Investigation & Remediation of Releases, and Groundwater Protection and Evaluation

The Navy/DLA are performing various environmental actions at Red Hill to ensure the drinking water remains safe.

Key Elements

- Testing and data evaluation
- Understand groundwater flow
- Understand potential movement of chemicals
- Contingency planning

1. Evaluate and Identify Additional Actions to Protect Drinking Water

2. Update the Current Groundwater Protection Plan

   - Ensure groundwater monitoring network is effective
   - Use most up to date regulatory criteria
   - Update existing contingency plans, which will include appropriate actions to address hypothetical future leak scenarios

Poster Station #3
5 Posters
March 14, 2018

14 March 2018
Understanding the Subsurface and How Groundwater Moves

Newly collected data will support improved understanding of groundwater flow, which will be used to make more informed decisions to protect drinking water.

1. New Groundwater Monitoring Wells
   - Six (6) new wells installed since the January 2014 Tank 5 leak
   - Plan to install additional new wells at Red Hill, North Hālawa Valley, South Hālawa Valley, and Moanalua Valley
   - Monitoring wells will improve understanding of groundwater and potential chemical movement

2. Groundwater Level Study
   - Started in July 2017 and conducted with the United States Geological Survey
   - First pump test completed in February 2018 at Navy’s Halawa Shaft and Red Hill Shaft, and at Board of Water Supply’s Moanalua wells and Halawa Shaft
   - Study will improve understanding of groundwater flow

3. Seismic Survey
   - Completed in December 2017 in North Hālawa Valley, South Hālawa Valley, and Moanalua Valley
   - Used hammer to create vibrations, and measured vibration distance and time traveled through subsurface materials (i.e. geology)
   - Seismic survey will improve understanding of subsurface geology

What We Have Learned So Far
- Different geologic layers exist in the subsurface
- Groundwater will not flow the same way through these different layers because of the different physical properties of each geologic layer

Photo of monitoring well installation activities. U.S. Navy photo by Denise Emsley, Public Affairs.

Example of a computer model showing different geologic layers for evaluation of groundwater flow.

Photo of seismic survey activities in South Halawa Valley. U.S. Navy photo by Jack Kronen, AECOM.

14 March 2018
Understanding What Happens to Fuel-Related Chemicals in the Subsurface

Newly collected data will support improved understanding of what happens to fuel-related chemicals in the subsurface, which will be used to evaluate and identify appropriate additional actions to protect drinking water.

What Have We Learned So Far?

- Fuel-related chemicals in the subsurface are degrading by naturally occurring microorganisms
- More evaluations are needed to understand how fast and complete the breakdown is occurring
- Based on testing results thus far, the drinking water remains safe for consumption

1. Biodegradation Studies
   Several studies are underway to evaluate if and how fuel-related chemicals break down naturally. The studies are evaluating:
   - Physical conditions (e.g., temperature, carbon traps, etc.)
   - Naturally occurring chemicals that indicate breakdown
   - Naturally occurring microorganisms that can break down fuel
   - How chemicals are being degraded over time and distance

2. Ongoing Groundwater Sampling
   - Quarterly sampling events
   - Analysis of fuel-related chemicals and biodegradation parameters

14 March 2018
The Navy/DLA’s current Groundwater Protection Plan has a process to protect drinking water. The Groundwater Protection Plan will be updated using collected data and current regulatory criteria, and will include appropriate actions to ensure continued protection of drinking water.

- **Current Groundwater Protection Plan**
  - Continue Monitoring Groundwater
  - Follow Current Contingency Plans

- **Update the Groundwater Protection Plan**
  - Integrate Newly Collected Data and Studies
    - Environmental data currently being collected
    - Evaluation of groundwater flow
    - Evaluation of potential movement of fuel-related chemicals
  - Refine Groundwater Monitoring Network
    - Monitor groundwater conditions more effectively
  - Update Contingency Plans for Hypothetical Future Leaks
    - Response procedures and trigger points
    - Additional actions to protect drinking water

- **Groundwater Protection Plan to be Updated Every 5 Years**

14 March 2018
Red Hill's Groundwater Monitoring Network

Navy's Investigation Tasks:
• Evaluate geology
• Investigate subsurface petroleum
• Identify chemicals
• Update groundwater flow & contaminant transport models
• Identify appropriate remedies

Legend
- Drinking Water Supply Well
- Red Hill Fuel Storage Tank
- Red Hill Tank 5
- Red Hill Facility Boundary

Groundwater Monitoring Location:
- Latest Validated Results
- Above Screening Criteria
- Below Screening Criteria
- Newly Installed Well, Not Yet Sampled

Key Map

Screening Criteria Exceedances, Latest Sampling Results (October 2017) (µg/L)

<table>
<thead>
<tr>
<th>Chemical</th>
<th>RHMW02 October 2017 Validated Result</th>
<th>Maximum Since 2014 Leak</th>
<th>Screening Criterion</th>
<th>SSRBL</th>
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<tbody>
<tr>
<td>Total Petroleum Hydrocarbons - Diesel</td>
<td>1,600</td>
<td>6,500</td>
<td>400</td>
<td>4,500</td>
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<td>1-Methylnaphthalene</td>
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<tr>
<td>2-Methylnaphthalene</td>
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<td>17</td>
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<tr>
<td>Naphthalene</td>
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<td>160</td>
<td>17</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Screening criteria are Hawai’i Department of Health Environmental Action Levels. µg/L: micrograms per liter (parts per billion)
SSRBL: Site Specific Risk Base Level

14 March 2018