

DAVID Y. IGE  
GOVERNOR OF HAWAII



**STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES**

POST OFFICE BOX 621  
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**Testimony of  
SUZANNE D. CASE  
Chairperson**

**Before the House Committee on  
WATER & LAND**

**Tuesday, March 23, 2021  
8:30 AM**

**State Capitol, Via Videoconference, Conference Room 430**

**In consideration of  
HOUSE CONCURRENT RESOLUTION 159/HOUSE RESOLUTION 135  
STRONGLY URGING THE DEPARTMENT OF LAND AND NATURAL RESOURCES  
TO WORK WITH THE INTERNATIONAL DIALOGUE ON UNDERWATER  
MUNITIONS' INTERNATIONAL SCIENTIFIC AND TECHNOLOGY ADVISORY  
BOARD ON UNDERWATER MUNITIONS TO SEEK AND SECURE FEDERAL  
FUNDING FOR THE NON-DESTRUCTIVE DISPOSAL OF THOUSANDS OF TONS  
OF UNDERWATER MUNITIONS DUMPED, LOST, OR ABANDONED IN HAWAIIAN  
WATERS.**

House Concurrent Resolution 159/House Resolution 135 strongly urges the Department of Land and Natural Resources (Department) to work with the International Dialogue on Underwater Munitions' International Scientific and Technology Advisory Board on Underwater Munitions to seek and secure federal funding for the non-destructive disposal of thousands of tons of underwater munitions dumped, lost, or abandoned in Hawaiian waters. **The Department supports these measures and offers the following comments.**

Hawaii is facing major threats to our marine resources while climate change takes hold. Hawaii has experienced repeated coral bleaching events recently, resulting in significant coral loss throughout the State. Therefore, there is an increasing need to better mitigate the threats of underwater munitions in Hawaii. When underwater munitions are reported, the State of Hawaii is faced with the decision to choose between potential harm to human health and safety if the munitions are left in place, and clear harm to marine species, including protected species such as whales and corals, if munitions are detonated for removal. In addition, the U.S. Military offers no environmental consultation or mitigative options to remove or secure underwater munitions.

**SUZANNE D. CASE**  
CHAIRPERSON  
BOARD OF LAND AND NATURAL RESOURCES  
COMMISSION ON WATER RESOURCE MANAGEMENT

**ROBERT K. MASUDA**  
FIRST DEPUTY

**M. KALEO MANUEL**  
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES  
BOATING AND OCEAN RECREATION  
BUREAU OF CONVEYANCES  
COMMISSION ON WATER RESOURCE MANAGEMENT  
CONSERVATION AND COASTAL LANDS  
CONSERVATION AND RESOURCES ENFORCEMENT  
ENGINEERING  
FORESTRY AND WILDLIFE  
HISTORIC PRESERVATION  
KAHOOLAWE ISLAND RESERVE COMMISSION  
LAND  
STATE PARKS

The issue is larger than a single agency can address, and there is a great need for collaborative expertise, technology, and funding to adequately address this important issue. Working with the International Dialogue on Underwater Munitions' International Scientific and Technology Advisory Board on Underwater Munitions and other experts to develop techniques and secure funding for more environmentally sensitive options for disposing or securing underwater munitions will benefit the people of Hawaii and our sensitive marine ecosystems.

Thank you for the opportunity to comment on these measures.

**HCR-159**

Submitted on: 3/21/2021 3:04:41 PM

Testimony for WAL on 3/23/2021 8:30:00 AM

<b>Submitted By</b>	<b>Organization</b>	<b>Testifier Position</b>	<b>Present at Hearing</b>
laurel brier	Kauai women's caucus	Support	No

Comments:

Time to clean up the toxic mess left by the military in our waters

## Testimony Before the House Committee on Water and Land (WAL)

Chair: David A. Tarnas  
Vice-Chair: Patrick Pihana Branco

### Resolution Number HR135 and HCR159 Tuesday-23-March-2021

Chair Tarnas, Vice-Chair Branco, and respected Committee Members

I am Dr. James W. Porter, Professor of Ecology & Marine Sciences at the University of Georgia. I am also a member of the International Science & Technology Advisory Board (ISTAB) of the International Dialogue on Underwater Munitions (IDUM). I am pleased to submit both written and oral testimony in favor of Resolutions HR135 and HCR159.

I have studied coral reefs for more than 50 years. I am an expert on the effects of underwater munitions on coral reefs.

Underwater munitions are point-source emitters of a host of highly toxic compounds which poison coral reefs and the people who use them. To give you a very brief overview, I attach Abstracts for two papers that describe these poisons and the effects they have on reef organisms and the health of fishing communities that depend on them.

I also attach President Barack Obama's letter to the people of Vieques, Puerto Rico regarding his commitment "to achieve an environmentally acceptable clean-up" of former munitions sites on the land and coral reefs of Vieques, Puerto Rico.

As you may be aware, coral reefs are found within the territorial boundaries of 94 sovereign nations. World-wide coral reefs generate more than \$9.9 trillion per year (the gross domestic product of Switzerland) and more than \$835 million per year in Hawai'i alone. Across the planet, coral reefs provide protein and income for more than 500 million people. In Hawai'i they create more than 8,000 full-time jobs. In the last two years, coral reefs have been the source of drugs that can cure prostate cancer (Bryostatins – from coral reef bryozoa) and breast cancer (Prostaglandin – from coral reef sea fans). In addition, two more coral reef drugs are under development that reduce the rate of heart attack in elderly Americans and kill the H.I.V.-A.I.D.S. virus more effectively than AZT.

Hawaiian coral reefs add immeasurably to the natural and cultural wealth of the world and the State. Hawai'i's coral reefs also provide shoreline protection against coastal zone damage from tsunamis and cyclones. They generate the sand for Hawai'i's world-famous tourist beaches.

Coral reefs are unique among all marine ecosystems because of their [1] high topographical complexity (like the trees in a forest, corals build the extraordinary three-dimensionality of this habitat), [2] high biodiversity (25% of all marine plants and animal species are found there), and [3] high productivity (2,000 dry grams C/m<sup>2</sup>/yr.). All three of these hallmark characteristics are diminished by toxins from decaying underwater munitions (Porter *et al.*, 2011 – see submitted Research Abstract 1).

Military activities on coral reefs have three main effects, in line with all three of the characteristics mentioned above: by severely reducing topographical complexity [Item 1 above], they secondarily also reduce the local biodiversity [Item 2 above] which is dependent on this topographical complexity. Most high-explosives are made with nitrogen compounds (e.g., TNT). Therefore, in addition to introducing toxins, explosives also release nutrients into these otherwise low-nutrient environments [Item 3 above]. In the marine environment generally, but especially on coral reefs, nitrogen is the limiting nutrient. Therefore small increases in nutrient concentrations reduce coral cover and increase algal abundance.

In recent decades coral reefs world-wide have been decimated by coral bleaching. Hawai'i has not been spared from this scourge either.

While most bleaching can be attributed to rising temperatures, a growing body of evidence identifies elevated nitrogen as another *causative* agent of bleaching

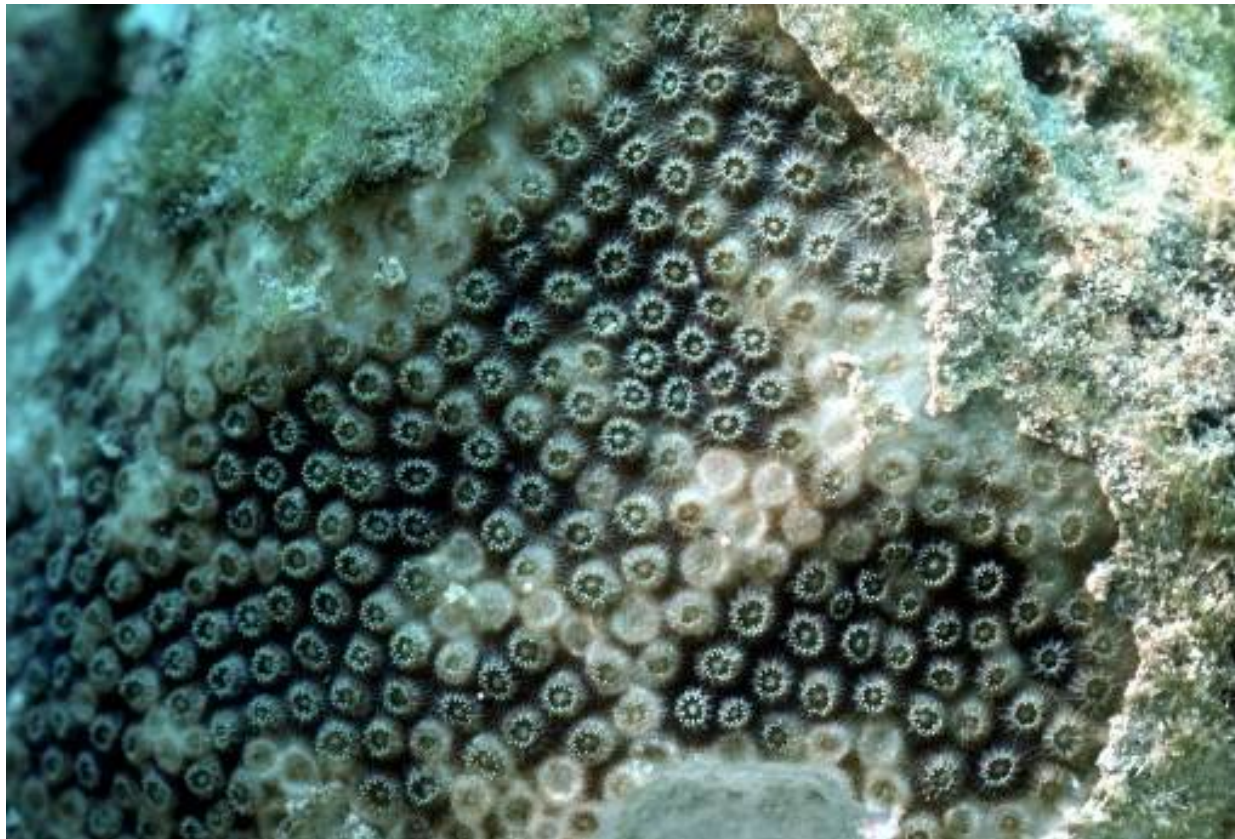


Figure 1. Bleached coral from Vieques Puerto Rico. All corals in physical contact with leaching ordnance (UWUXO) were bleached, whereas no coral without physical contact with live ordnance exhibited bleaching.

On Vieques in Puerto Rico, every coral in physical contact with corroding ordnance exhibited **BOTH** elevated tissue-nitrogen levels (up to 800 ppm of TNT) **AND** coral bleaching (Figure 1). Nitrogenous compounds in the coral tissue had the same chemical composition as the TNT leaching from the adjacent ordnance.

On Vieques, Puerto Rico, our research group tested sea water, marine sediment, and biotic samples from nearshore localities (some less than 100' from public beaches). This investigation revealed that every animal tested on the seaward reef of Vieques near unexploded ordnance (UWUXO) contained at least one carcinogenic compound leaching from these submerged bombs, bullets, and artillery shells (Figure 2). For instance, we found the following carcinogens: (1) 1,3,5-Trinitrobenzene; (2) 1,3-Dinitrobenzene; (3) 2,4-Dinitrotoluene + 2,6-Dinitrotoluene; (4) 1,3-Dinitrobenzene; (5) 4-Nitrotoluene; (6) 2,4,6-Trinitrotoluene; (7) 2-Nitrotoluene; and (8) Hexahydro-1,3,5-Trinitrotriazine leaking from UWUXO. Some of these leached compounds were in very high concentrations near the UWUXO, greatly exceeding EPA's Risk-Based-Level for Cancer. Our data show, unequivocally, that toxic substances leaching from UWUXO enter the marine food web and are passed up the food chain.



**Figure 2** Leachate from UWUXO on Vieques, Puerto Rico resembled TNT compounds found in bleached coral physically adjacent to this ordnance.

Although little is known about the disease-causing potential of toxic materials leaching from UWUXO, anecdotal observations on Vieques, Puerto Rico identified high rates of disease among sea fans living within a meter of UWUXO, but no disease among sea fans living more than a meter away (Figures 3a & b). The “Black Spot Disease” visible on sea fans growing near ordnance is known to be stimulated by elevated nitrogen concentrations, further suggesting that nitrogen-derived compounds from UWUXO can contribute to reduced coral reef health.

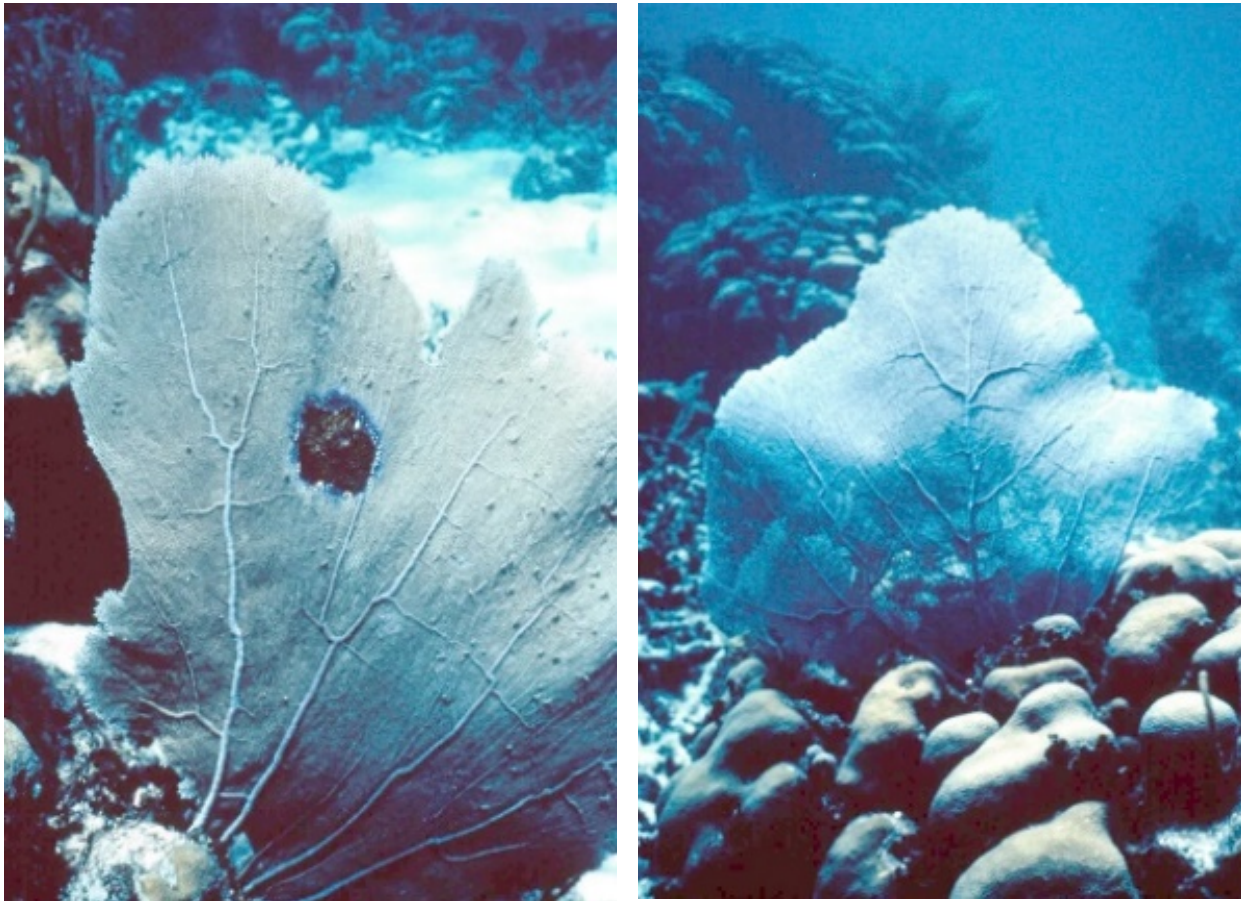


Figure 3a & b. Diseased (left) and healthy (right) sea fans (*Gorgonia ventalina*) from Vieques Puerto Rico from within close proximity (< 1m) to UWUXO (left) and from outside (> 1m) this area, respectively.

Health data for long-term residents of Vieques show significantly elevated levels of cancer and several other types of chronic illnesses (hypertension, asthma, and cirrhosis of the liver) (See submitted Research Abstract 2). The types of cancers and the timing of their appearance are all consistent with a causal relationship between the carcinogenic compounds released on the island during military exercises and the expressions of cancer among the island's residents.

I urge you to pass Resolutions HR135 & HCR159. I urge you to partner with IDUM to rid Hawaiian coral reefs of underwater munitions. I urge you to take these actions to help restore and preserve Hawai'i's precious coral reefs.

Respectfully submitted,

James W. Porter, Ph.D.

# Supporting Material For the Testimony of Dr. James W. Porter

Before the House Committee on Water and Land (WAL)

Chair: David A. Tarnas  
Vice-Chair: Patrick Pihana Branco

Resolution Number HR135 and HCR159  
Tuesday-23-March-2021

## Supporting Material Item 1 Abstract of:

Porter, J.W., J.V. Barton, C. Torres. 2011. Ecological, radiological, and toxicological effects of naval bombardment on the coral reefs of Isla de Vieques, Puerto Rico. In: G.E. Machlis *et al.* (eds.), *Warfare Ecology: A New Synthesis for Peace and Security*, 65 NATO Science for Peace and Security Series C: Environmental Security. Springer Science+Business Media, Holland. DOI 10.1007/978-94-007-1214-0\_8

## Supporting Material Item 2 Abstract of:

Sanderson, H., P. Fauser, R.S. Stauber, J. Christensen, P. Løfstrøm, and T. Becker. 2017. Civilian exposure to munitions-specific carcinogens and resulting cancer risks for civilians on the Puerto Rican island of Vieques following military exercises from 1947 to 1998. *Global Security: Health, Science and Policy* 2:1, 40-61, DOI: 10.1080/23779497.2017.1369358 (<https://doi.org/10.1080/23779497.2017.1369358>)

## Supporting Material Item 3 Letter:

Obama, B. 2008. Letter to Mr. Acevedo Vila, Governor of Puerto Rico.



# Ecological, Radiological, and Toxicological Effects of Naval Bombardment on the Coral Reefs of Isla de Vieques, Puerto Rico

James W. Porter, James V. Barton, and Cecilia Torres

**Abstract** Between 1943 and 2003, land and sea areas on the eastern end of Isla de Vieques, Puerto Rico were used as a naval gunnery and bombing range. Viequean coral reefs are littered with leaking and unexploded ordnance (UXO). Radiological, biological, and chemical surveys were conducted to assay the health of these coral reefs.

Biotic surveys revealed a statistically significant inverse correlation between the density of military ordnance and several measures of coral reef health, including (a) the number of coral species ( $p=0.007$ ), (b) the number of coral colonies ( $p=0.02$ ), and (c) coral species diversity ( $H'$ ) ( $p=0.0005$ ). Reefs with the highest concentrations of bombs and bomb fragments have the lowest health indices.

Water, sediment, and biotic samples revealed that: (a) every animal tested on the seaward reef of Vieques near unexploded ordnance contained at least one potentially toxic compound leaking from *in situ* ordnance [1,3,5-Trinitrobenzene; 1,3-Dinitrobenzene; 2,4,6-Trinitrotoluene; 2,4-Dinitrotoluene + 2,6-Dinitrotoluene; 4-Nitrotoluene; 2-Nitrotoluene; Hexahydro-1,3,5-Trinitro-1,3,5-Triazine]; (b) concentrations of these substances in fish and lobster tested do not exceed EPA's Risk Based Concentrations for commercially edible seafood, but (c) concentrations of these substances in several of the non-commercial species tested (e.g. feather duster worms, corals, and sea urchins) greatly exceed these concentrations. For chromium in sediments, and for TNT in both water and sediment, there is an exponential decline with increasing distance from unexploded ordnance. An organism's mobility and proximity to UXO determine its body burden of toxic compounds: (1) the

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closer an organism is to a leaking bomb, the higher its body burden will be, and (2) the less mobile (and therefore more sessile) an organism is, the higher the concentration of toxic substances will be.

Our data show unequivocally that toxic substances leaching from UXO have entered the coral reef marine food web. Since the concentration of explosive compounds is highest near unexploded ordnance, we recommend that surface UXO on the Vieques coral reef be picked up and removed. We assert that this action will have an immediate and beneficial effect on the coral reef ecosystem by removing these point sources of pollution from the environment. Existing technology can perform this required action easily.

**Keywords** Coral reefs • Ecotoxicology • Carcinogens • Explosive compounds • Underwater ordnance • UXO • Puerto Rico • Vieques

## Introduction

Both the preparation for and conduct of war are environmentally destructive. While the financial and human costs of war are readily acknowledged, the environmental costs of war are rarely recognized, let alone quantified. Machlis and Hanson [50] point out that in the past two decades there have been 122 armed conflicts and that 85% of the 192 sovereign nations on earth maintain standing armies [38, 50, 51]. Further, the preparation for war consumes 6% of raw materials and produces as much as 10% of global carbon emissions annually [17, 18, 50, 51]. Bidlack [17] estimates that military installations and bombing ranges cover 15 million km<sup>2</sup> of the earth's surface.

Isla de Vieques, Puerto Rico is one of these places. Vieques is situated off the eastern end of Puerto Rico and lies within the 100 m depth contour of the Puerto Rican rise. Vieques is substantially larger than St. Thomas and only slightly smaller than St. Croix, US Virgin Islands. The island is partitioned into three sectors (Fig. 1 [top]): the Eastern Naval Area, on the eastern end of the island (Fig. 1 [bottom]), the Naval Ammunition Facility on the western end, and the Civilian Area in the middle. With almost two-thirds of the island designated as restricted areas, the island is unique in the Caribbean in having almost 100 miles of uninhabited coastline. Vieques has been used for naval training exercises since 1941. Beginning in 1999, formal requests were made by the Puerto Rican government to the US Navy to cease military operations on Vieques [11]; naval exercises ceased entirely in May, 2003 [15].

### *Air-Dropped Bombs and Artillery Shells*

The amount of bombs and other explosives dropped and detonated on the eastern end of Vieques is staggering (Table 1). US Navy Vice Admiral Hohn Shanahan



**Fig. 4** (*Upper left*) Underwater unexploded ordnance (UWUXO) in high concentrations litters the seafloor in many areas around the world. Photograph shows a 2,000 lb General Purpose air-dropped bomb located at Site 3 (Fig. 1 [bottom]) just south of Roca Alcatraz within the US Naval bombing range, Isla de Vieques, P.R. This ordnance had several corrosion holes located in its mid-section exposing the contents of the bomb to the surrounding seawater. (Photograph by Dr. James W. Porter) (*Upper right*) Bomb craters pock mark coral reefs on the seaward side of Bahia Salina del Sur, Isla de Vieques, P.R. All craters investigated in the magnetometer survey were perfectly symmetrical holes, approximately 14 m in diameter and 1.5 m deep, such as this typical crater 50 m south of Roca Alcatraz (18° 07' 21.60" N; 065° 18' 03.50" W). (Photograph by Dr. James W. Porter) (*Lower left*) High explosives from within the cavities of a corroding bomb on the Vieques coral reef spill and leach out onto the surrounding reef. The granular material from these unexploded munitions was analyzed for TNT, Semtex, C-4, and other high explosive compounds. (Photograph by Dr. James W. Porter) (*Lower right*) Diseased colony of the mountainous star coral (*Montastraea faveolata*) in physical contact with a leaking bomb. Samples of this colony detected the presence of exceptionally high concentrations of explosive compounds. (Photograph by Dr. James W. Porter)

rocket fin assemblies, machine-gun bullets, and unexploded battleship artillery rounds. Later studies attempted to quantify the impact as a function of distance from the epicenter of military activity [66, 67]. Local [24, 32, 39, 45] and region-wide comparisons followed [72].



## Civilian exposure to munitions-specific carcinogens and resulting cancer risks for civilians on the Puerto Rican island of Vieques following military exercises from 1947 to 1998

Hans Sanderson, Patrik Fauser, Ricky Steven Stauber, Jesper Christensen, Per Løfstrøm & Thomas Becker

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## Civilian exposure to munitions-specific carcinogens and resulting cancer risks for civilians on the Puerto Rican island of Vieques following military exercises from 1947 to 1998

Hans Sanderson<sup>a</sup> , Patrik Fauser<sup>a</sup>, Ricky Steven Stauber<sup>b</sup>, Jesper Christensen<sup>a</sup> , Per Løfstrøm<sup>a</sup> and Thomas Becker<sup>a</sup>

<sup>a</sup>Department of Environmental Science, Aarhus University, Roskilde, Denmark; <sup>b</sup>Independent Consultant, Waldorf, MD, USA

### ABSTRACT

Estimation of legacy public health risks from munitions residues near or at former military test ranges has for the past decades been a challenge to health authorities. Parts of the island of Vieques (PR) were for six decades used for military training, and these are now declared as a Superfund site. ATSDR has conducted site assessments there and found no cause for public health concerns. The reports and findings of ATSDR have since been heavily contested and disputed. This paper provides a case study on cancer risk screening of munitions-specific carcinogens for the full period of military training on Vieques. Added cancer risks and Margins of Exposure for the different carcinogens for each year were derived. We found that there is a potential for cancer risk concern related to BaP exposures. Furthermore, there were health risks from TNT exposures. The primary exposure route of these compounds was oral. The period 1992–1997 showed a significantly elevated lung and bronchus cancer incidence rate in Vieques compared to Puerto Rico mainland mainly among women <50 yr and men 50–64 yr. These correlate with high munitions exposures in the period 1977–1984.

### ARTICLE HISTORY

Received 4 January 2017  
Accepted 14 August 2017

### KEYWORDS


Munitions; Vieques; cancer; munitions residues; military training area

### Introduction

Estimating the human health risks from historical and legacy distributed munitions residues from military test ranges has for the past decades been a challenge to authorities (Phillips & Perry, 2002). This is because there generally is little information available regarding estimating the public health risks of military-unique releases to humans via environmental pathways from past activities (Phillips & Perry, 2002). The aim of this paper is therefore to provide an example of how a risk assessment can be developed to help prioritise further empirical risk research with an emphasis on cancer risks. We chose the Puerto Rican island of Vieques, which has been used as a military test area for more than six decades by the U.S. military. The Navy engaged two-thirds of the island's 9000 acres where military exercises tested live ammunition. Testing was open on average 180 days per year (AJPH, 2001). Meanwhile, between 9000 and 14000, inhabitants lived eight miles away from the ranges during the period. The first large-scale war games took place in 1948 involving more than 60 war ships, 350 planes and 50,000 troops from all branches of the military. In the

early 1980s, an average of 3400 bombs were deployed, 158 days of naval bombardment, 200 days of air-to-ground combat exercises and 21 days of marines practising invasions per year on the island. Over 15 years from 1983 to 1998, the military deployed more than 17.7 million kg of munitions on Vieques (Davis, Hayes-Conroy, & Jones, 2007). In 2005, the United States Environmental Protection Agency (USEPA) listed the Vieques bombing range as a Superfund site (Davis et al., 2007). After the closure and the Superfund status, the US EPA commissioned an assessment of ecological and human health risks. The current conclusion regarding human health risks is that the exposure is not under control – meaning that; (1) contamination has been detected at a site at an unsafe level; and (2) a reasonable expectation exists that people may be exposed to the contamination (US EPA, 2016b). The remedial efforts have so far resulted in surface clearance of more than 10.25 km<sup>2</sup> cleared of munitions; over 38,000 munitions items have been removed and destroyed. Sub-surface clearance includes a total of 15.3 km of roads cleared (includes a 7.5 m buffer on either side) and 17 km of beaches cleared.

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 Supplemental data for this article can be accessed <https://doi.org/10.1080/23779497.2017.1369358>.

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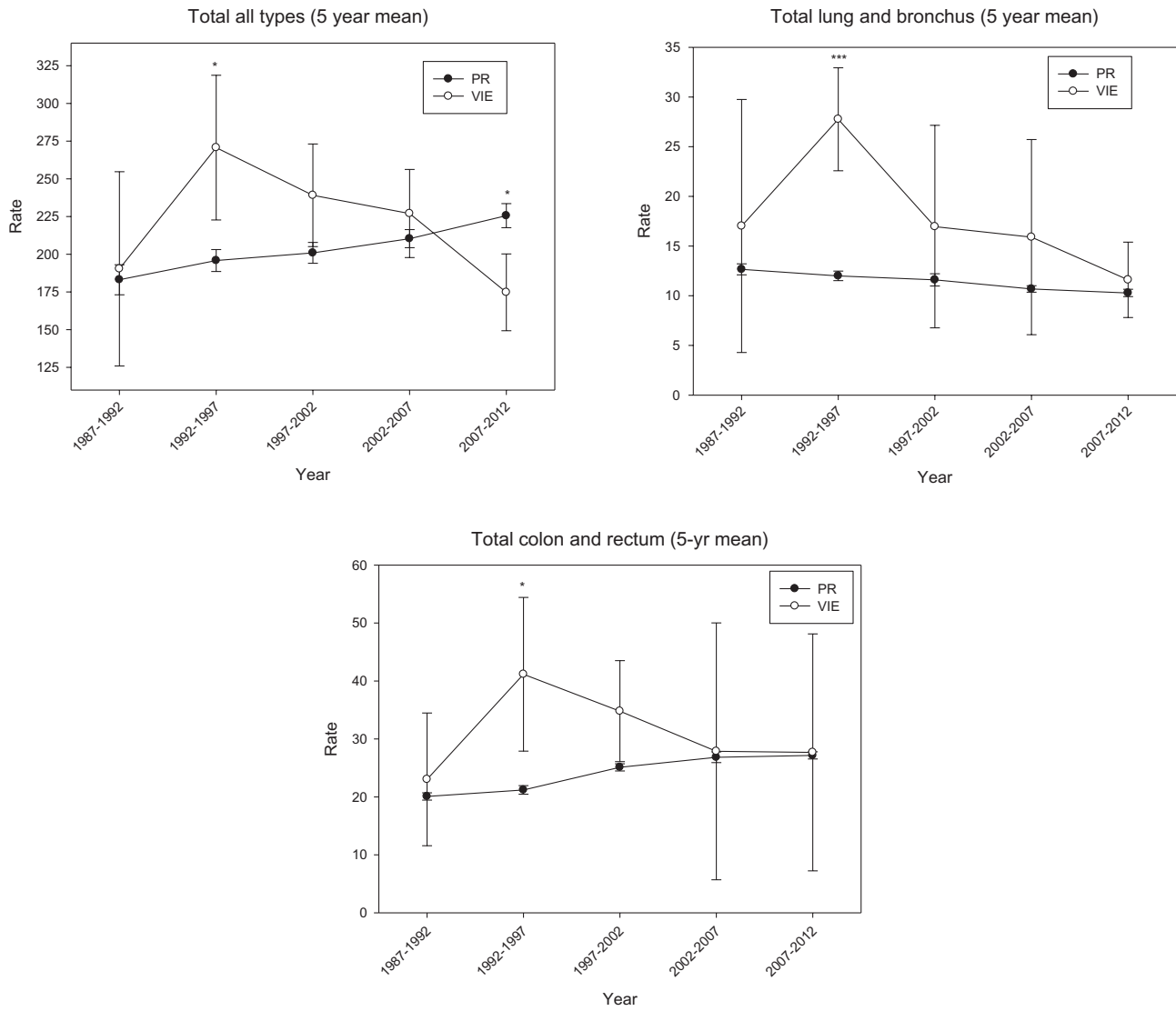


Figure 9 (a-c). Five-year mean cancer incidence rates for Puerto Rico (PR) and Vieques (VIE), 1987–2012. Note: \* =  $p < 0.05$ ; \*\*\* =  $p < 0.001$ .

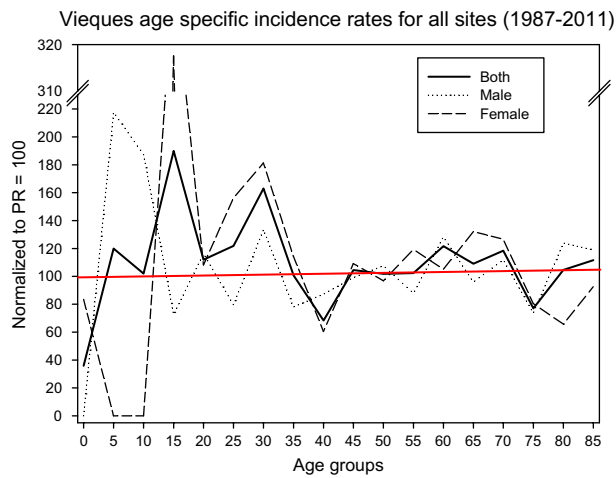


Figure 10. Relative overall cancer incidence rates for specific age groups per year normalised to Puerto Rico. Note: Red line = 100.

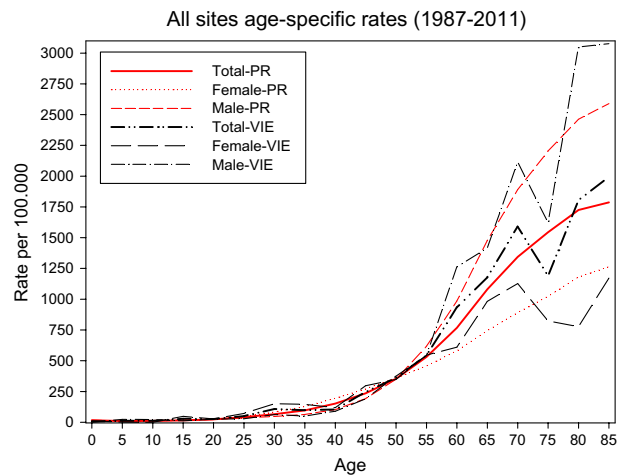


Figure 11. All site age-adjusted and age-specific absolute cancer rates for Puerto Rico and Vieques.

# Barack Obama

February 12, 2008

Honorable Anibal Acevedo Vila  
Governor  
Commonwealth of Puerto Rico  
La Fortaleza  
San Juan, Puerto Rico 00901

Dear Governor Acevedo Vila:

Puerto Rico is a vitally important part of our country and Puerto Ricans have made immeasurable contributions to the United States. As President of the United States, I will pay close attention to issues that have an impact on the well-being of the people of Puerto Rico.

Puerto Rico's status must be based on the principle of self-determination. Puerto Rico has a proud history, an extraordinary culture, its own traditions, customs and

In addition, I will work closely with the government of Puerto Rico and Congress to enhance the participation of Puerto Rico in Medicaid and all federal health care assistance programs. My Administration will actively work with the Department of Defense as well to achieve an environmentally acceptable clean-up of the former U.S. Navy lands in Vieques, Puerto Rico. We will closely monitor the health of the people of Vieques and promote appropriate remedies to health conditions caused by military activities conducted by the U.S. Navy on Vieques. I will also work to evaluate and expand the existing land use plan for the former U.S. Navy lands to prioritize improving the lives of the Island's residents and the sustainable economic development of the people of Vieques.

Sincerely,



Barack Obama



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Paid for by Obama for America

**Testimony Before the House Committee on Water and Land**  
**Chair: David A. Tarnas**  
**Vice-Chair: Patrick Pihana Branco**

**Resolution Number HR135 and HCR159**

Aloha Chair Tarnas, Vice-Chair Branco, and Members of the Committee,

My name is Mr. Terrance P. Long CPSM. SSM. CD., and I am submitting written testimony on behalf of the International Dialogue on Underwater Munitions (IDUM) **in the strongest support of HR135 and HCR159.**

**Background**

I am the Chairperson and Chief Executive Officer of the International Dialogue on Underwater Munitions (IDUM) Board of Directors, and the Chair of IDUM's International Science and Technology Advisory Board (ISTAB) on Underwater Munitions (UWM's). Over the course of my 40+ years professional career, I served as a United Nations Commissioned Officer (UNO), Combat Engineer, and Explosive Ordnance Disposal (EOD) Chief in the Canadian Army. In 2004, I received a Master's in Project Management from Saint Mary's University in Nova Scotia, Canada.

My explosives and international demining experiences in Asia, Africa, Middle East and Europe, along with my life-long passion and respect for the seas and oceans, motivated me to establish the **International Dialogue on Underwater Munitions** after I learned that many countries around the world had dumped surplus and obsolete munitions into practically every major body of water during the 20th century. IDUM is a non-governmental organization (NGO) founded 2004 in Canada to respond to the growing concerns related to the human health and environmental impact of decaying, dumped, lost, or abandoned munitions in our seas and oceans. IDUM quickly became a platform and international focal point for cooperation on all types of underwater munitions, where stakeholders and impacted communities could openly discuss their concerns and demand government action.

IDUM's mission is to cleanup dumpsites and remove underwater munitions from marine environments through non-destructive methods. Corroded munitions are filled with many toxic chemicals and energetic materials that pose severe health and environmental hazards. Underwater munitions can poison fish stocks and coral reefs, while also endangering tourists, fishermen, beachgoers, and other people who work in the energy, construction, and off-shore economies. The IDUM's ultimate goal is to help create and implement an internationally-binding treaty to cleanup all classes of underwater munitions (chemical, conventional, biological and radiological). This treaty would encourage signatory countries to collaborate on policies, research, science, technology, and management and remediation strategies. To this end, IDUM has written documents and reviews on risk assessments, management options, legal aspects, technologies, and destruction methods.



In 2010, the IDUM established the **International Science and Technology Advisory Board on Underwater Munitions** which consists today of 16 diplomats, scientists, academics, munitions experts, and other stakeholders representing more than 10 nationalities. Board members provide independent advice on scientific, technical, research, public education, and organizational elements related to dumped munitions within the context of IDUM's efforts to promote dialogue and bilateral and multilateral cooperation amongst states and international organizations, including the European Union, the Organization for the Prohibition of Chemical Weapons, and the United Nations.

The ISTAB responds to global concerns by receiving accreditations and by taking actions to discuss underwater munitions in global and regional forums as an observer to the Head of Delegations (HOD) for OSPAR Commission for the Protection of the North-East Atlantic Oceans; the Helsinki Commission (HELCOM) for the Protection of the Baltic Sea; the International Seabed Authority (ISA) for Law of the Sea; the Conference of State Parties (CSP) and State Parties Review Conferences to the Organization for the Prohibition of Chemical Weapons (OPCW), the Chemical Weapons Convention (CWC); and High-Level Summits for the United Nations Sustainable Development Goals 13 (Climate Action) and 14 (Life below water).

In 2018 IDUM registered a major UN Ocean Commitment (#21356 in the UN Ocean Registry) to "Establish an International Science and Technology Center" for capacity building to eliminate all underwater munitions from the world's oceans. By investing in capacity building an opportunity arises to trained, transfer skills, knowledge, resources and equipment to Hawaiians to develop a long-term response to the threats in their region from underwater munitions. IDUM aims to build capacity and support for the investment in the effectiveness and future sustainability of underwater munitions disposal and to have an everlasting positive effect on Hawaii's surrounding ocean and communities.

The UN Oceans Commitment was made to seek partners to aid local, regional, national and international organizations to achieve their 2030 Ocean Sustainable Development Goals Targets. In pursuit of a sustainable ocean in 2019, and with the late Chis Welsh, President of Deepsea LLC., we conducted surveys in Hawaiian waters that identified munitions (torpedoes, bombs, sea-mines, and shipwrecks) on the seafloor.

The IDUM has a long history of working with Hawaiian partners to advance our cause and mission. The results of these efforts have been acknowledged by some of the highest-ranking officials in the United States Military (**See attached letter of appreciation for IDUM hosting an International Dialogue on Underwater Munitions in Honolulu Hawaii from the Deputy Assistant Secretary of the Army Environment, Safety and Occupational Health**).

For the past seventeen years, as new science became available, the IDUM has cooperated with international organizations and bodies to collect and process relevant information on underwater munitions to better understand how they impact coral reefs, marine life, and ecosystems. The process has included hosting five international dialogues, several working groups, and conferences and seminars with host governments.

Most significantly, the IDUM has participated in three multi-year scientific research programs on chemical and conventional weapons in the Baltic Sea, as a Partner and Co-Director partly financed by the European Union and by NATO Science for Peace and Security.

Our work has identified potential concerns from decaying underwater chemical and conventional munitions and their degradation products. They can spread with ocean currents and impact fish health. One Baltic Sea investigation in a dumpsite revealed extra fish diseases, stress on kidneys and livers of Cod fish, and the inability of juvenile fish to reproduce. Other studies have identified TNT, a conventional explosive found in most munitions, causes the bleaching and killing of coral reefs, and is known to cause black-spot disease on corals, crabs, lobsters, and shellfish. Scientists believe that some chemical warfare agents dissipate in water, but others like arsenic, can bioaccumulate in food chains. Ultimately, this endangers human health with a variety of concerns, including cancers, when contaminated seafood is caught and sold for consumption. In many regions of the world, people unknowingly consume fish harvested from dumpsites containing chemical and convention munitions.

Munitions are "Point Source Emitters of Pollution", so if we remove the munitions from the sea, we will remove the source of the pollution. Leaving munitions in-place to disintegrate and decay will only serve to continue to pollute underwater environments for decades, which threatens marine ecosystems and their future economic value.

We must work towards removing underwater munitions from the environment by adequately conducting remedial actions that focus on their removal and non-destructive disposal (cause no harm to the sea-life, corals or environment). As a multi-national umbrella organization, comprised of independent scientists and dedicated professionals, the IDUM is the only institution capable of mobilizing the expertise, science, and technology to address the underwater munitions problem.

The IDUM and ISTAB stand committed to cooperate with the Department of Land and Natural Resources, including its Division of Aquatic Resources, to work towards eradicating underwater munitions in Hawaiian waters and aid in:

- (1) Restoring Hawaii's coral reefs;
- (2) Conserving the State's coral reefs for present and future generations; and
- (3) Creating a resilient and sustainable future for Hawaiian coral reefs.

One of the greatest threats to corals and sea-life is the current disposal method used by militaries and private contractors to explode the munitions in-place. This process, is to place more explosives on or near the munition, than detonated the explosives, to blow-up the munitions. A similar process becoming more common with militaries, is where an underwater drone is sent out with an explosive charge to detonate the munition.

This disposal process only removes the energetic risk, while increasing the toxicity risk to corals, sea-life and the seafood chain. IDUM, is strongly against blowing up munitions in the seas and ocean. We promote the safe and environmentally friendly disposal of underwater munitions to protect the seas and oceans from unnecessary carnage.

There is current technology, and a combination of technologies, that could be applied for the safe recovery and environmentally friendly disposal of underwater munitions in Hawaii.

Here within, is my testimony that I believe to be true. I welcome the opportunity to be call upon to testify during the hearing in the strongest support of Resolution HR135 and HCR159.

Thank you for your time and consideration.

Sincerely,

*Terrance P. Long*

Terrance Patrick Long CPSM. SSM. CD.

Chair and Chief Executive Officer

International Dialogues on Underwater Munitions(IDUM) &

International Science and Technology Advisory Board (ISTAB) on Underwater Munitions (UWM's)

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[Chair@idum.org](mailto:Chair@idum.org)

[Http://underwatermunitions.org](http://underwatermunitions.org)

Appendixes:

1. Letter, Dated 10 October 2010, DEPARTMENT OF THE ARMY, OFFICE OF THE ASSISTANT SECRETARY OF THE ARMY, INSTALLATIONS, ENERGY AND ENVIRONMENT, Addison D. Davis, IV, 110 ARMY PENTAGON, WASHINGTON DC 20310-0110
2. 8th Meeting of the Parties to ASCOBANS Resolution 8.8, Helsinki, Finland, 30 August - 1 September 2016, Resolution No. 8: Addressing the Threats from Underwater Munitions

**HCR-159**

Submitted on: 3/20/2021 2:42:00 PM

Testimony for WAL on 3/23/2021 8:30:00 AM

<b>Submitted By</b>	<b>Organization</b>	<b>Testifier Position</b>	<b>Present at Hearing</b>
cheryl B.	Individual	Support	No

Comments:

**SUPPORT**

When I first went to Hapuna Beach and saw the signs, I was shocked. Now that I have lived here for a long time, I understand that there are live munitions all over our waters and land that the military has not cleaned up. This resolution is great but we really have to rethink our relationship with the US military on Hawaiian lands.

1. NO new leases until the clean ups have been begun and monitored for completion.
2. The Hawai`i Supreme Court's decisions should not be ignored as they are in Ching vs. Case.
3. People need to understand the total of these ammunitions and see the plan for the cleaning. As we saw with UH and the agreement to decommission telescopes. There was no plan and now the State's tax payers are seeing 1+ million dollars being used for the Hokukea. Money that should be used for the general population not one tool of the astronomy dept. at UH.

It is appalling that as a US Taxpayer and Hawai`i Taxpayer that the US Military has not been held responsible for the clean up around our islands.

**HCR-159**

Submitted on: 3/20/2021 3:15:48 PM

Testimony for WAL on 3/23/2021 8:30:00 AM

<b>Submitted By</b>	<b>Organization</b>	<b>Testifier Position</b>	<b>Present at Hearing</b>
Rhonda	Individual	Support	No

Comments:

Please support HCR 159 to seek non-destructive disposal of underwater munitions in Hawaiian waters!

**Testimony Before the House Committee on Water and Land (WAL)**

**Chair: David A. Tarnas**

**Vice-Chair: Patrick Pihana Branco**

**Resolution Number HR135 and HCR159**

**Tuesday-23-March-2021**

**Chair Tarnas, Vice-Chair Branco, and respected Committee Members**

Chair Tarnas, Vice-Chair Branco, and respected Committee Members,

I am Professor Valentine A. Nzengung, an Environmental Geochemist, and a fellow of the National Academies of Inventors. I am an inventor of multiple patented technologies for neutralization and destruction of explosives and chemical warfare agents and their precursors to non-hazardous end products. For over 25 years I have taught and conducted research at the University of Georgia on the development and evaluation of multiple technologies currently applied at the field scale. I am the founder, Chief Technology Officer and the Chief Executive Officer of MuniRem Environmental, LLC. I am also a member of the International Science & Technology Advisory Board (ISTAB) of the International Dialogue on Underwater Munitions (IDUM).

I am writing to submit testimony in favor of Resolutions HR135 and HCR159. The purpose of this bill is to urge the Department of Land and Natural Resources to work with the IDUM's International Scientific and Technology Advisory Board on underwater munitions to seek and secure federal funding for the non-destructive disposal of thousands of tons of underwater munitions dumped, lost, or abandoned in Hawaiian waters.

Land resources alone cannot sustain the world's population. To provide the oxygen, food and energy required to sustain life on this planet, we rely to a significant extent on our oceans. Our Oceans and other surface water bodies (e.g., lakes) make up a significant part of our natural capital that provides essential ecosystem services. Unfortunately, pollution of lands, oceans and lakes by unexploded ordnance and old and expired munitions intentionally dumped into our lakes and oceans threatens critical ecosystem services that they provide. The militaries of almost every industrialized country have used ocean dumping as the primary disposal method for surplus conventional and chemical munitions. Consequently, hundreds of millions of tons remain sunk in underwater environments worldwide. We are conscious of the fact that Pearl Harbor and Hawaii played a prominent role in the history of munitions dumping. Some munitions dump sites have even been given names by their communities, for example Ordnance Reef. Underwater munitions represent a clear and present danger to public safety and marine environments. Corroded munitions are known to poison food chains with carcinogens and toxic chemicals, threaten fish health and coral reefs, injure fishermen and beachgoers, and impede offshore economic developments in the energy, tourist, and transportation sectors.

As a scientist who has spent a good part of my professional career developing solutions to neutralize and destroy explosives on land and sea, I can say with certainty that there currently exist green solutions for the demilitarization of munitions in underwater environments. In a 2018

report titled “Alternatives for the Demilitarization of Conventional Munitions” submitted to the United States Senate and published for worldwide consumption, the National Academies of Sciences Engineering and Medicine (NASEM) identified many alternatives to the undesired and polluting disposal of munitions by open burning and open detonation. In a similar report published by the United States Environmental Protection Agency in 2019 titled “Alternative Treatment Technologies to Open Burning and Open Detonation of Energetic Hazardous Wastes”, the USEPA confirmed the existence of more environmentally friendly solutions for the disposal of munitions.

As an inventor of one of the alternative technologies to the disposal of munitions by open burning and open detonation (OB/OD) that is applied worldwide to support demilitarization and treatment of energetic hazardous waste, I can state that technologies for recovery and demilitarization of munitions dumbered at sea are ready for application at the field scale. For example, in support of the Savannah Harbor Expansion Project, an alternative technology to OB/OD was applied to demilitarize the discarded military munitions recovered from the ship channel. Technologies currently exist to demilitarize underwater munitions in-situ as well as on-site.

IDUM, a multi-national umbrella organization, comprised of independent scientists and dedicated professionals, is the only institution in the world capable of mobilizing a diverse team of experts, scientists, and technologists to independently address the underwater munitions problem in Hawaii.

I thank you and your fellow committee members for listening to my testimony. I urge you to pass Resolutions HR135 & HCR159. I urge you to support a partnership with IDUM to rid Hawaiian coral reefs of underwater munitions. Your actions today will help restore and preserve Hawaii’s precious aquatic ecosystems and coral reefs.

Respectfully submitted,  
Valentine A. Nzengung, Ph.D.

**Supporting Material**

**For the  
Testimony of  
Dr. Valentine A. Nzungung**

**Before the House Committee on Water and Land (WAL)**

**Chair: David A. Tarnas  
Vice-Chair: Patrick Pihana Branco  
Resolution Number HR135 and HCR159**

**Tuesday, March 23<sup>rd</sup>, 2021**

**Supporting Material Item #1**

USEPA Office of Resource Conservation and Recovery Final Report published December 2009.  
“Alternative Treatment Technologies to Open Burning and Open Detonation of Energetic  
Hazardous Wastes.”. Cover page.

**Supporting Material Item #2**

National Academies of Sciences Engineering and Medicine (NASEM) 2018 “Alternatives for the  
Demilitarization of Conventional Munitions” Cover page.

**Supporting Material Item #3**

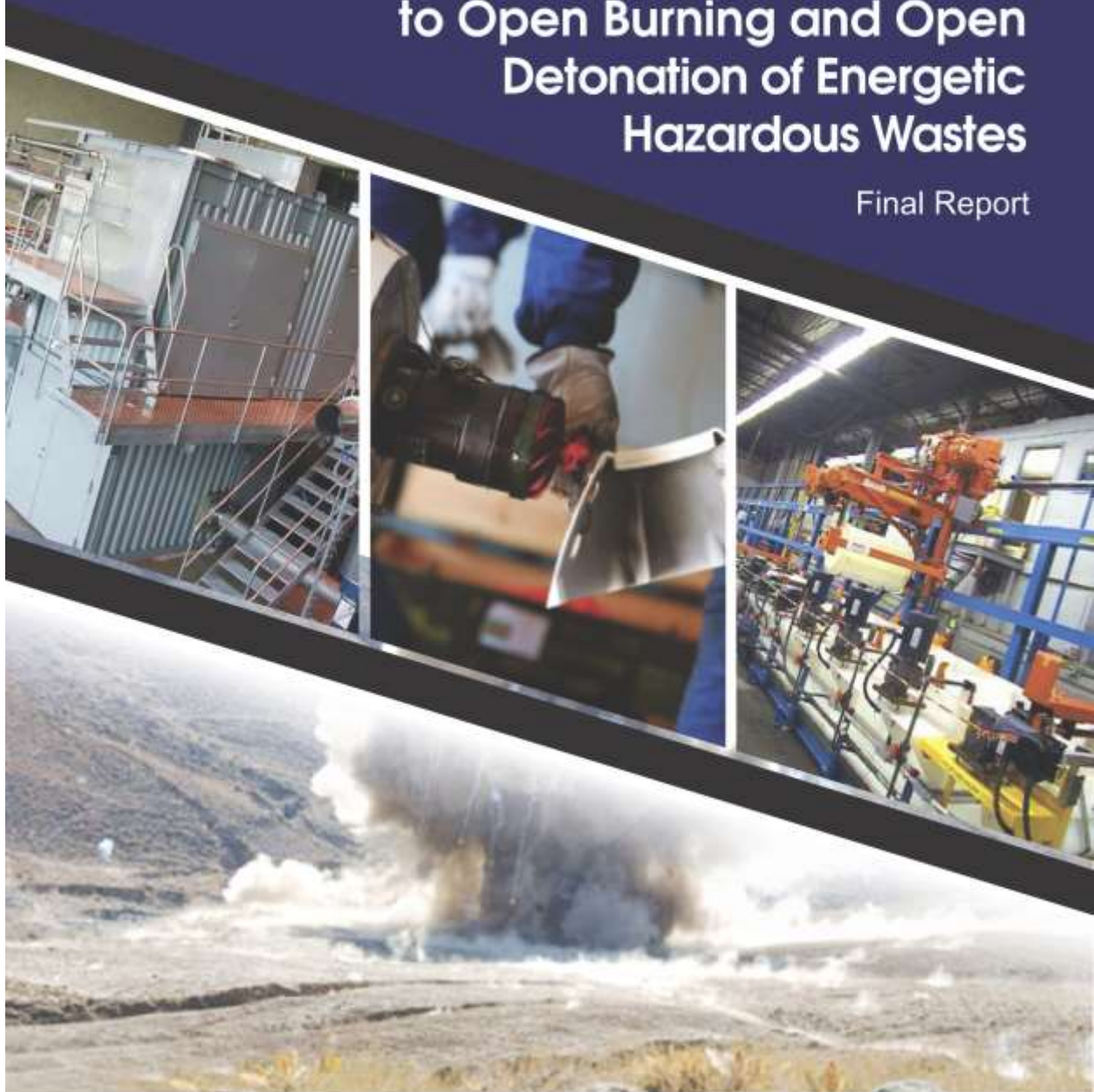
Valentine Nzungung and Ben Redmond (2016) “On-site Neutralization of Civil War Munitions Recovered  
from an Underwater Environment”  
Journal of Marine Technology Society, Volume 50, Number, November/December 2016  
Journal Cover page and Abstract Page.





# Alternative Treatment Technologies to Open Burning and Open Detonation of Energetic Hazardous Wastes

Final Report



Office of Resource Conservation and Recovery (5303P) | EPA 530-R-19-007 | December 2019

This PDF is available at <http://nap.edu/25140>

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# On-Site Neutralization of Civil War Munitions Recovered From an Underwater Environment

## AUTHORS

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## Introduction

It was an internationally accepted practice in the early to middle 20th century to dispose of excess, obsolete, or unserviceable munitions, including chemical warfare materiel, at sea. Prior to the enactment and ratification by many countries of the 1972 London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter at sea, millions of tons of munitions were known to have been disposed throughout the world's oceans (Carton & Jagusiewicz, 2009; Edwards, 2016). Many warships sunk during armed conflicts have also added to the inventory of underwater munitions. European and U.S. coastal waters have the largest number of underwater munition sites. So far, the U.S. Department of Defense (DoD) has identified more than 400 underwater sites potentially contaminated with discarded military munitions (DMMs) and unexploded ordnance (UXO) (SERDP-ESTCP Report, 2007). A worldwide increase in human consumption and development of marine

## ABSTRACT

This paper describes the recovery, on-site nondestructive mechanical breaching, and chemical neutralization of munitions recovered from an underwater environment. The munitions were recovered during salvaging of the scuttled confederate states ship (CSS) *Georgia*, as part of the Savannah Harbor Expansion Project (SHEP). The *CSS Georgia* was scuttled on December 20, 1864. The *CSS Georgia* wreck site is on the Georgia and South Carolina border and covers an approximate area of 350 x 200 feet at a depth of about 36 feet. Because the *CSS Georgia* shipwreck site would obstruct the SHEP, the U.S. Army Corps of Engineers (USACE) entered into agreements to salvage some artifacts, including the munitions, for conservation. Due to the historical significance of the artifacts and the munitions among the *CSS Georgia* wreckage, the USACE required that the munitions be neutralized in the safest and least destructive manner possible. The munitions on board the scuttled *CSS Georgia* consisted of two types of civil war era projectiles, often described as cannon balls. A total of 185 munitions were removed from the *CSS Georgia* site in 2015. The majority of the recovered projectiles (170) were mechanically breached, and energetics were safely neutralized using MuniRem, an innovative chemical reduction reagent for explosives. After the black powder was completely flushed and neutralized, fuzes were unscrewed, if it could be done safely; otherwise, the explosive ordnance disposal technicians drilled into the fuzes at an angle. The contents of the fuze were neutralized in a solution of MuniRem before reattachment to the projectile. The neutralized black powder solids and wastewater were disposed as nonhazardous wastes. This project constitutes the largest on-site chemical neutralization of recovered confederate and underwater disposed military munitions from the U.S. civil war era.

Keywords: underwater, munitions, MuniRem, neutralization, confederate

resources has resulted in more frequent encounters with munitions dumped at sea.

During the American civil war of 1861–1865, the Confederate States Navy (CSN) constructed and deployed many warships to fight the U.S. Navy. Along the U.S. East Coast are many sites containing century-old munitions from ships sunken during the U.S. civil war. Among the

confederate warships, the ironclad steamer batteries were designed to provide coastal defense. The confederate states ship (CSS) *Georgia* was one of such ironclad gunboats, built specifically to defend the city of Savannah, Georgia. The 1,200-ton *CSS Georgia* was built and launched on May 20, 1862. The engines could not provide the power necessary to drive the heavy vessel against the Savanna