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### The Superfund Research Program at NIEHS funds: Centers (P42), projects (R01) and small businesses (SBIR), and worker training (R25) in 35 states



**Texas A&M University Superfund Research Center (2017-2022):** 

### Comprehensive tools and models for addressing exposure to mixtures during environmental emergency-related contamination events



Case scenario: Hurricane Ike (2008) hit on Galveston Bay-Houston Ship Channel





### "Thematic" Approach to **Disaster Research**

Theme 1 – Disaster **Research** [ "get samples"]

### Theme 2 – Disaster **Response Exposomics**

Theme 3 – Disaster **Response Hazard** Identification

Theme 4 – Disaster **Response Modeling** 

Theme 5 – Disaster **Mitigation Strategies** 

## **RESEARCH PROJECTS**

#### Project 1: Dynamic exposure pathways under the conditions of environmental emergencies.

Goal: Study the mobilization of contaminants through laboratory and computational models.

### Project 2: Novel broad-acting sorption materials for reducing bioavailability of contaminants.

Goal: Development of novel enterosorbent materials for communities at risk of exposure to hazardous substances during disasters.

#### Project 3: In vitro and in vivo studies of hazard, kinetics and inter-individual variability of responses to mixtures.

Goal: Develop a tiered translational experimental testing strategy for evaluating inter-tissue and interindividual variability in responses to mixtures.

#### Project 4: In vitro multiplex singlecell assays to detect endocrine disruption potential of mixtures.

Goal: Develop and commercialize in vitro assays that facilitate evaluation of endocrine disruption hazards through novel high throughput imaging approaches.

## SUPPORT CORES



### Administrative Core

The central hub for all Superfund Center activities. Provides leadership and guidance, assuring the excellence of research, support, outreach, community engagement, translation, and training activities



#### Community Engagement Core Builds relationships with community partners to ensure community involvement in every stage of the research process to the communication of findings



#### **Research Translation Core**

Expands the reach and impact of research by communicating key findings with stakeholders and communities with the dissemination of key data and predictions on the impacts of contamination



### **Training Core**

The central hub for science and practice learning by creating opportunities for the professional development of graduate students and postdoctoral fellows

#### Data Science Core

Translates data produced by the research projects into useful knowledge for the community via data collection, quality control, analysis, and modeling

### **Decision Science Core**

Helps investigators to convert environmental and biological data into predictions of health effects and economic costs useful for risk management

### **Exposure Science Core**

Uses state of the art instruments to identify known chemicals of interest, as well as unknown chemicals in environmental samples to understand exposures



# Intercontinental Terminals Company (ITC) Fire Deer Park, TX [March 2019]



Extensive use of firefighting foams containing PFAS, with runoff into the ship channel... impacts on water quality?

- March 17, 2019
  - ITC fire started with two tanks about 10:30 a.m.
- March 18, 2019 (morning)
  - Fire had spread to an additional five
- March 18, 2019 (afternoon)
  - Officials reported that the number of tanks burning was down to six, and three of those are starting to "settle down"
- March 18, 2019 (night)
  - A temporary loss of water pressure overnight caused the blaze to spread to two additional tanks, bringing the total back up to eight by morning



## What are PFAS and where can you be exposed?

• Per- and polyfluoroalkyl substances (PFAS) are a group of man-made chemicals that have been in use since the 1940's and are widely used to make everyday products



Food Packaging – in 2019 the FDA has discovered food contaminated with PFAS associated with packaging materials



Water-repellent fabrics- found in some clothing, camping gear, as well as stain-resistant carpeting and building materials



Nonstick Cookware– many nonstick cookware products, such as pots and pans (e.g. Teflon), contain PFAS



Fire-fighting foams – are a major source of groundwater contamination at airports and military bases where firefighting training occurs



## **Health effects linked to PFAS**

•Currently, the health implications in humans are still somewhat unclear. However, there is growing evidence that exposure to PFAS can lead to certain adverse health outcomes.

•Some studies have shown that elevated levels of PFAS in humans may:



Reduce cognitive functioning in infants

Increase risk of cancer (for PFOA) Cause thyroid hormone disruption (for PFOS)



### EPA Tested for PFAS only once...

High levels of several PFAS near the incident
 03-21-2019 EPA Samples







### Sampling Trips in Collaboration with GBF







### Texas A&M Superfund Center and Galveston Bay Foundation Water Sampling Sites (March-August 2019)

### **Houston Ship Channel Water Sampling**

20 samples: March 22; April 24; June 13; July 23, 2019



PFAS levels near ITC remained elevated for about a month before declining in July





### **Houston Ship Channel Shore Sampling**

26 samples: March 22; April 24; June 13; July 23, August 02, 2019



Further away from ITC, PFAS peaked several weeks after the incident before declining to much lower levels in July

**Baytown Nature Center** 





## PFOS (CAS#1763-23-1) 6:2 FTS (CAS#27619-97-2) March 2019 ITC Tank Farm April 2019 June 2019 1,231 ng/L 767 ng/L 623 ng/L 3,800 ng/L 262 ng/L 144 ng/L 12.1 ng/L 7,000 ng/L 57 ng/L

### **Houston Ship Channel PFAS** Water Concentration: **The Timeline**

- PFAS levels remained high for about a month after the incident.
  - Near the site, levels peaked soon after the incident
  - Further from the site, levels peaked in April
- From June onwards, PFAS levels declined substantially and were still quite low in August
- But what do these "levels" mean in terms of potential health effects?

59.6 ng/L



### Very limited health data available to set water quality guidelines

- Most data available for PFOS
- Several state and federal agencies have set drinking water limits.

Regulatory Source	Drinking water level (ng/L)	Recreational level equivalent (ng/L)
EPA Health Advisory	70	18,000
ATSDR (Draft)	14	3,600
Texas and Maine	560	150,000
New Hampshire	38	9,900
Minnesota	15	3,900
New Jersey	14	3,400

- Comparison to PFOS drinking water regulatory limits
  - > Well above regulatory levels in March-April
  - 70% of samples < even most stringent limits by June

## • Recreational use is a more realistic exposure scenario for this area

- Primary pathway likely incidental ingestion while swimming
- Equivalent regulatory limits calculated using reduced intake rate relative to drinking water
- All samples below recreational limit except a few EPA data points from 3/21/2019



### EPA/TCEQ time-course data on "metals, SVOCs, VOAs": Analyses planned @TAMU

- Data for many additional pollutants and time points are available from EPA/TCEQ
- We plan to use EPA/TCEQ data on metals, SVOC and VOAs to create HSC time-course maps for the individual contaminants and whole classes



## **Preliminary Conclusions:**

- The ITC fire incident was associated with high levels of a variety of perfluorinated alkyl substances (PFAs) in HSC water
- The time-course data showed a steep decline in PFAs contaminants in the HSC by mid-June 2019 continuing through August
- Confirmation of this trend is needed through regular future sampling

## **Next Steps:**

- Additional analyses of the already collected samples using more comprehensive analytical techniques (analysis of additional PFAs)
- Additional sampling campaigns to establish the "background" levels
  Publications and interactive maps of the HSC contaminant levels



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TEXAS COMMISSION ON ENVIRONMENTAL QUALITY



