

A photograph of a rocky coastline with waves crashing against the shore. The water is a deep blue-green, and the waves are white with foam. The rocks are dark and jagged, scattered across the foreground and middle ground. The sky is a clear, pale blue.

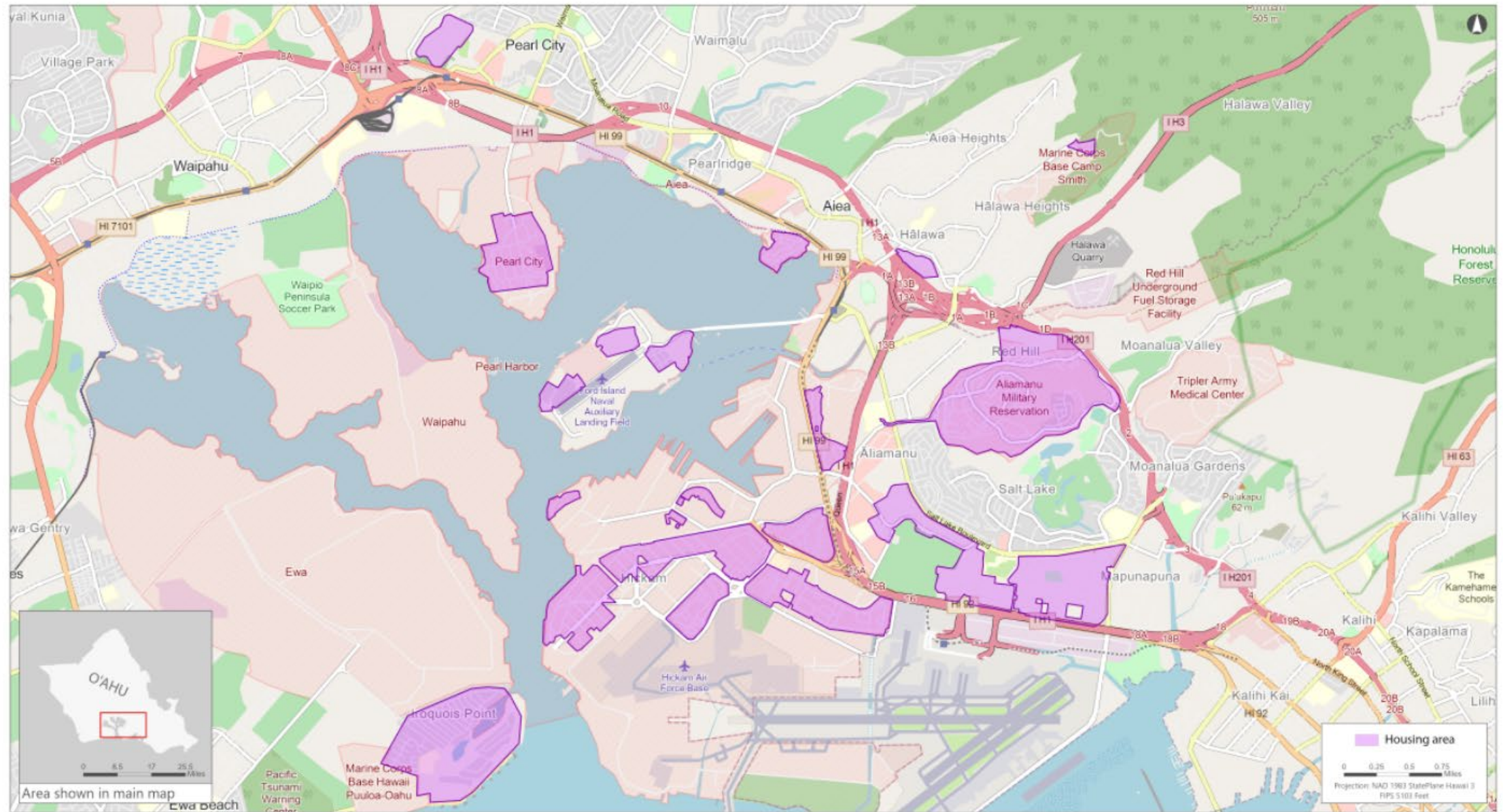
JET FUEL IN THE DRINKING WATER IN HAWAII: UTILIZING ATSDR'S ACE IN AN ENVIRONMENTAL CATASTROPHE

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CSTE Disaster Epidemiology Workshop
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OUTLINE

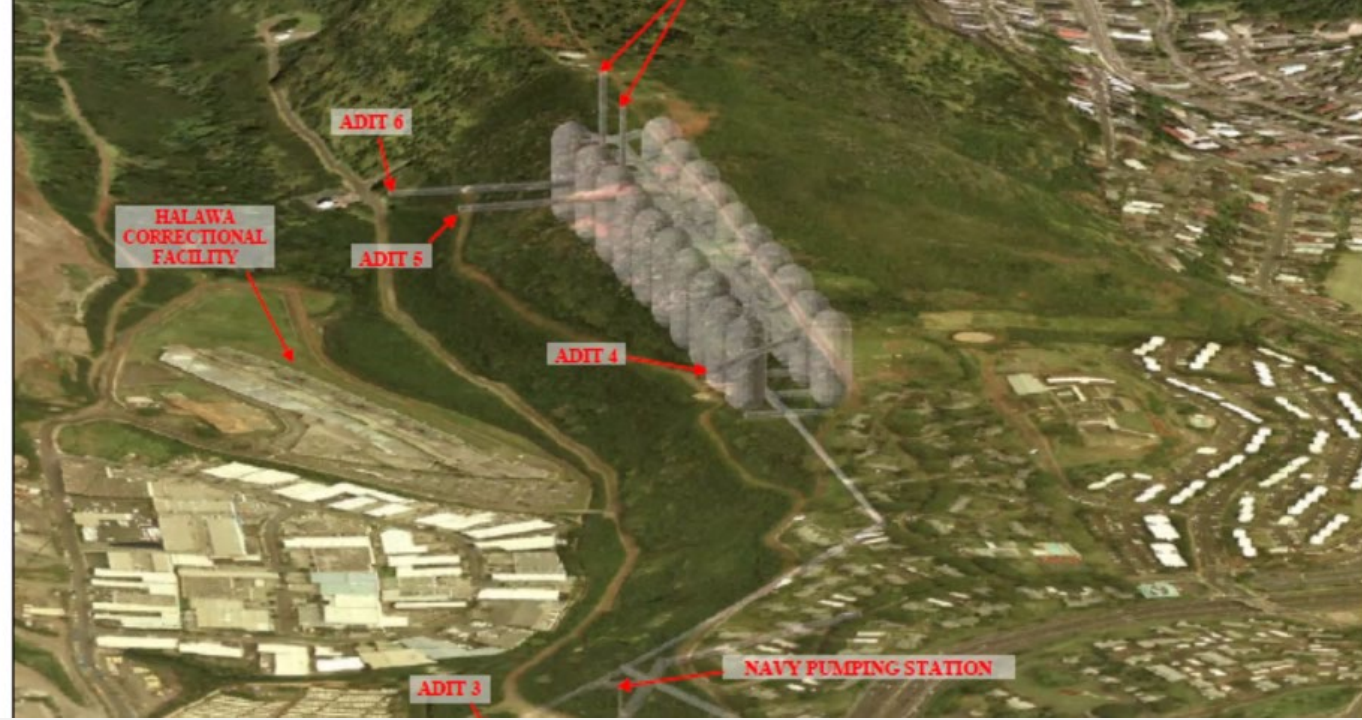
- Background on the Red Hill Bulk Fuel Storage Facility.
- Details about the November 2021 release of JP-5 jet fuel into the Joint Base Pearl Harbor Hickam Drinking Water System and the subsequent poisoning of thousands of people
- Evaluation of short and long-term health effects – Using ACE and other Epi tools
- What's next for the facility and the people affected

Housing areas served by the Joint Base Pearl Harbor-Hickam Water System



RED HILL BULK FUEL STORAGE FACILITY

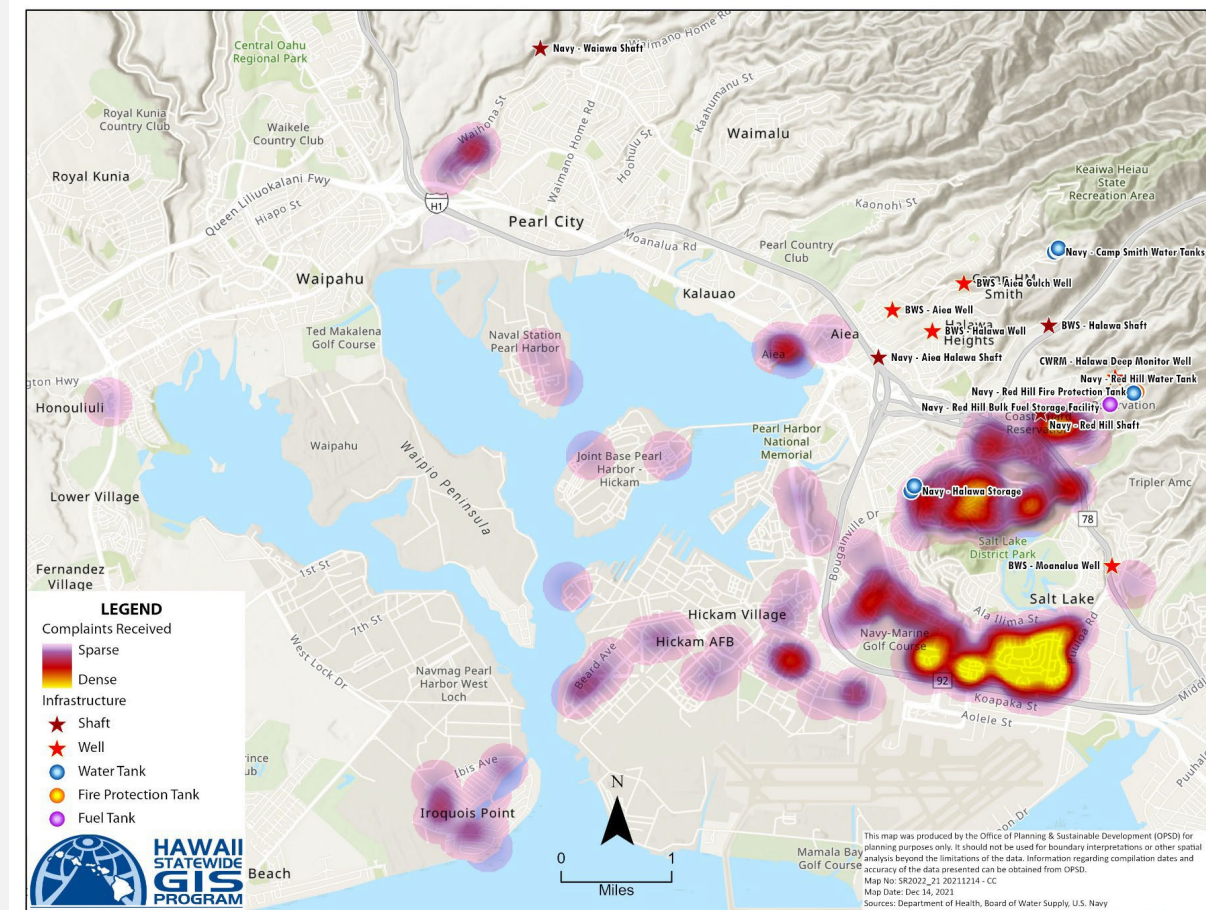
- 20 tanks with over 200 million gallons of fuel just 100 feet above Oahu's primary drinking water supply
- Built in the 1940s
- 2.5 miles mauka (uphill) of Pearl Harbor with connecting tunnel and pipes
- History of spills, three reported releases in 2021





NOVEMBER 28-29, 2021 IDENTIFICATION OF A PROBLEM

- Hundreds of calls to HDOH Safe Drinking Water Branch reporting fuel-like odor in drinking water and health symptoms
- Hawaii Poison Center received 30 calls and identifies a “sentinel event”
- November 29, 2021 – HDOH issues “Do Not Drink” health advisory for the Navy’s JBPHH water system



UNPRECEDENTED
EVENT

No historical or experimental model of this type of exposure

Short – Medium term exposure to JP-5 jet fuel in drinking water

How do we assess immediate health impacts?

How do we predict long-term health impacts?



Petroleum Hydrocarbons in Water: Health Effects



What happens if I swallow water with petroleum?

Drinking water containing petroleum hydrocarbons can cause an upset stomach, stomach cramping, nausea, vomiting, and diarrhea. Your throat and mouth may also get irritated.



What happens if water with petroleum gets on my skin?

Petroleum hydrocarbons can irritate the skin (dermal exposure). Continuous exposure can cause itchy rash with red and peeling skin. After skin contact, always wash with soap and clean water.



What happens if I breathe air that smells like petroleum?

Breathing petroleum vapors (also called inhalational exposure) can cause



How can this affect my future health?

Evaluation of the possibility of long-term health effects is ongoing. Based on current information, people exposed



What Are Petroleum Hydrocarbons?

Petroleum Hydrocarbons are a large class of chemicals made up of carbon and hydrogen that are the primary compounds found in common fuels such as kerosene, gasoline, diesel, motor oil, and different jet fuels, including JP-5. Each type of fuel consists of a slightly different mixture of hundreds of types of petroleum hydrocarbons.

Petroleum Hydrocarbons are organized in categories based on their size and chemical properties. They are measured in different ranges such as TPH-g, TPH-d, and TPH-o. All petroleum products and fuels consist of hydrocarbons in these ranges but with different amounts in each range.



RISK COMMUNICATION

- Complications of different messages from different groups
- HDOH tried to provide consistent, clear messaging
- Targeted public via news releases, TV appearances, fact sheets, website and social media
- Guidance for health care providers



Review of environmental sampling data in the setting of health recommendations



Literature review of available science related to short and long-term health effects of petroleum in drinking water



Water system expertise including water treatment options, flushing risks, and other water system issues



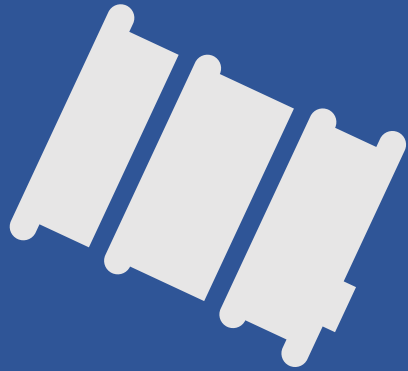
Evaluation of the feasibility of biomonitoring related to the event



Disease surveillance and health surveys

TECHNICAL ASSISTANCE FROM ATSDR- NCEH

PURPOSE OF ASSESSMENT OF CHEMICAL EXPOSURES (ACE) INVESTIGATION



**Assess the impact
of the incident**

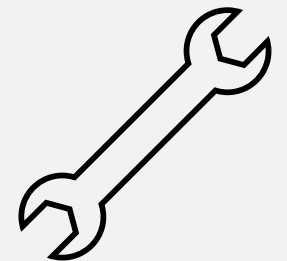


**Provide
recommendations**

HAWAII ACE INVESTIGATION TOOLS USED

- Epi-aid
- ACE toolkit-modifiable surveys, consents, medical chart abstraction form, database, trainings
- Epi-CASE toolkit-survey, registry decision support tool
- Qualitative questions
- Key Informant interviews

- ATSDR Tox Profiles
- Epi-info
- RedCap
- Syndromic surveillance
- Poison Control Center reports
- ATSDR Public Health assessment activities
- Follow-up ACE survey



CDC/ATSDR Assessment of Chemical Exposure (ACE) Investigation

- ACE #1
- January 7 – February 10, 2022
- Extensive Recruitment
- 2,289 participants

HEALTH IMPACT SURVEY



Water Use



Health Symptoms



Medical Care

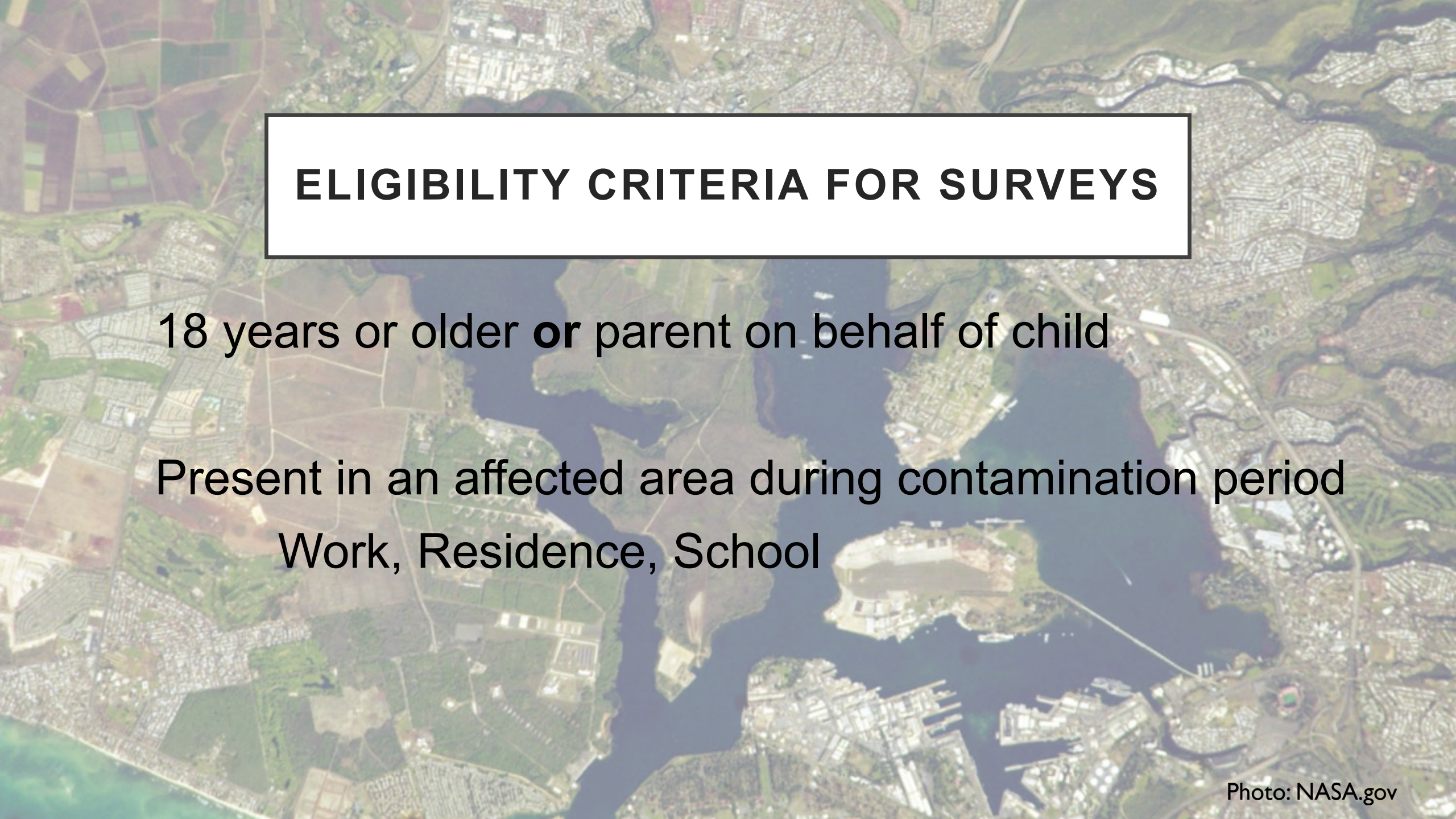


Children



Pets



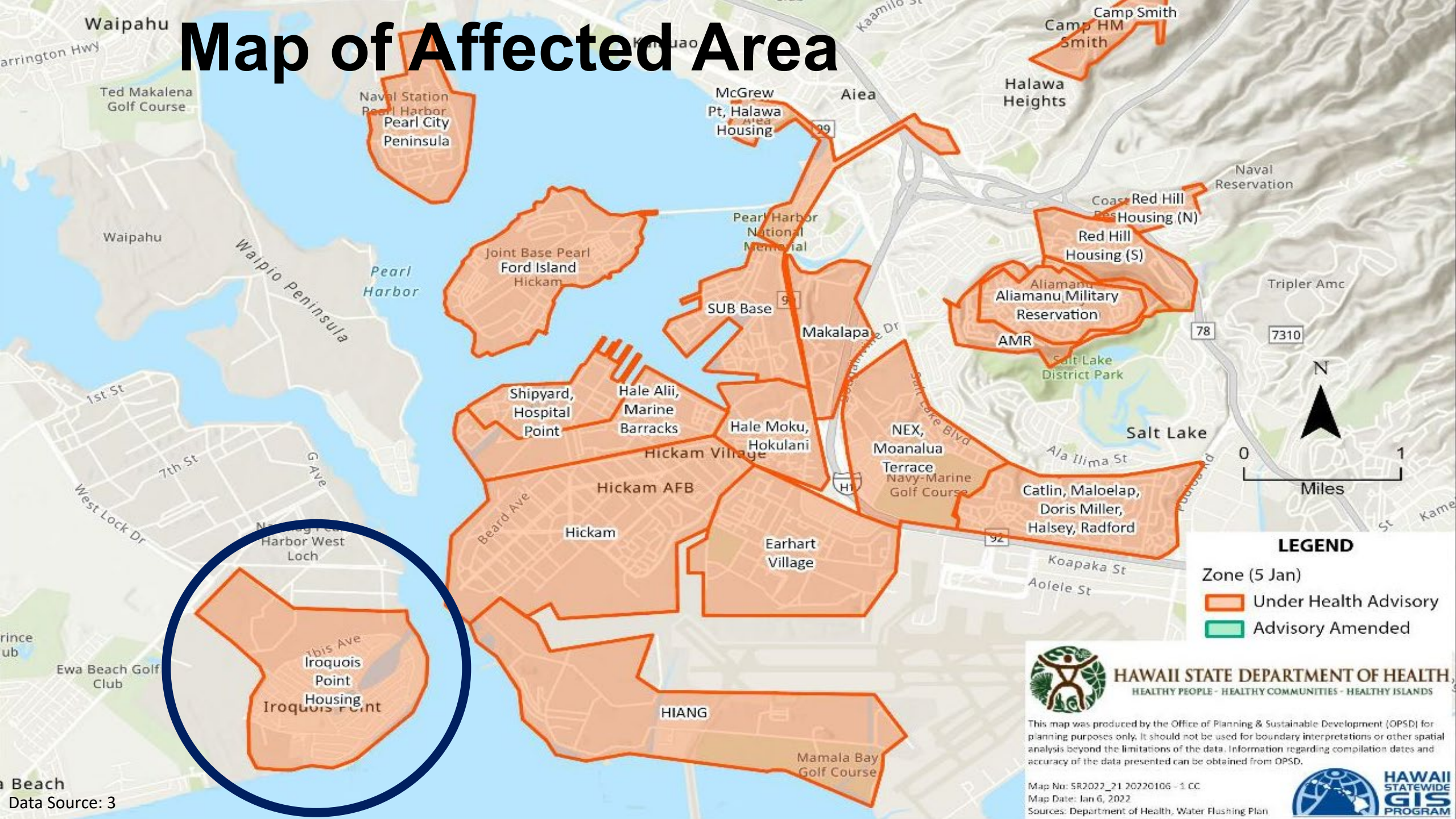
An aerial photograph of a coastal region, likely Puget Sound, showing a mix of urban development, green spaces, and water. The text is overlaid on this image.

ELIGIBILITY CRITERIA FOR SURVEYS

18 years or older **or** parent on behalf of child

Present in an affected area during contamination period
Work, Residence, School

Map of Affected Area

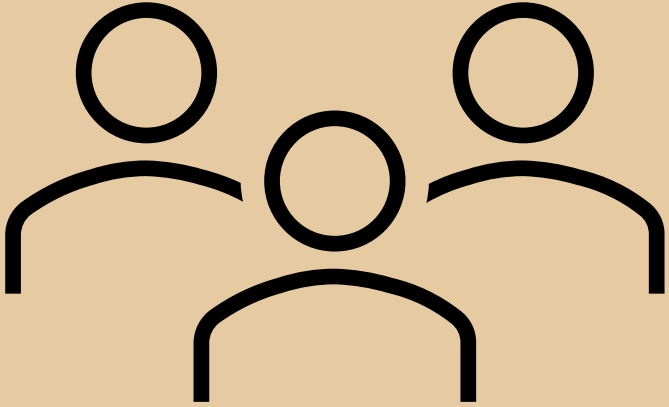


SURVEY RECRUITMENT



Pictures provided by the ACE team members

Participation



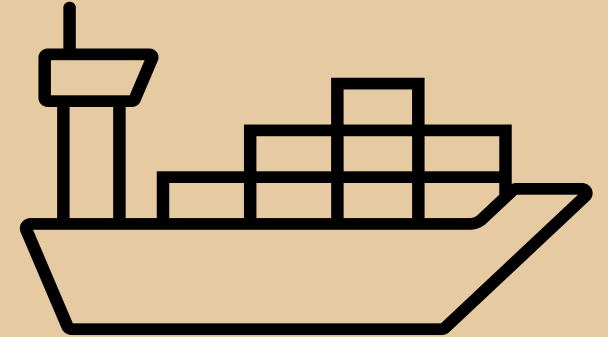
**2,289 Baseline
986 Follow-up**

**participants
submitted
surveys**



**14% Baseline
8% Follow-up**

**of affected
households
were
represented**



**88% Baseline
90% Follow-up**

**were affiliated
with the military**

ACE #1 SURVEY SYMPTOMS

Symptom	Symptoms Present	Percent Present	Thirty Days	Percent Thirty Days
Headache	1330	57%	733	32%
Skin_Dry_Itchy	1152	50%	777	34%
Diarrhea	1128	49%	399	17%
Fatigue	1026	44%	704	30%
Nausea	936	40%	393	17%
Skin_Rash	932	40%	509	22%
Eye_Irritation_Burning	885	38%	457	20%
Dizziness	885	38%	469	20%
Skin_Irritation_Burning	862	37%	477	21%
Anxiety	847	37%	673	29%

ACE #1 COMMON HEALTH CONCERNS

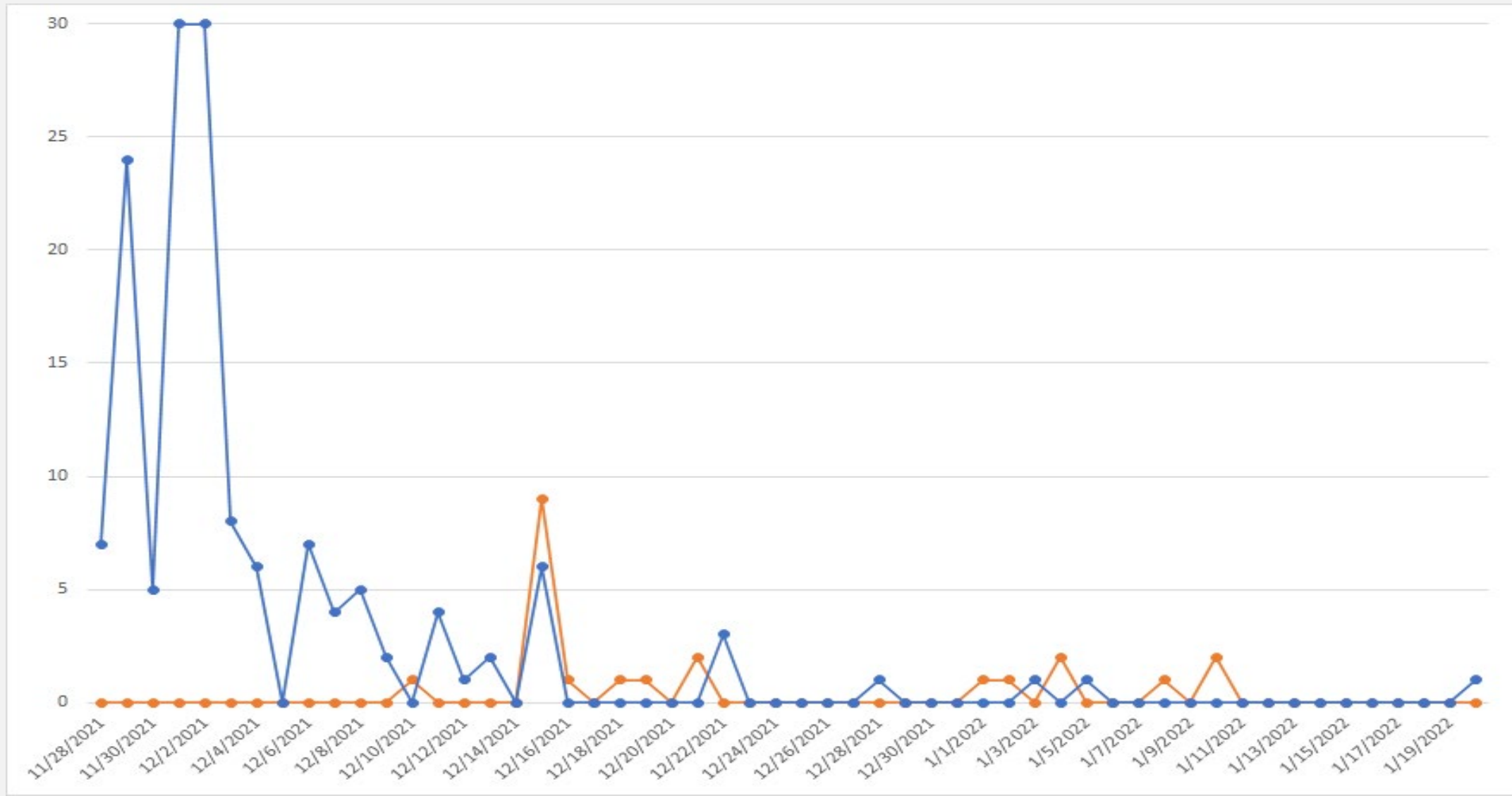
Mental Health

"This event has caused me to be an anxious mess, not knowing if our water is safe..."

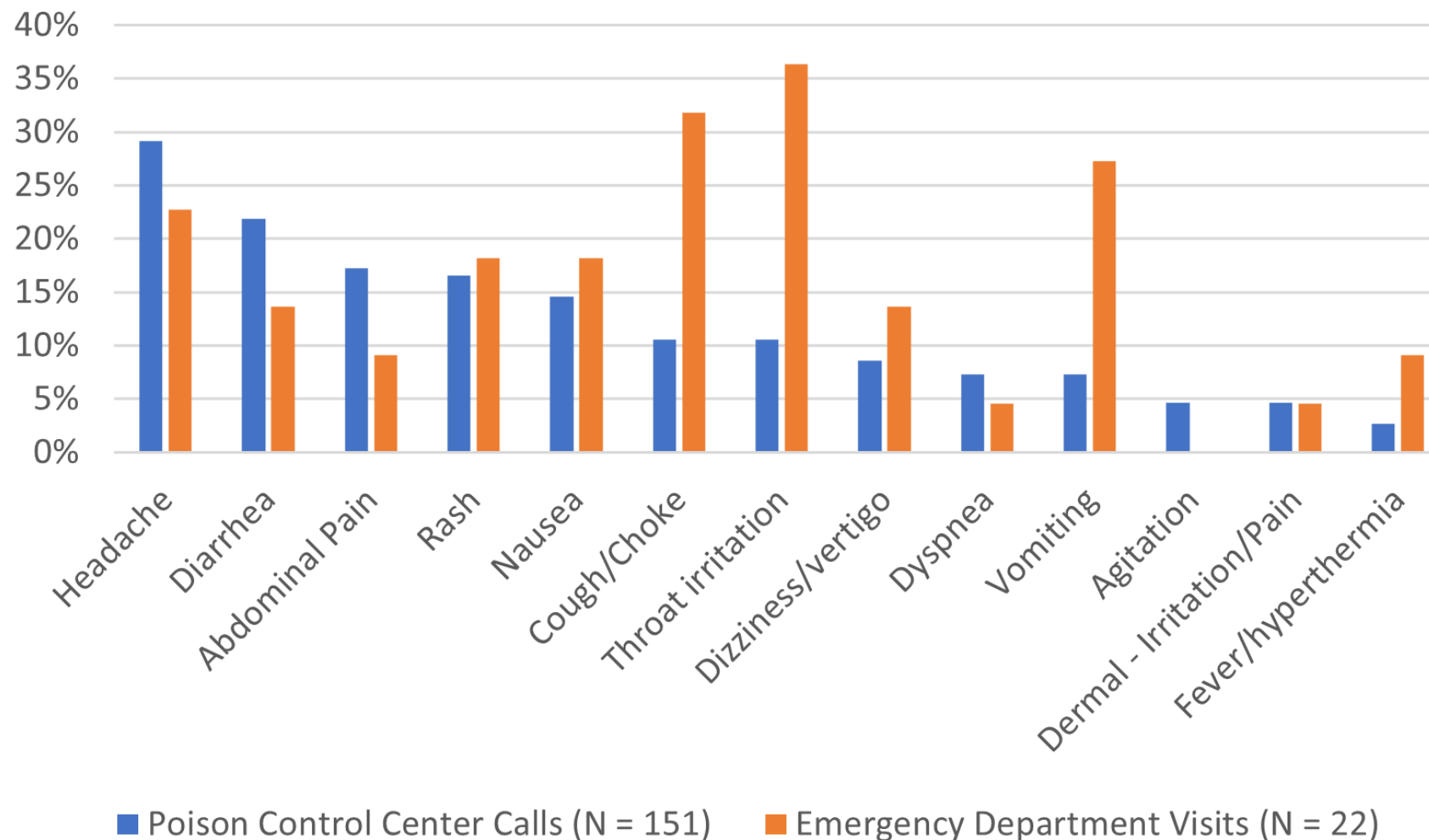
Long-term Health

"I, and many others, are concerned ... about the long-term health impact this will have on us and our children."

Poison Control Calls and Syndromic Surveillance Emergency Department Visits



SYMPTOMS REPORTED IN POISON CONTROL CALLS AND EMERGENCY DEPARTMENT VISITS

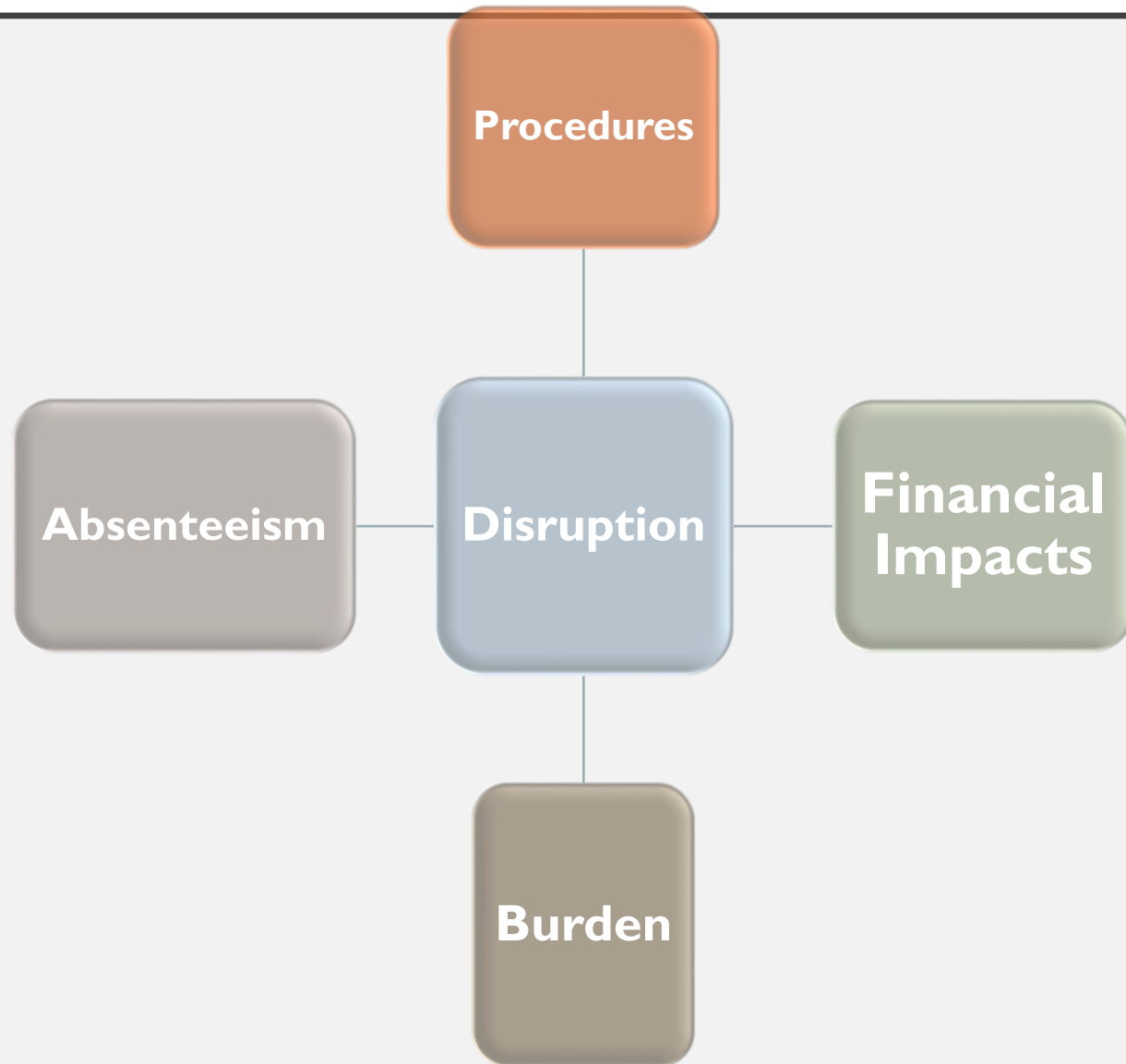


ACE #1: KEY FINDINGS - HEALTH

- 87% of people, 77% of children, were experiencing symptoms, 66% for > 30 days
- Most symptoms were expected (dermal, neurological and gastrointestinal) and improved after switching water source
- Concern over unknown long-term effects especially on pregnant women and children
- Concerning persistent neurological and mental health symptoms
- Recommended 6-month follow-up



ACE KEY FINDINGS- DISRUPTION TO COMMUNITY



ACE #2
FOLLOW-UP
SURVEY

September 2022 (8.5 months after incident)

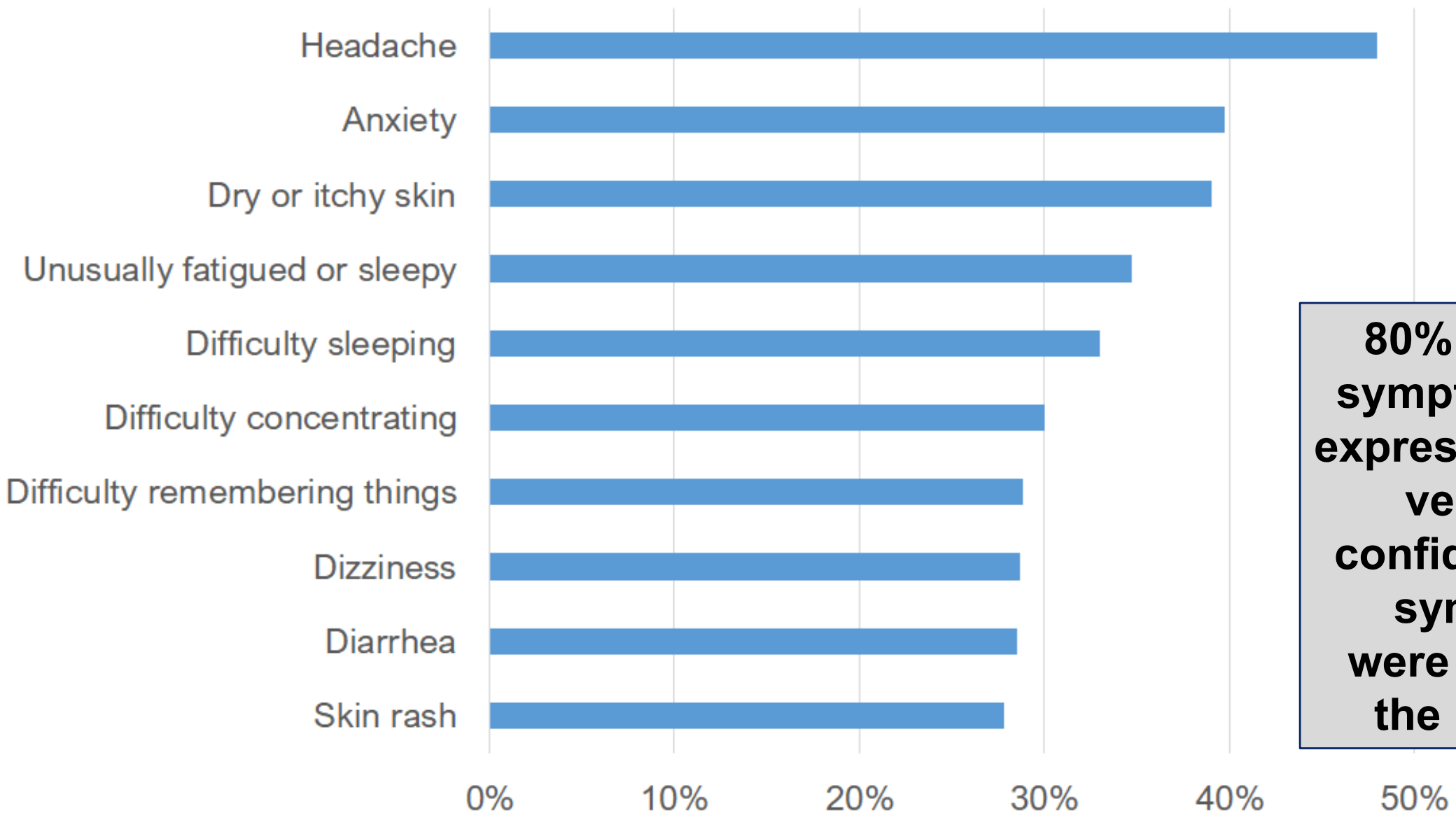
Similar format

Eligible included those that completed prior survey or new participants that met criteria

Emphasis on pregnancy outcomes and mental health symptoms

986 Submissions – 61% completed ACE #1,
90% DOD affiliated

ACE #2 - SYMPTOMS IN THE PAST 30 DAYS



80% reported symptoms 65% expressed high to very-high confidence that symptoms were related to the incident

PHYSICAL HEALTH AT FOLLOW-UP

41%

of all participants
reported
worsening of an
existing condition

31%

reported a new
diagnosis from a
healthcare provider
since the incident

25%

of those with
new diagnoses had
no pre-existing
conditions prior to
the incident

MENTAL HEALTH AT FOLLOW-UP

55%

reported worse
physical health
after the incident
when compared
to before

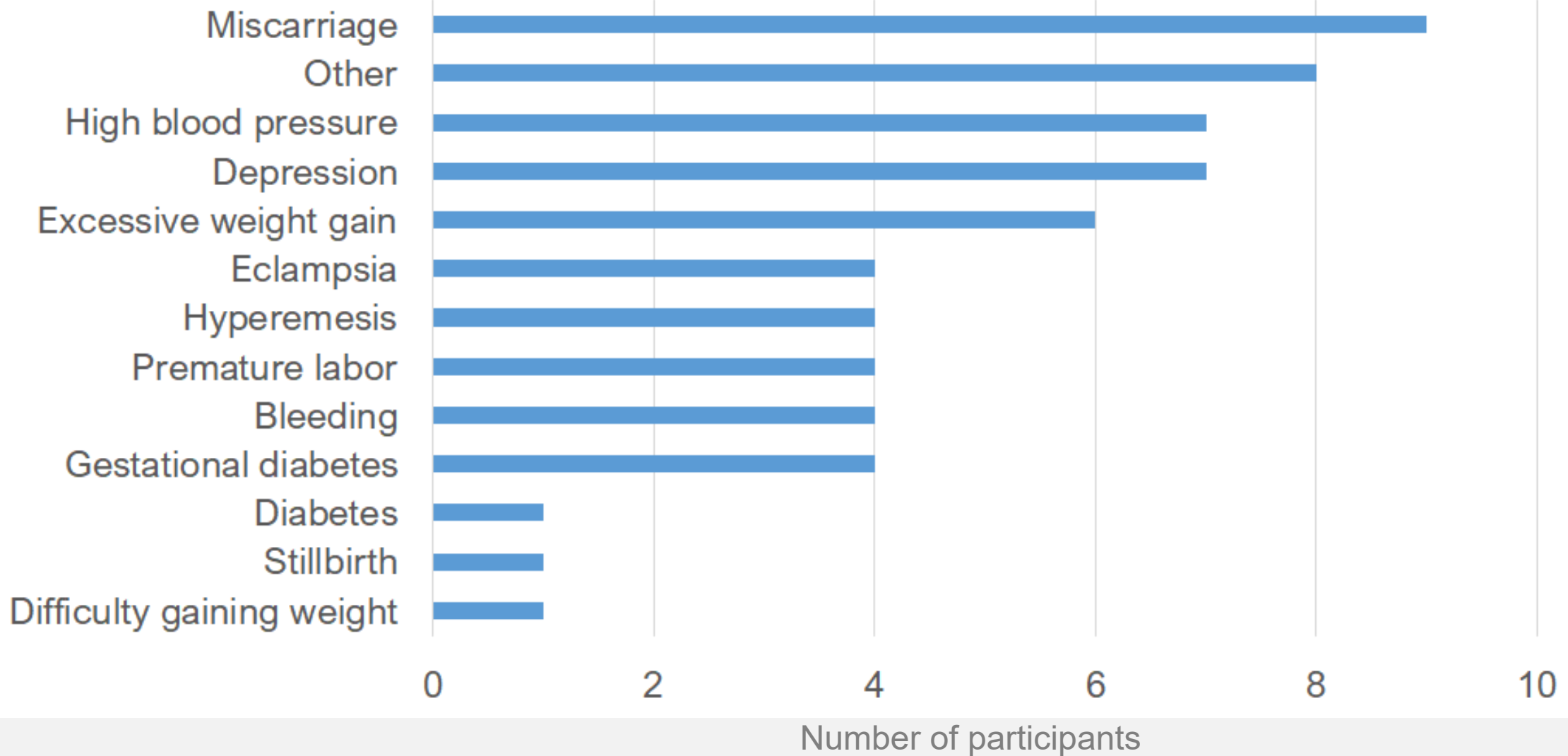
50%

reported worse
mental health
after the incident
when compared
to before

21%

kept from usual
activities for 14+
of the past 30
days due to poor
health

ACE FOLLOW-UP PREGNANCY COMPLICATIONS

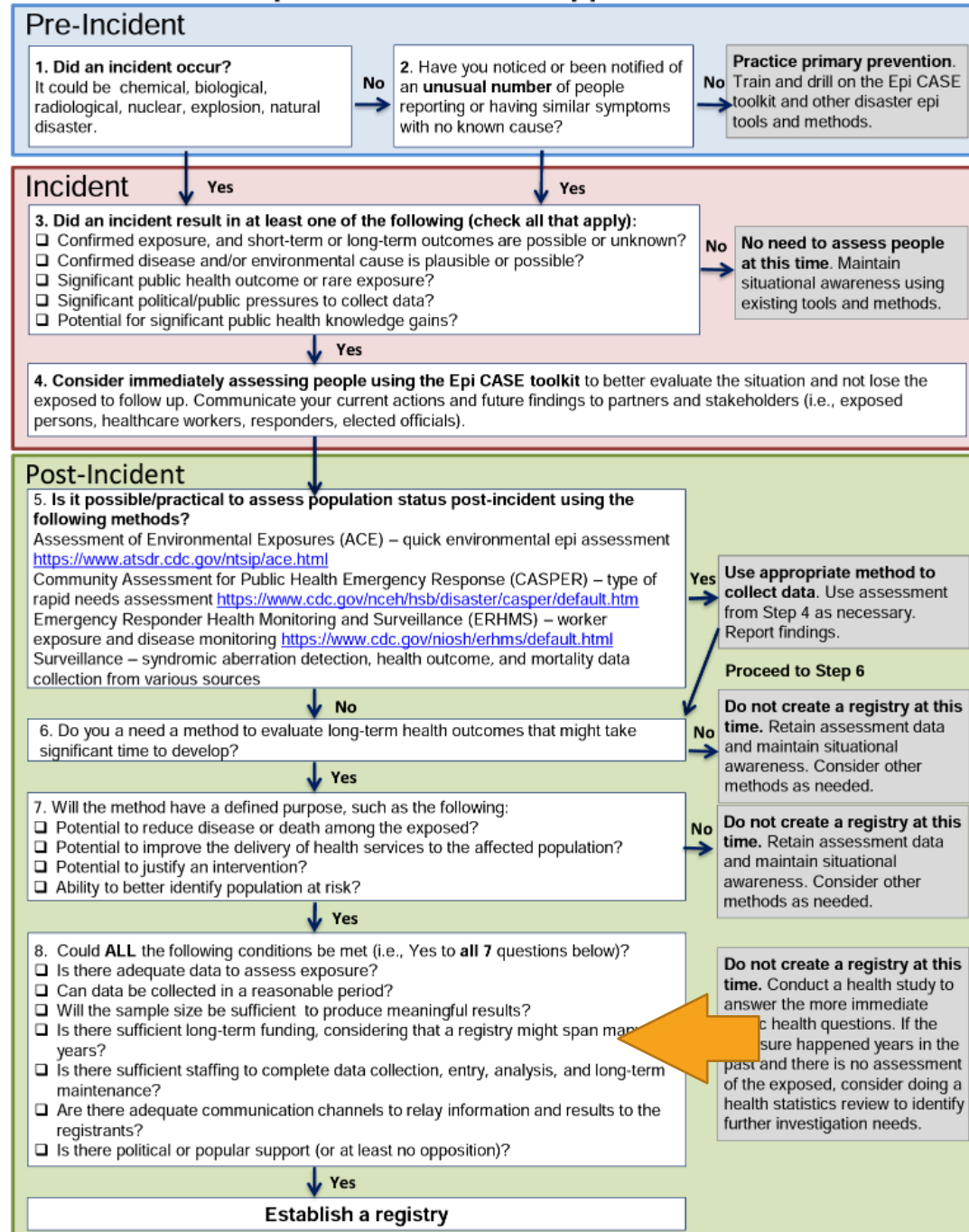


ACE #2 - KEY HEALTH FINDINGS AND RECOMMENDATIONS

- 80% of participants had symptoms in the prior 30 days
- Concerning but not scientifically measurable pregnancy and birth outcomes
- Persistent mental health and other neurologic symptoms
- Follow-up ACE recommendations:
 - Assist clinical providers in supporting affected communities
 - Further investigate health and environmental impacts via medical chart reviews of military roster of exposed, share syndromic surveillance findings, public health assessment activities and ...

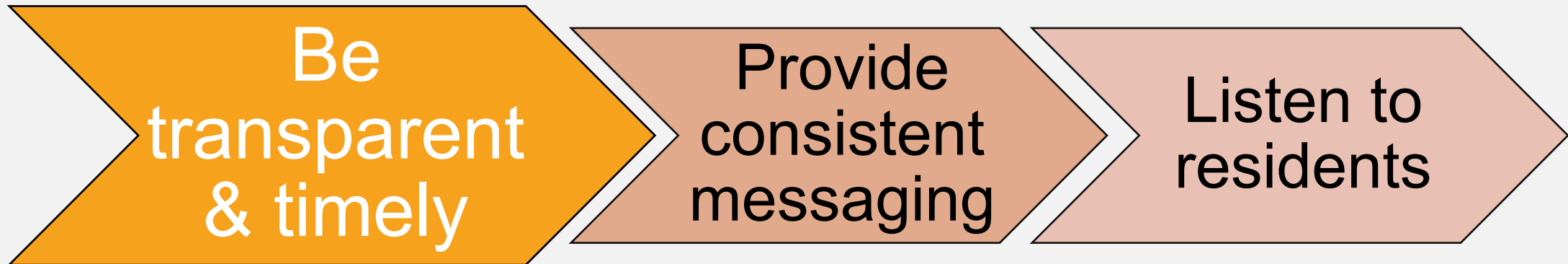
ACE #2: RECOMMEND THIRD-PARTY REGISTRY

Epi CASE Decision Support Tool



ACE KEY FINDINGS- WATER USE & COMMUNICATIONS

- 93% people in ACE #1 and 85% at follow-up ACE #2 were using alternate water sources
- People did not regain trust in using the water. Recommended a multi-pronged approach to establish trust in the water



LIMITATIONS

Study design

Convenience sampling

Self-reported/parent reported symptoms

Lack of exposure data

Outreach Barriers

Strengths

Widespread partner engagement

Large number of responses

Timely data for action

DIRECT
IMPACTS OF
ACE



Red Hill Clinic set up in Hawaii



Interagency Work Group meeting resumed



DHA sharing of syndromic surveillance data



DHA EPI Aid for medical record review



DHA to fund a third-party registry



Support for Providers including case conferences, CME, tele-health Toxicology consults

WHAT'S NEXT – HEALTH



- Tracking health effects
- ATSDR Public Health Assessment Activities

ATSDR Agency for Toxic Substances and Disease Registry

Division of Community Health Investigations (DCHI)

WHAT'S NEXT ENVIRONMENTAL

Long Term Monitoring of the
Drinking Water System

Defueling

Facility Closure

Aquifer recovery

Environmental Remediation



KEY LESSONS LEARNED

Clear and consistent communication

Marshall resources early

Transparency and data sharing

Remember the goal

**PROTECTING HUMAN HEALTH AND
THE ENVIRONMENT**

CDC/ATSDR

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Photos provided by the ACE Epi-Aid team

QUESTIONS?



Photo: Daniel Davila

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SOURCES

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5. Hawaii Department of Health. Navy Water Contamination Survey Results; Updated 5/26/22. <https://health.hawaii.gov/about/files/2022/05/JBPHH-Water-Contamination-Survey-Results.pdf>