NATIONAL ACADEMIES Sciences Engineering Medicine

National Academies Study on Clinical Follow-Up and Care for Those Impacted by the JP-5 Releases at Red Hill

March 2026

Briefing Slides

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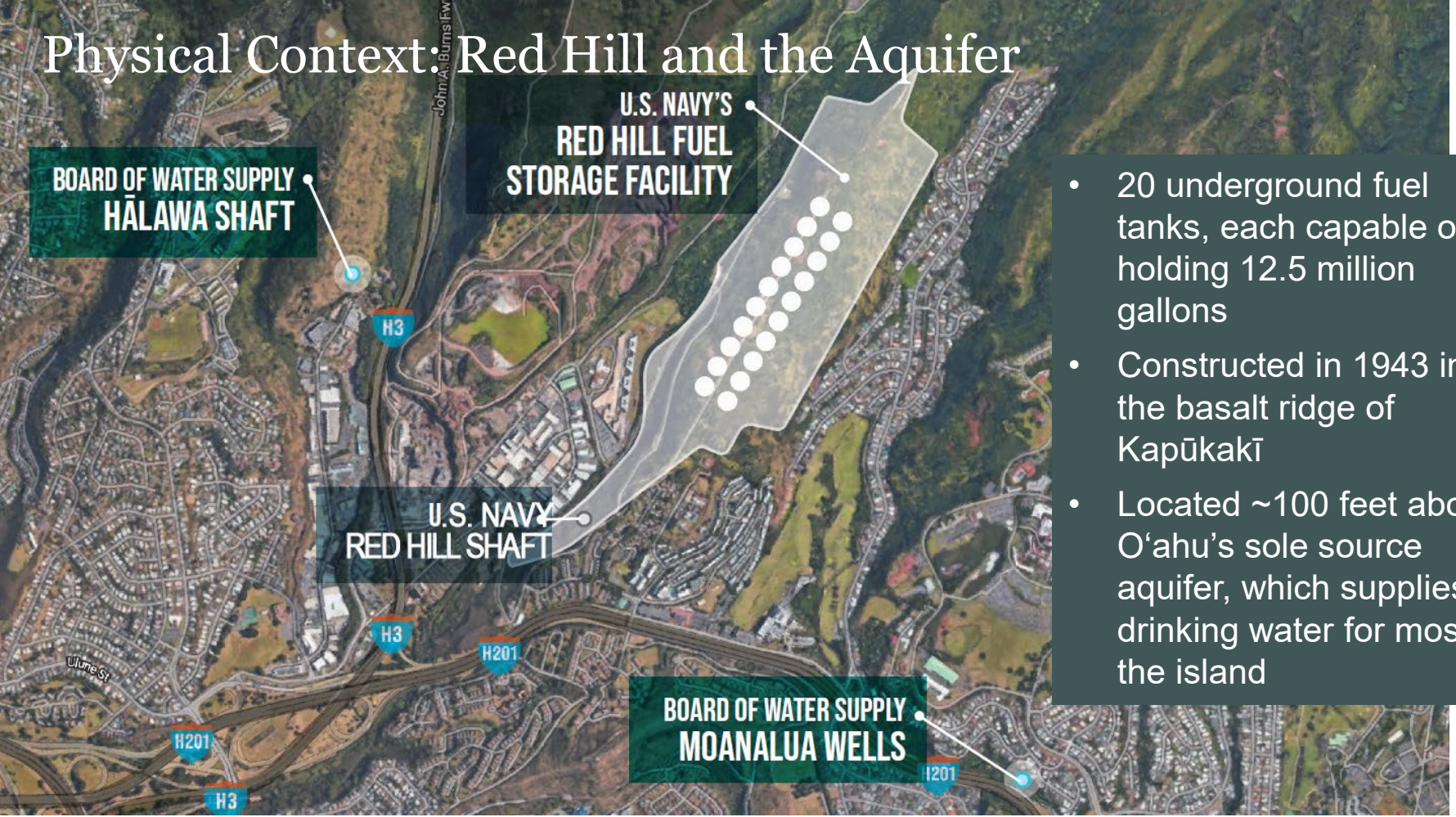
Timeline

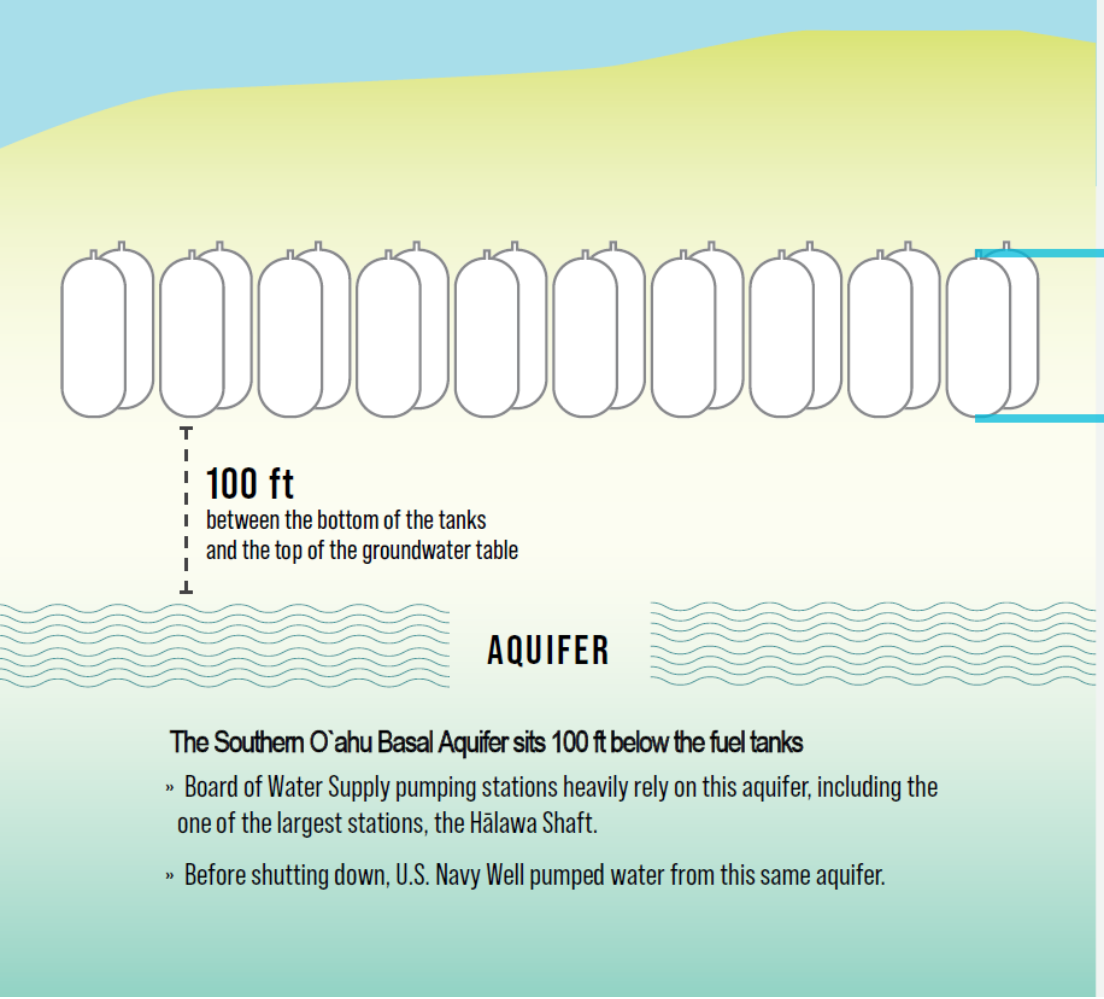
- **May 6, 2021:** Over 19,000 gallons of JP-5 were spilled during a fuel transfer and diverted into an overhead fire suppression pipeline
- **November 20, 2021:** A vehicle strike released the residual fuel, contaminating the drinking-water systems serving Joint Base Pearl Harbor–Hickam and Āliamanu Military Reservation
- **November 29, 2021**: Drinking water advisory issued
- **March 18, 2022:** All zones met clearance criteria; drinking water advisory lifted
- **March 2024:** All bulk fuel removed from the 20 underground storage tanks

Physical Context: Red Hill and the Aquifer



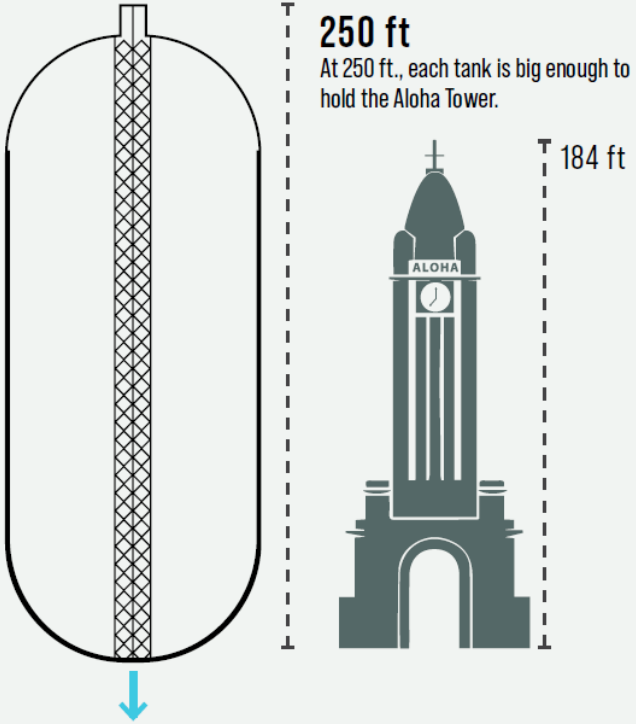
- 20 underground fuel tanks, each capable of holding 12.5 million gallons
- Constructed in 1943 into the basalt ridge of Kapūkakī
- Located ~100 feet above O‘ahu’s sole source aquifer, which supplies drinking water for most of the island

SOURCE: Lindsey, C. 2022. OHA calls for shut down of the Navy's Red Hill fuel tanks. *Ka Wai Ola,* January 1. https://kawaiola.news/aina/oha-calls-for-shut-down-of-the-navys-red-hill-fuel-tanks (accessed October 10, 2025).



The Southern O`ahu Basal Aquifer sits 100 ft below the fuel tanks

- Board of Water Supply pumping stations heavily rely on this aquifer, including the one of the largest stations, the Hālawa Shaft.
- Before shutting down, U.S. Navy Well pumped water from this same aquifer.



- The tanks are made of concrete with a 1/4 in steel liner
- As these thin steel liners corrode, leaking fuel can contaminate surrounding enviroment
- Since 1943, at least 180,000 gallons of fuel have leaked from the Red Hill facility

SOURCE: Lindsey, C. 2022. OHA calls for shut down of the Navy's Red Hill fuel tanks. *Ka Wai Ola,* January 1. https://kawaiola.news/aina/oha-calls-for-shut-down-of-the-navys-red-hill-fuel-tanks (accessed October 10, 2025).

Social Context: Water, Trust, and Institutional Responsibility

- Clean drinking water is legally protected in the U.S. (Safe Drinking Water Act)
- On military installations, federal law requires housing that is safe and protective of health (10 U.S.C. § 2833)
- In Hawai‘i, wai (fresh water) is a source of life and there is a cultural responsibility to protect fresh water, kapūkakī (Red Hill) is a sacred place
- The contamination raised ecological, cultural, and institutional trust concerns amid the complex history of Hawai‘i and the longstanding military presence

Why This Study Was Conducted

- This was the first large-scale contamination of a public drinking water system with jet fuel
- Exposure occurred through ingestion, inhalation, and dermal contact
- The event disrupted daily life and raised acute and long-term health concerns for tens of thousands of people
- The Department of Veterans Affairs and the Defense Health Agency requested independent advice on clinical follow-up and care for those potentially exposed

Abbreviated Statement of Task/ Scope of work

- The goal of the study is to review the health risks associated with JP-5 exposure from the releases in 2021 and make recommendations to the Department of Veterans Affairs and the Defense Health Agency regarding clinical follow-up for those exposed.

Engage with exposed community members to understand health issues and experiences.

Determine the strength of evidence for putative health effects of JP-5 exposure, based on a review of scientific evidence.

Review existing clinical guidance for health risks associated with JP-5 exposure and consider the harms and benefits of increased clinical follow-up for patients.

Review available exposure assessments to determine how exposure estimates can inform patient clinical follow-up and care.

Recommend ways to improve patient care and identify research needs to better support those exposed at Red Hill.

Committee Approach to Evidence Review & Engagement

- Review epidemiologic evidence leveraging systematic reviews
- Assess exposure data provided by federal and state agencies
- Evaluate existing clinical guidance standards
- Deliberate in closed-session meetings to assess the strength of evidence for health effects

- Engaged the communities impacted by the JP-5 releases through listening sessions, community meetings, and input shared in public meetings
- Site visits of the Red Hill Facility and the Waihe‘e Tunnel

Committee Approach to Making Recommendations

Engagement with Red Hill and Other Affected Communities

Application of Core Public Health Functions to the Red Hill Response

Development of the Committee's Frameworks for Decision Making

Characterization of the Exposures to Inform Clinical Care

Scientific Evidence on Long-Term Health Risks from JP-5 Exposure

Review of Existing Clinical Guidance for Environmental Exposures

Identification of Clinical Follow-up and Research Needs

- We applied the core public health functions of assurance, policy development, and assessment to frame our recommendations
- The committee adapted established National Academies evidence-to-decision and public health ethical frameworks and incorporated Native Hawaiian values as complementary guiding principles in developing its recommendations.

English-Language Medical and Public Health Principles

- **Accountability** – Responsibility and integrity; following through with fairness and care.
- **Adaptability** – Flexibility and openness; moving with change and uncertainty.
- **Feasibility** – Realism and clarity; creating achievable and meaningful actions.
- **Harm Reduction, Benefit Promotion, and Proportionality** – Promoting benefit and minimizing harm; keeping burdens fair and proportionate.
- **Justice** – Fairness, equity, and goodness; ensuring all are treated with integrity and respect.
- **Respect for Persons and Communities** – Honoring autonomy, dignity, privacy, and mutual regard.
- **Stewardship** – Caring for and protecting shared resources for future generations.
- **Transparency** – Honesty and authenticity; building trust through openness.

Hawaiian Cultural Values

- **Aloha** – Love, compassion, and mutual care; a deep connection between people.
- **Kuleana** – Responsibility, privilege, or concern.
- **Lōkahi** – Unity and harmony through cooperation; "many hands working together."
- **Mālama ʻĀina** – To care for and protect the land; reflects the reciprocal relationship between people and the earth.
- **Nalu** – A wave; to reflect deeply or move with the natural flow of events.
- **No'ono'o pono**– To think carefully and righteously; to use good judgment and intent.
- **ʻOiaʻiʻo** – Truth, honesty, and authenticity.
- **Pono** – Righteousness, goodness, fairness, and being in right relationship with others, the land, and oneself.

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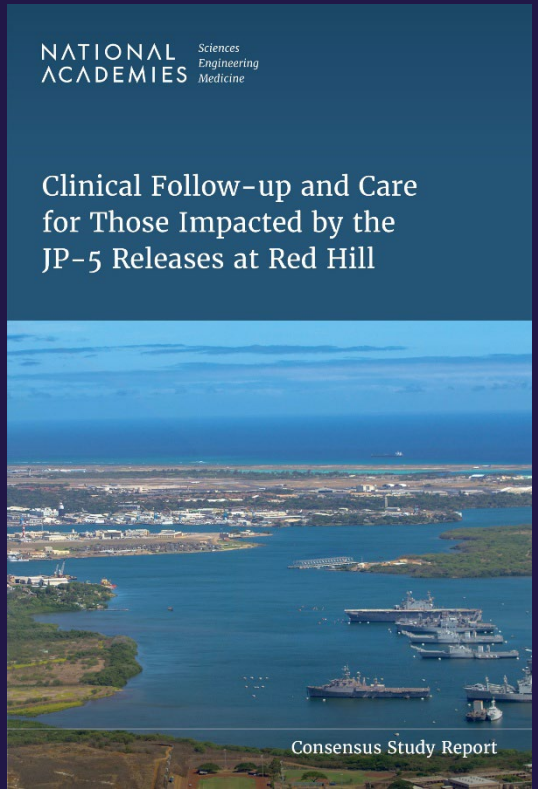
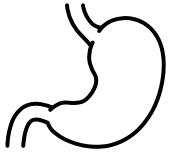
SOURCE: Committee generated

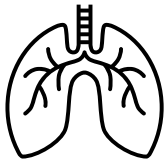
Primary Findings and Conclusions



Exposure Findings and Conclusions (Chapter 3)

- The committee found evidence of drinking-water contamination prior to November 2021, suggesting that low-level exposure before the November 20 release is possible
- Peak exposure most likely occurred between November 20 and December 3, 2021
- Actions such as shutting down wells, flushing distribution systems and household plumbing, and defueling the facility likely reduced future exposures and helped protect public health
- Limitations in sampling methods, reliance on odor to guide advisories, and the absence of specific biomarkers made it difficult to fully characterize exposures
- Experimental evidence suggests contamination levels were plausibly high enough to exceed safety factors for the chemical components of jet fuel





Available Evidence on Health Effects of Jet Fuel

- The review approach considered all epidemiologic evidence in the Red Hill communities, and the studies identified in systematic reviews conducted on the health effects of jet fuel exposure.
- Eight epidemiologic studies evaluated health outcomes in the Red Hill population; all were judged to be low confidence due to methodological limitations.
  - Common limitations included:
    - Low response rates and potential selection bias
    - Lack of empirical exposure measurement
    - Exposure misclassification
    - Reliance on self-reported symptoms or administrative coding
- Two recent systematic reviews of jet fuel exposure were judged to have low risk of bias and high confidence, but most individual studies within them were low confidence.
- The committee synthesized evidence using a similar approach as in other reports conducted for the VA

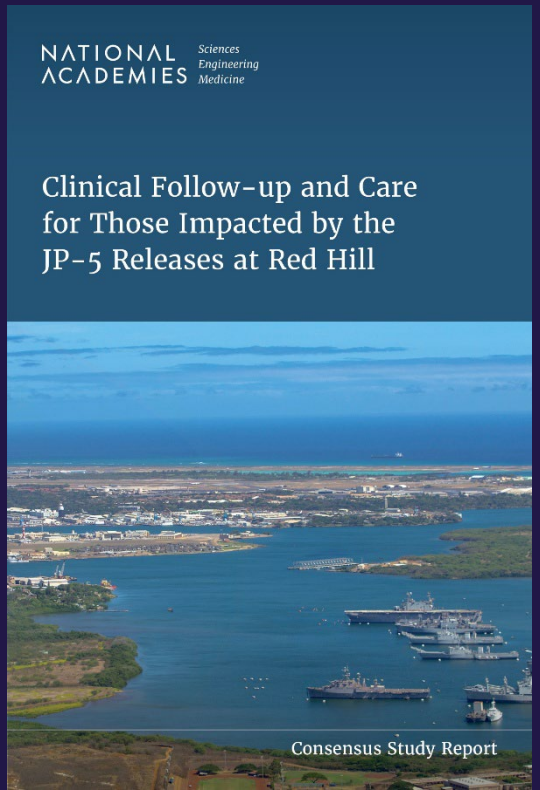
Health Effects of Jet Fuel Exposure (Chapter 4)

	Category of Association	Health outcome conclusions
+ +	**Sufficient Evidence of an Association:** Based on strong evidence, there is high confidence that there is an association between jet fuel exposure and the outcome. It is unlikely that the association is due to chance or bias.	• No outcomes were identified
+	**Limited or Suggestive Evidence of an Association:** Based on limited evidence, there is moderate confidence that there is an association between jet fuel exposure and the outcome. It is possible that the association is due to chance or bias.	• Acute respiratory, skin, gastrointestinal, and mental health symptoms
?	**Inadequate or Insufficient Evidence to Determine an Association:** Based on inconsistent evidence, a lack of evidence, or evidence of insufficient quality of an association between jet fuel exposure and the outcome. No conclusion can be drawn about a potential association.	• All other acute outcomes and all long-term outcomes
-	**Limited or Suggestive Evidence of No Association:** Based on at least limited evidence, there is at least moderate confidence that there is NO association between jet fuel exposure and the outcome.	• No outcomes were identified

Clinical Implications (Chapter 5)

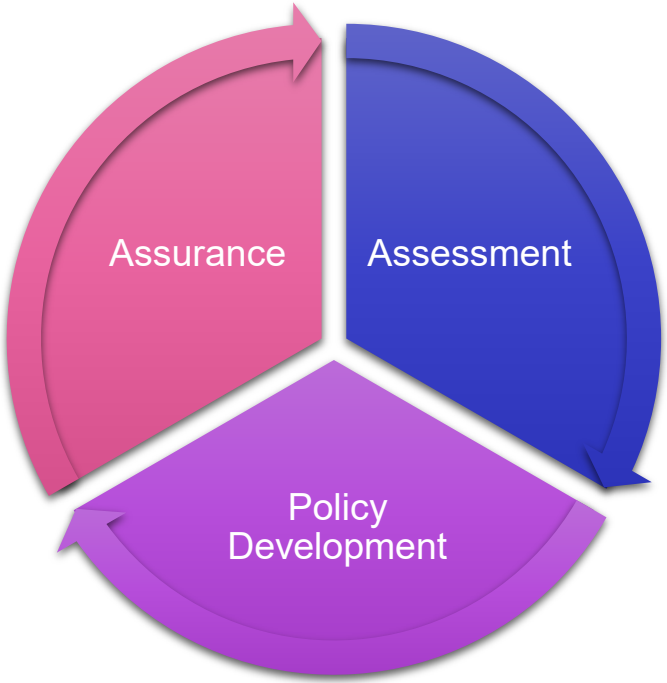
- No long-term clinical guidance currently exists for health effects of jet fuel exposure
- Exposure characterization is limited, and no validated biomarkers are available
- Care should emphasize careful symptom documentation and continuity of primary care
- Clear, culturally responsive and trust-centered communication between clinicians and patients is essential as evidence evolves

Recommendations and Closing Reflections



Core Public Health Functions

- Public health has been defined as “what we, as a society, do collectively to assure the conditions in which people can be healthy” (IOM, 1988)
- The Institute of Medicine identified three core public health functions: Assurance, Policy Development, Assessment
- The committee used these functions to organize its recommendations in ways that:
  - Support the exposed population
  - Strengthen clinical and public health protections
  - Improve the evidence base for understanding exposure and its consequences to aid long-term recovery and resilience



Assurance – Clinical Follow-up

- Recommendation 1
  - Clinicians should focus on symptom evaluation and continuity of primary care, and follow the USPSTF (adults) and Bright Futures (children) recommendations
  - DHA, VA, and community partners should jointly develop and disseminate Red Hill Clinical Guidance
  - Guidance should be periodically updated with input from affected individuals and clinicians caring for exposed patients

Assurance - Exposure Mitigation and Reassurance

- Recommendation 2: Key partners should continue efforts to mitigate exposure and reassure the public about the safety of the water
  - Collaboratively and transparently continuing drinking water monitoring and improve compound-specific chemical analysis
  - Follow through on recommendations from prior oversight and accountability reviews
  - Jointly identify and apply lessons learned to strengthen preparedness for future events

Policy Development: Coordinated and Credible Action

- Policy development translates assessment findings into coordinated public health and clinical action.
  - Lessons from Red Hill include the need to:
    - Define clear roles and communication protocols across agencies
    - Ensure rapid action when contamination is identified
    - Standardize approaches to exposure characterization
    - Integrate physical and mental health guidance in response plans
    - Leverage existing federal and state response frameworks
    - Consider financial impacts on affected families
    - Include scientific and community review in emergency response planning

(Adapted from Box S-4)

Assessment: Improving exposure characterization

- Recommendation 3 — Develop and Validate Biomarkers
  - CDC, NIH, DoD, and VA should support research to develop and validate biomarkers of petroleum associated with jet fuel exposure
- Recommendation 4 — Standardize Environmental Sampling
  - EPA and CDC should support development of standardized environmental sampling and chemical analysis methods for petroleum-contaminated drinking water.
- Recommendation 5 — Characterize Fate and Transport
  - Support research to characterize how petroleum constituents move from drinking-water sources to points of use.
  - Include evaluation of reactions with disinfectants and behavior in plumbing systems.

Assessment: Longitudinal Health Research

- Recommendation 6 — Longitudinal, Community-Engaged Research
  - Federal and state partners should support longitudinal, community-engaged research on the health impacts of exposure to petroleum hydrocarbons associated with jet fuels.
  - Three areas of research priorities are recommended.

High-quality epidemiologic studies	Toxicologic studies reflecting real-world exposure	Effective use of existing health data systems
• Careful assessment of mixed exposures relevant to Red Hill • Measurement of both physical and mental health outcomes • Use of valid comparison groups • Rigorous control of confounding factors	• Multi-route exposure (ingestion, inhalation, dermal) • Chemical mixtures consistent with contaminated drinking water	• Link electronic health records, claims data, and registries • Develop electronic cohorts with cross-mapped exposure documentation • Apply rigorous statistical methods to assess short- and long-term outcomes

Assessment: Registry Maintenance and Expansion

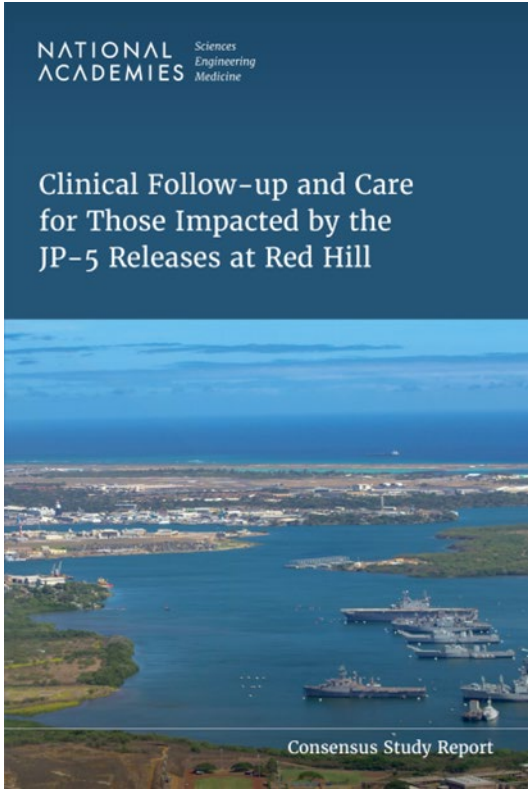
- Recommendation 7 — Maintain the DOEHRS Registry
  - The Defense Occupational and Environmental Health Readiness System (DOEHRS) Registry documents occupational and environmental exposures for service members and eligible beneficiaries
  - DOEHRS exposure records are linked to the Individual Longitudinal Exposure Record (ILER), supporting continuity between Military Health System and VA records
  - Expand eligibility to include all individuals who lived or worked at JBPHH or ĀMR from May 6, 2021, to March 18, 2022.

Closing Reflections

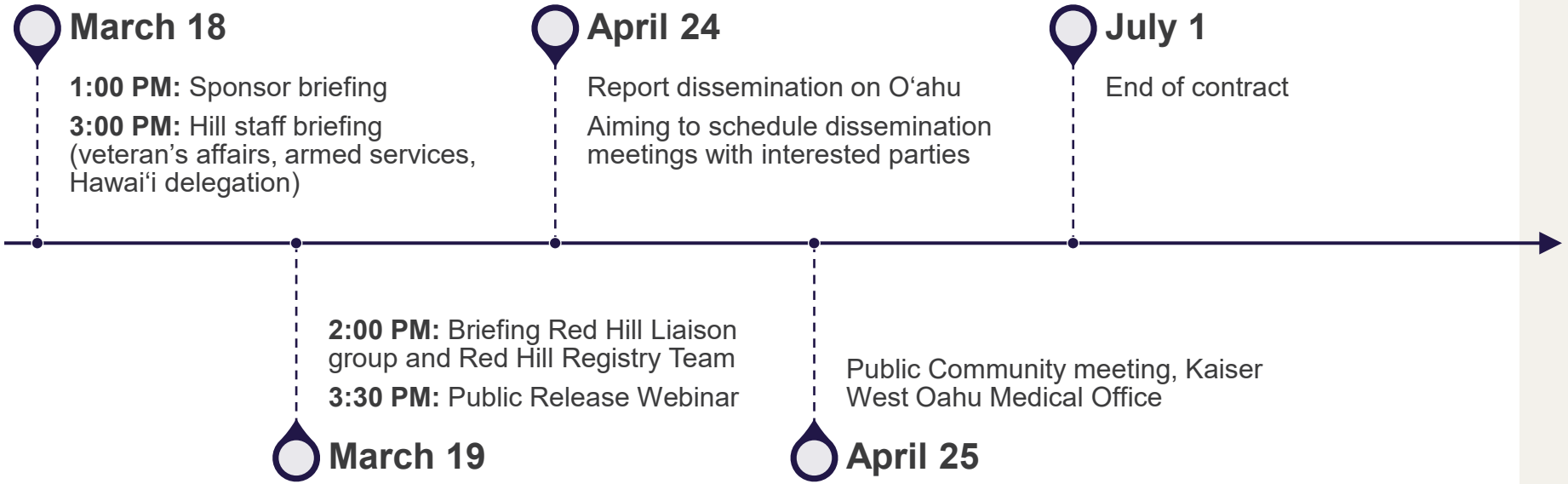
- The Red Hill Fuel releases were a defining environmental health event for Hawai‘i and the nation
- Water safety, public trust, and institutional integrity are intertwined
- Recovery requires transparency, coordination, and sustained investment
- Guided by aloha, pono, kuleana, and mālama ‘āina
- An opportunity to strengthen preparedness and stewardship of Hawai‘i’s wai and support the recovery of communities impacted by Red Hill

Thank you!

- Questions
- Contact the Red Hill Project Team at: redhill@nas.edu
- Report available on 19 March at 2pm EDT.



Red Hill Report Release and Dissemination Timeline



Selected Ongoing National Academies Projects of Interest

Projects of interest to military and veteran communities:

- Epidemiologic Study on the Health of Veterans Who Served at Fort McClellan, 1979-1999
- Neurodegenerative Outcomes and Selected Military Exposures
- Aviator Cancer Examination Study
- Standing Committee on Occupational Exposure Threshold for Blast Overpressure and Process of Determination

Projects related to occupational and environmental health:

- Review of Methods in the Report on Carcinogens Handbook
- Health and Safety Impacts of Aircraft Cabin Temperatures
- Overall Aircraft Cabin Air Quality
- Assessing Radiation Exposure, Health Outcomes, and Mitigation Strategies for Flight Crewmembers