



May 11, 2021

To Stakeholder:

We are seeking input on a project aimed to increase understanding of toxic releases due to flooding and sea-level rise in the Galveston Bay area. The project team, led by Environmental Defense Fund, includes several experts from Texas A&M University and Galveston Bay Foundation. The National Academy of Sciences Engineering and Math has funded a series of projects that seek to improve the understanding of how the interaction of natural processes and human activities impact the U.S. Gulf Coast region ecosystems. To that end, we have been exploring the use of Natural and Nature-Based Features (also known as green or natural infrastructure solutions, such as dunes or increased vegetation) as resilience strategies to protect or mitigate petrochemical facilities at risk of flood-related damage. We are conducting a series of meetings to inform stakeholders and interested parties of this effort and its potential impacts.

A primary goal of these meetings will be to obtain feedback from stakeholders on community concerns that will be used to guide the development of recommendations or guidance for future planning. We have included groups with stakeholders from state and federal agencies, private corporations, and nonprofit groups with an interest in promoting resilient facility management to protect sensitive ecosystems and vulnerable communities. This feedback and engagement will be essential to the development of successful and effective adoption of nature-based solutions.

We invite your participation in the following workgroup meeting, which will be held virtually on **Monday June 14<sup>th</sup> at 2-5 pm CDT**. Additionally, please feel free to forward this invitation to other potentially interested participants.

**Information on the webinar:**

Each attendant must register for this event in order to join this webinar. After registering, you will receive a confirmation email containing information about joining the webinar.

Please use this link to register:

[https://edf.zoom.us/webinar/register/WN\\_JlzaeBAhQzKBWdtd3W\\_o4A](https://edf.zoom.us/webinar/register/WN_JlzaeBAhQzKBWdtd3W_o4A)

The meeting will include a general overview of the project and will run approximately one hour and fifteen minutes. This session will be followed by a brief intermission before a second session of the technical advisory committee, which will also run one hour and fifteen minutes. You are invited to the first session but are welcome to join the second. A meal will be provided for attendees. Details to follow.

**If you have questions about this project:**

Please refer to the summary document included as an attachment of this letter. If you have questions about this project, you may “reply” to this email and we will respond as soon as possible.

Thank you for taking the time out of your schedule to participate in the process of improving coastal resilience.

Regards,



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Attachment: Project Summary Document

Partners:

Galveston Bay Foundation: Scott Jones and Charlotte Cisneros  
Texas A&M University

Related news and links:

- <https://today.tamu.edu/2020/11/24/texas-am-researchers-to-address-chemical-pollution-following-gulf-coast-storms/>
- <https://www.edf.org/media/project-will-address-risk-flood-induced-chemical-spills-gulf-coast-facilities>
- <https://www.nationalacademies.org/our-work/healthy-ecosystems-grants/awards>

# Development of Gulf Coast Resiliency Management Plan Using Sentinel Species and Natural Infrastructure

## General Background

The Gulf Coast along Texas and Louisiana hosts the highest density of petrochemical companies in the world and is at the forefront of hazards associated with climate change. In recent years, hurricanes and more intense and frequent flooding events have demonstrated the vulnerability of petrochemical facilities to storms. Flooding, and flooding-related damage, is a growing threat that has triggered the release of petroleum products and chemical contaminants into air, waterways, and surrounding neighborhoods. These releases threaten the surrounding area's communities, putting underserved neighborhoods and sensitive ecosystems at greater risk of exposure and causing devastating effects to commercial fishing fleets and related jobs.

This National Academy of Science-funded project aims to improve understanding of toxic releases due to flooding and sea-level rise in the Galveston Bay area, and to explore potential solutions to mitigate risks. It will explore how natural and nature-based features (NNBF) may reduce flood impacts, mitigate environmental releases, lessen adverse impacts to human and ecological health and promote resilience of coastal communities and ecosystems. While this project focuses on Galveston Bay, its results can be applied to Louisiana and the wider Gulf. The project team, led by Environmental Defense Fund, includes several experts from Texas A&M University and Galveston Bay Foundation.

## Research Questions and Objectives

This project seeks to (1) advance understanding of how increasing flood threats may trigger release and dispersion of chemical contaminants into Gulf Coast ecosystems; and (2) explore how NNBF can be incorporated into community and facility plans to reduce risks of chemical release and exposure. To meet these two objectives, the project is organized around five Aims that seek to answer the following questions:





## Summary of actions/products by Aim

**Aim 1.** We will conduct a six-month sampling campaign of spotted sea trout, red drum, and black drum from the Galveston Bay. Specific contaminants identified in these species—including polycyclic aromatic hydrocarbons (PAHs), per- and polyfluoroalkyl substances (PFAS) and metals—will be used as biomarkers of petrochemical industrial activity, and will increase understanding of the function and dynamics related to the natural-human nexus along the Gulf Coast. These species, which provide nutritive value and have robust economic impact through the recreational fishing industry, are ideal indicators of overall ecosystem health given their lifespan and relevance within the broader ecosystem hierarchy. Similar contaminants have been measured under the National Centers for Coastal Ocean Science Mussel Watch Program, which has been monitoring coastal contaminants continuously since 1986, providing a historical record of legacy and emerging chemicals of concern that can be used to understand impacts and trends from chemical use and environmental management decisions. Collectively, sampling data and publicly available Mussel Watch data can establish a relationship that describes contaminant loading and impacts on different levels of biological organization. Sampling results will assist in understanding fate and transport of chemicals of concern and will provide real-world context for ecosystem impacts.

**Aim 2.** We will identify and characterize Galveston Bay-area petrochemical facilities in terms of risk for potential chemical releases in context of sea level rise, increased storm frequency and flooding. Each facility will be evaluated for three considerations: (1) a facility's vulnerability to inundation and flooding; (2) the potential for a facility to release chemicals into the environment as a result of inundation and flooding, and (3) the extent and nature of chemical hazards present at a facility. These data will be sourced through a variety of publicly available sources, including Facility Registry Service databases and flood and inundation-related mapping resources. Results will be used to prioritize facilities in terms of flood vulnerability, exposure potential, and hazard potential, and will describe both overall as well as specific drivers of increased vulnerability to these facilities.

**Aim 3.** We will utilize fate and transport modeling to assess the impacts in the lower Galveston Bay watershed from flood-damage-induced releases from high-priority industrial facilities identified in Aim 2. The key outcome will be the characterization of ecosystem potential exposure because of flooding from urban rainfall-runoff, riverine flooding, and storm surge. We will evaluate flood scenarios with varied sets of assumptions about interactions between natural and built environments historically and under potential future conditions. Modeled exposure, combined with ecosystem health and toxicity endpoints, will allow us to identify scenarios that present the greatest risk to ecosystem health and map the locations of those ecosystems. Products to be developed include an ensemble of flood damage scenarios characterizing historic and potential natural and anthropogenic environmental conditions and a calibrated Galveston Bay watershed hydrology (SWAT) and coastal-estuary hydrodynamic (Delft3D) models. These models will include predictions of upstream contaminant concentrations, discharges to Galveston Bay, and contaminant concentrations throughout the coastal ecosystem.

**Aim 4.** Using highly flooded and polluted case study areas that are physically vulnerable (identified in Aims 2 and 3), we will develop and propose optimal natural and nature-based features (NNBF) as mitigation strategies for flood-risk and/or chemical-spill hazard mitigation. These predicted locations will be compared to a variety of social vulnerability metrics to understand how these areas intersect with historically disadvantaged communities. Additionally, we seek to evaluate and identify the additional ecosystem services and social/public health benefits provided by NNBFs. We will quantify the current and future risks of flood and flood-induced chemical spills within each study area and develop appropriate NNBF options to mitigate those impacts. To achieve this, we will model future scenarios developed by Aims 2 and 3 in conjunction with strategically identified and spatially applied NNBF options (“Future with Action”). We will then use performance models and urban analytics to compare the results of these applications across scenarios without including such NNBF provisions (“Future without Action”) to demonstrate and evaluate the effectiveness of NNBFs. After identifying the ecosystem services (including, for example, stormwater reduction, carbon sequestration, and/or decreased energy costs) provided by the NNBF and their related beneficiaries, we will analyze their existing and potential values through mechanisms such as Cost and Benefit Analyses.

**Aim 5.** Based on findings from the other four Aims, we plan to develop a guideline/decision tool that facilitates feasibility-level consideration of NNBF solutions to reduce flooding and reduce risk of releases from petrochemical facilities. The findings will be outlined in a “Resilient Nature-Based Solutions for Chemical Risk Reduction Report.” This guideline will serve as a roadmap for better managing risks associated with toxic releases from a variety of flooding events, including episodic or frequent pluvial, riverine, and coastal floods as well as gradual sea level rise. The decision tool can be used by communities, facility managers, and state and community floodplain and emergency management specialists to identify management actions that can be incorporated into facility risk management plans or community and state flood hazard mitigation plans. Use of the tool can also support petitions for funding to implement measures that reduce flood hazards, improve coastal resource management, and build community and ecosystem resilience to climate change. While the guideline will be built from information gathered in Texas’ Galveston Bay area, we intend to create a decision tool able to help communities across the Gulf consider NNBF to reduce environmental and health impacts associated with increased flooding.