Leaking Underground Storage Tank Sites in Rhode Island
A Risk Assessment Based on Potential Human and Environmental Impact

**BACKGROUND**

With the rise of the automobile and industrialization in the twentieth-century came a rise in the need for fossil fuels and petroleum products. Gas stations, manufacturing sites, and military bases stored these products in underground storage tanks (USTs). Over time, these tanks may corrode or be damaged and subsequently rupture. These leaking underground storage tanks (LUSTs) pose great health and environmental threats.

UST leakage can easily contaminate environmental media like soils and groundwater. Many USTs were used to hold petroleum products such as gasoline, diesel, heating oil, waste oils, and other related hydrocarbons. When petroleum products enter the soil, they are mostly drawn down by gravity towards the water table but are also adsorbed into soil particles. LUST contamination has both immediate and lasting effects as these chemicals are slowly released.

The State of Rhode Island (Figure 2) is home to over 1,000 underground storage tanks once necessary for the state’s two-largest former industries—agriculture and manufacturing. There are several hundred active LUST sites in Rhode Island. Ideally, all could be remediated, but finances and infrastructure are limited. The goal of this project is to identify which LUST sites are a high priority for remediation based on their potential effects on human and environmental health.

**METHODOLOGY**

Many chemicals from LUST sites pose threats to humans and the environment. Motor fuels, for example, are a mixture of over 200 toxic chemicals. Some of these chemicals include benzene, toluene, ethylbenzene, and xylene—known human carcinogens and neurotoxins. The closer one is to the leak, the higher the risk of exposure. Similarly, the most immediate environmental impacts are to areas closest to the LUST site. To determine the LUST sites that are a high priority for remediation, proximity to seven human and environmental factors was examined. These were proximity to: class A or higher lakes and streams, class A or higher lakes, schools, groundwater recharge and reservoir zones, natural heritage sites, coastline, and centers of high population density (Figure 3).

<table>
<thead>
<tr>
<th>Score</th>
<th>Distance (feet)</th>
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<tbody>
<tr>
<td>5</td>
<td>0 - 500</td>
</tr>
<tr>
<td>4</td>
<td>500 - 1000</td>
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<tr>
<td>3</td>
<td>1000 - 2000</td>
</tr>
<tr>
<td>2</td>
<td>2000 - 4000</td>
</tr>
<tr>
<td>1</td>
<td>4000 - max</td>
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Necessary layers were downloaded and clipped from RI GIS. The Euclidian distance from each variable of interest was found and reclasified using Spatial Analyst. Each reclasification was done on a scale of 1 to 5 with 5 being the least desirable (Figure 4). An additive model was created using the reclasified layers: lakes + rivers + schools + groundwater + natural heritage sites + coastline + population. In the resulting additive model, the value of each raster cell can range from 7 to 35. Once joined with the active LUST sites layer, the additive model can be used to determine which LUST sites pose the highest risk of negative human and environmental impact.

**RISK MODEL**

The additive raster model of the seven factors of this project (Figure 5) revealed several areas of potentially high health and environmental repercussions if they were the site of a LUST. Particularly high potential risk areas are the islands of Narragansett Bay, the central south corridor with many natural heritage sites and groundwater resources, and the northeastern corner of the state.

**PROJECT FINDINGS**

It is important to note that not every factor associated with LUST sites was included in this study, but a representative sampling of variables was used. When joined with the raster data and symbolized (Figure 6), the active LUST sites can be ranked according to risk level. Natural breaks were used to choose the risk levels. Some of the sites of extremely high risk fall within the larger high potential risk areas described above, but, fortunately, many high potential risk areas do not actually have LUSTs.

Fourteen active LUST sites are considered as posing an extremely high risk (Figure 7) based on the seven variables considered in this study. These 14 sites are currently affecting ecosystems, groundwater, and humans, particularly children.

**CONCLUSIONS**

Given the grave carcinogenic and toxic effects of many of the chemicals held in underground storage tanks, it is imperative for all LUST sites to be prevented for future generations. The four risk level classes can be thought of as a suggested remediation prioritization list. The sites with the highest risk analysis score should be remediated first as they have the greatest impact on the seven factors used in the calculation. Through remediation of currently active sites, stabilization of non-leaking tanks, and stricter regulations, problems associated with LUSTs can be prevented for future generations.

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