

METALS FROM NATURAL AND ANTHROPOGENIC SOURCES IN PUERTO RICO SOILS

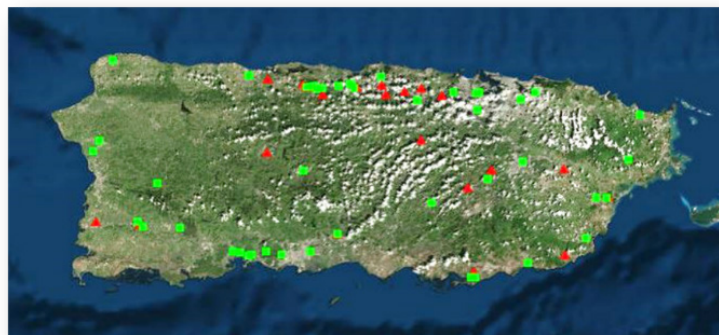
The Issue

A number of diverse issues impact the health of communities in EPA Region 2's Caribbean territories, such as the lack of sufficiently treated source waters in small, remote communities; inadequately closed landfills; and, compared to the U.S. mainland, greater risks of asthma and a greater likelihood of preterm births. Puerto Rico is currently home to over 50 contaminated sites under the [Superfund](#) and Resource Conservation and Recovery Act ([RCRA](#)) Corrective Action Cleanup programs. Research that improves contaminated site cleanups on the island is a priority for EPA.

Some soils in Puerto Rico have concentrations of arsenic and other metals that may be above regulatory limits due to natural or anthropogenic sources such as local geology, tropical soil chemistry, or past agricultural activities. Data on soil concentrations of arsenic and other metals, both natural and anthropogenic, for areas throughout Puerto Rico are necessary to implement effective



Concentrations of inorganics in soil may be due to natural or anthropogenic sources such as local geology, tropical soil chemistry, or past agricultural activities.



EPA records were reviewed for all Superfund (red triangles) and RCRA Corrective Action sites (green squares) to identify existing background soil data.

cleanups that protect human health and the environment.

To distinguish between substances directly attributable to releases at a contaminated site and those from naturally occurring or widespread anthropogenic sources, samples need to be collected in the appropriate locations. This background sampling can be time consuming and expensive and can sometimes result in misleading information if not conducted properly.

The purpose of this project was to investigate background concentrations of metals in the soils of Puerto Rico and create a database to help contaminated-site practitioners make informed decisions to protect human health and the environment.

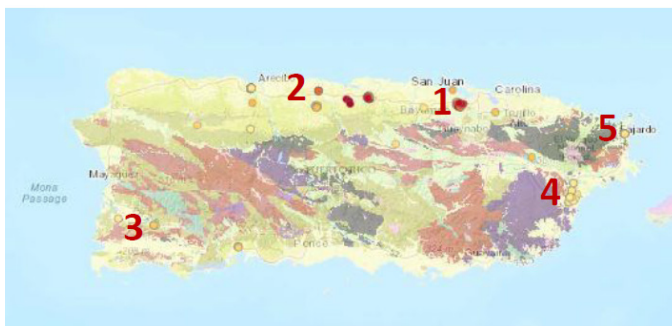
Approach

A literature and database search was conducted to identify existing data. EPA records were reviewed for all Superfund and RCRA Corrective Action sites on the island to identify data for arsenic, barium, cadmium, chromium, lead, silver, mercury, and selenium. Records from initial site investigations that were conducted to determine CERCLA National Priorities Listing candidates were also reviewed for background data.

EQuIS™ and GIS were used to compile data and create maps and other products to graphically depict the data and compare it to known contaminated sites and the underlying geology. The data were analyzed and data gaps were identified.

Results

The data were limited since background samples were found for only 18 of the 50 CERCLA/RCRA sites on the island. Samples from 301 locations at these 18 sites were evaluated and 2,058 results were used for this study. The distribution of available data was limited to roughly five geographical areas:



1. the San Juan metropolitan area,
2. the northern coast extending to the west of San Juan,
3. southwest Puerto Rico extending west to east from Cabo Rojo to Guayanilla,
4. the east coast of Puerto Rico in the Humacao municipality, and
5. northeast Puerto Rico in the municipality of Fajardo.

Since geology plays an important role in the inorganic content of surrounding soils, the rock types underlying or outcropping in the areas where the samples were collected were identified using a geology map. The geologic units include sedimentary rock in the San Juan and the northern coast areas, volcanic (Cabo Rojo) and sedimentary (Guayanilla) rock in the southwest, and interlayered sedimentary and volcanic rock in the eastern regions of Puerto Rico (Humacao and Fajardo).

The results were presented in a user-friendly interactive [Story Map](#) so that stakeholders, including the community and site

assessment/remediation practitioners, will be able to access the data.

Data Gaps and Next Steps

This study represents the first compilation of soil background data in Puerto Rico. Since data for the island were limited, additional work is needed to fill data gaps.

Next steps include:

- determine locations for sampling based on soil types/geology, and current and past land use,
- collect additional background samples,
- add the data to the Region 2 EQuIS™ database, and
- analyze the data to determine representative island-wide background inorganic concentrations,
- update the [Story Map](#) and make available to the public.

Contacts

This project was a collaboration between EPA's Office of Research and Development (ORD), EPA Region 2, and the University of Puerto Rico/Medical Sciences Campus/School of Public Health and was funded by ORD's Regional Applied Research Effort (RARE) Program.

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