

July 14, 2021

Re: Response to questions from Natural Resources Committee

Dear Chairman Grijalva, Ranking Member Westerman, and Members of the Committee:

Thank you for the opportunity to address the Committee during the Hearing on the Vieques Recovery and Redevelopment Act of 2021. I am pleased to provide responses to the questions submitted by Committee Members below and remain at your disposal should any Committee Members request additional detail. Below are the questions (in italics) followed by my response (in bold).

- 1. Generally, how do groundwater contaminants of concern, such as benzene, MTBE, or 1,2-DCA, move in water tables?*

In general, contaminants such as those listed above move with the flow of the groundwater, but that movement is slowed by the solubility of the compounds and their retention by soil in the aquifer. The result of this is that, in general, these types of contaminants do not simply flush out of the groundwater as quickly as water moves through it. Rather, they persist for long periods of time, causing long-term impact to groundwater and requiring active treatment or alternative water sources to ensure public health and safety. In addition, wells that pump water will actively draw those contaminants in, as water supply wells influence the direction and speed of groundwater flow.

- 2. In an island as small as Vieques, can distance be counted upon to mitigate exposures in the long term?*

In general, distance is not closely related to exposure. If contamination is in groundwater, it is the flow of groundwater and the distribution and use of groundwater that will determine exposure. On Vieques, there are many complex mechanisms of exposure. For exposure through the marine food chain, distance by itself is almost meaningless. What matters is the process by which contaminants are taken up and magnified through the food chain, and the species that are being consumed by people. To make these types of determinations, research is needed to characterize and quantify these processes so exposure mitigation can be achieved.

3. *Please describe the best available technologies for Vieques to mitigate health consequences caused by groundwater that exceeds the maximum contamination limits established by EPA.*

There is likely not one best available technology for the suite of contaminants that are present in Vieques groundwater. There is not sufficient information that I am aware of that would provide confidence in describing a best available technology. It is likely that certain technologies, such as reverse osmosis, could be expected to adequately protect public health. More research is needed to understand what suite of contaminants is present in potable water supplies and from there, determinations can be made as to what technologies would most cost-effectively protect human health.

4. If it is within your area of expertise, please describe how persulfate mitigates the health risk of groundwater contamination and lowers observable contamination levels, and how long persulfate is expected to be protective of human health for groundwater contamination.

Persulfate is one example of a class of compounds that can be used to achieve In-Situ Chemical Oxidation (ISCO). ISCO is a process that can degrade organic chemicals in the ground and eliminate the source of groundwater contamination. As described in response to question 1, consider a concentrated volume of chemical sitting in or above the groundwater. That chemical will slowly contaminate water over decades or millenia. ISCO is designed to act to eliminate the concentrated volume of chemical and to eliminate the source of groundwater contamination. ISCO is one available technology to address such contamination, but it is not the only approach that may be effective. A detailed and thorough evaluation of the contamination and technological approaches would need to be conducted to determine the most efficacious approach to mitigation and remediation.

5. As residential use and commercial activity keeps expanding to formerly rural areas of Vieques in the former Navy lands, what would be the best strategies for reducing or preventing chemical exposure from contamination of groundwater sources? Would this involve ensuring a central supply of treated and tested water for human consumption, as opposed to reliance on individual wells?

It is important to fully characterize the extent of contamination and the mechanisms through which exposure occurs. There appears to be significant exposure through

the aquatic and terrestrial food chains in addition to exposure through groundwater sources. That being said, yes, it would make sense to evaluate centralized water treatment and provision. However, the cost-effectiveness of this approach may also vary by geographic region on the island. This is once again a critical area for research to inform land use planning.

I remain available to the Committee to provide greater detail or answer additional questions.

Sincerely,

A handwritten signature in black ink that reads "Kevin H. Gardner". The signature is written in a cursive style with a large initial 'K'.

Kevin H. Gardner, PhD
Executive Vice President for Research and Innovation
Professor, Civil and Environmental Engineering

