PHA are what amounts of contaminants are released, where these contaminants go, and whether people come into contact with levels of contamination that could present a public health hazard. The following conclusions present ATSDR's findings on these questions.

- *On days when military training exercises **do not** occur, does wind-blown dust from the LIA pose a health hazard?* **Wind-blown dust from the LIA is not a health hazard on days without bombing exercises.**

- *Do contaminants released when the Navy uses "practice bombs" pose a health hazard?* **ATSDR concludes that the Navy's military training exercises with practice bombs do not pose a health hazard.**

ATSDR recognizes that the amount of emissions from military training exercises depends on many factors, including the numbers of bombs dropped, the types of bombs dropped, and meteorological conditions, all of which vary from one exercise to the next. As a result, it is possible that future military training exercises on Vieques, if of a different nature than those that have taken place this year or if conducted during substantially different meteorological conditions, might cause levels of air pollution to be different from what PREQB has recently measured. As a prudent public health measure, therefore, ATSDR recommends that PREQB continue its air sampling efforts in the residential areas of Vieques to characterize potential exposures.

- *Did contaminants released when the Navy used "live bombs" pose a health hazard?* No, based on the results of ATSDR's modeling analysis. Military training exercises using "live bombs" (or explosive ordnance) released many contaminants into the air, including particulate matter, chemical by-products of explosions, metals, and explosives. Because the few air samples that were collected on Vieques when the Navy used live bombs are poorly documented, no reliable measurements of past levels of air contamination are available.

ATSDR's modeling considered nearly 100 different contaminants believed to be released to the air during live bombing exercises and simulated how these contaminants move through the air. The modeling analysis predicted that chemicals emitted from bombing exercises disperse to extremely low levels over the 7.9 miles that separate the emissions source (the LIA) and the receptor (the residential area of Vieques). For a majority of the contaminants released, the estimated concentrations in the residential areas are so low that even highly sensitive air sampling devices would likely not be able to measure them. In the case of particulate matter, for example, emissions from live bombing exercises were predicted to account for less than 1% of the concentrations of particulate matter that were recently measured in the residential areas of Vieques. This comparison suggests that emissions sources located in the residential area of Vieques—and not emissions from the past live bombing exercises—accounted for nearly all of the particulate matter that residents breathed in the past.

In summary, whether considering acute or chronic exposure scenarios, ATSDR's modeling estimates indicate that **emissions from live bombing activities did not cause ambient air concentrations of explosion byproducts, including metals released from soil, to reach levels known to be associated with adverse health effects. ATSDR concludes, therefore, that chemicals released to the air during the past live bombing exercises did not pose a health hazard.**

ATSDR acknowledges that this finding is based entirely on a modeling analysis, which has inherent uncertainties and limitations. However, as Section V.C describes, ATSDR has reason to believe that the modeling analysis has not understated exposures and public health implications. Of particular note, the approaches ATSDR used to estimate emissions of contaminants are based on, and consistent with, EPA modeling guidance and several assumptions ATSDR made likely overstate the actual emissions. These observations, combined with the fact that estimated ambient air concentrations for most contaminants considered were several orders of magnitude lower than concentrations of health concern, lead ATSDR to believe that the modeling analysis presents a reasonable account of exposures that occurred on Vieques and does not understate the exposures that residents might have experienced.

- *Do chemicals released to the air during open burning or open detonation operations pose a public health hazard?* Over the years, the Navy has conducted open burning and open detonation on Vieques to treat two types of waste: unused munitions (munitions that were never used in a military training exercise) and unexploded ordnance (munitions that were used in an exercise, but did not detonate). Based on waste management statistics obtained from both the Navy and EPA, ATSDR estimated levels of air pollution that open burning and open detonation operations would likely cause in the residential areas of Vieques. These estimated exposure concentrations were lower than levels known to be associated with adverse health effects. Therefore, **chemicals released to the air during open burning and open detonation operations on Vieques do not pose a public health hazard.**

- *Did the Navy's past use of depleted uranium pose a health hazard?* No. To address concerns about past usage of depleted uranium on the LIA, ATSDR examined several hypothetical exposure scenarios to estimate the amount of depleted uranium that residents of Vieques might contact. **Even the maximum estimated exposure to depleted**

uranium that a Vieques resident might realistically experience is considerably lower than levels known to cause adverse health effects. The very low levels of radiation released by depleted uranium at the LIA do not present health hazards. ATSDR's conclusion is consistent with findings published by the U.S. Nuclear Regulatory Commission, which collected 114 environmental samples at Vieques and found no evidence of widespread depleted uranium on the island.

- *Does the Navy's use of chaff pose a health hazard?* No. During military training exercises, the Navy has released chaff, which is aluminum coated glass fibers. Chaff is released thousands of feet in the air in order to simulate actual battlefield scenarios. Because chaff is released at such high altitudes, and never directly over the island of Vieques, only a very small fraction of the fibers used are believed to deposit in areas where people live. To date, no air samples at Vieques have shown levels of particulate matter a levels that could present a public health hazard from chaff in the air. Moreover, ATSDR investigated realistic exposure scenarios and the predicted concentrations of chaff components (e.g., aluminum) were below levels of health concern. **Therefore, the Navy's past and current use of chaff at Vieques have not led to exposures that could present a public health hazard.** Because the Navy may use chaff in the future, ATSDR recommends that additional air sampling be conducted at Vieques to evaluate further the potential air quality impacts of chaff.