WRITTEN TESTIMONY OF DR. KEVIN GARDENER, EXECUTIVE VICE PRESIDENT FOR RESEARCH AND INNOVATION, PROFESSOR OF CIVIL AND ENVIRONMENTAL ENGINEERING AT THE UNIVERSITY OF LOUISVILLE

HEARING ON THE VIEQUES RECOVERY AND REDEVELOPMENT ACT OF 2021
BEFORE THE COMMITTEE ON NATURAL RESOURCES
U.S. HOUSE OF REPRESENTATIVES

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Chairman Grijalva, Ranking Member Westerman, and Members of the Committee, thank you for the opportunity to testify today on innovative remediation strategies that could significantly improve the lives of the residents of Vieques, as well as the environment of the island, as the Committee considers the Vieques Recovery and Redevelopment Act of 2021.

My name is Kevin Gardner and I am the Executive Vice President for Research and Innovation and a Professor of Civil and Environmental Engineering at the University of Louisville (UofL). I am a registered Professional Environmental Engineer and received a Ph.D. in Civil and Environmental Engineering in 1996. Over my research career I have published over 60 manuscripts and received research funding in excess of $60 million from the National Science Foundation (NSF), Environmental Protection Agency (EPA), the Strategic Environmental Research and Development Program (the Department of Defense's (DOD) environmental science and technology program), and the Environmental Security Technology Certification Program (ESTCD), DOD's environmental technology demonstration and validation program, among other agencies. My work has focused on understanding how contaminants become available to be released to the natural environment, and from there how they can lead to human exposure. This includes how they move into complex aquatic food chains, and importantly, my work has focused on approaches and technologies that can interrupt the pathways that ultimately lead to human exposure.

The history of environmental contamination on the Island and environs of Vieques is sobering. The complex mixture of different types of contaminants, the complex environment of the island, and the multiple exposure pathways make any simple assessment impossible. The US Navy reported it had dropped between 3 and 4 million pounds of ordinance on Vieques each year from 1983-1998. Studies have found very high levels of many munitions-related contaminants in humans, livestock, crops, marine seafood, marine plants and algae. It is clear that the contamination on Vieques is significant and that the association between contamination expected from ordinance, contamination found in humans, and contamination found in many of the pathways that would translate contaminants from the environment into humans is also present.

To reduce contamination level in humans, it is critical to evaluate and understand the pathways by which humans are exposed to contaminants through ingestion, inhalation, or dermal contact. Understanding and quantifying the significant pathways provides opportunity to interrupt that pathway and thereby reduce human exposure. On the island of Vieques, with the severity of contamination and the significant disease burden, I would first and foremost recommend that any remedial efforts are directed at ways to reduce human exposure (as contrasted with notions about restoring the island to its natural condition). Focusing on reducing exposures is the most efficacious approach to lessening the disease burden and minimizing the significant health inequities present in the people of Vieques.

The likely significant pathways on Vieques include ingestion of fish and seafood, ingestion of crops grown in soils that have been contaminated, ingestion of meat and dairy grown on pasture lands and fed locally grown crops, ingestion and/or contact with contaminated water, and inhalation of dust. My own research and that of many other researchers over past decades have developed approaches to reduce exposures, including remediation alternatives that can be deployed remotely in areas where significant unexploded ordinance are present. This process necessarily starts with research that quantifies the most significant exposure pathways, which can lead to identifying the most cost-effective and expedient approaches to cut off or significantly reduce continued exposure. For example, there has been (only) one technology demonstration through ESTCP0 program at the Vieques site where underwater munitions are present (Rosen, ESTCP project ER-201433). The project team validated the ability of a technique that measures bioavailable concentrations of organic munitions constitutions (e.g. TNT and RDX), which is a critical need to enable quantification of an exposure pathway. While there may be pounds of chemical constituent present in munitions remnants, those are not the masses or concentrations relevant for biouptake and transfer up the aquatic food chain to humans.

Remediation specifically targeted at reducing human exposure requires techniques to measure relevant concentrations, as noted, and technologies to target cutting off exposure pathways. In the case of bioconcentration of a chemical up a food chain, this means targeting the bioavailable concentrations that result in uptake into the food chain. This may be bioavailable concentrations in a sediment porewater which ultimately ends up in a seafood (such as crab or fin fish) or bioavailable concentrations in the rhizosphere that gets taken up in a crop that is consumed by humans or livestock. Remedial approaches have been developed in recent years to target reducing bioavailable concentrations and these types of innovative methods are precisely what need to be applied, adapted, and further developed to the grossly contaminated island of Vieques. Through research and development, innovative solutions targeted at reducing exposure can be developed, tested, and implemented that can address the environmental exposures and on-going health inequities faced by the people of Vieques.

I applaud the Committee for its leadership in prioritizing the clean-up of the island of Vieques and for seeking to restore the health and safety of Vieques and its people. There are a lot of unanswered questions about specifically how chemicals are moving from the environment to humans. Without a complete picture of the decontamination on the island, we will never be able to understand the exposure to dangerous chemicals. I would encourage the expeditious

assessment of environmental conditions on Vieques as the status quo continues to cause an unmistakable danger to the public's health.