Inventorying and Mapping Hazardous Soil Vapor in Brooklyn Brownfield Sites

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BACKGROUND

- NYC has over 2,000 brownfield sites that may contain soil vapor with high levels of volatile organic compounds (VOCs), such as BTEX (benzene, toluene, ethylbenzene, xylenes), TCE (trichloroethylene), and PCE (tetrachloroethylene).
- Investigating soil vapor is necessary in sub-slab depressurization, vapor extraction, and vapor barrier systems within mitigation systems because, unlike soil, soil vapor tends to remain stationary.
- Addressing soil vapor contamination in brownfield sites is crucial due to its potential risks of adverse health effects to humans, such as cancers, neurological disorders, and respiratory illnesses.
- Our goal is to obtain and explore soil vapor concentrations (high-level /over health-based levels) and spatial distribution of brownfield sites in Brooklyn.

METHODS

- **Data Collection & Conversion:** Downloaded 442 PDF reports from NYC Environmental Project Information Center (EPIC) website, then used Adobe Acrobat Pro to convert PDF files to Excel files.
- **Data Extraction & Cleaning:** Used RStudio to extract data for each type of lab report and clean data. Standardized the data before merging them into a comprehensive database.
- **Exploratory Analysis:** Geocoded locations, used QGIS to map chemical concentrations of interest and site data and RStudio to perform descriptive statistical analysis on chemicals.

RESULTS

- Built databases of chemical levels, site characteristics, and geographic data for **442** Brooklyn brownfield sites (**1500+** samples).
- The largest number of sites (**53**) are in Greenpoint (ZIP code 11222).
- Over half of the sites (**50.9%**) have a maximum TCE concentration above the health-based guidance level.
- For PCE and TCE, **spatial-overlapping** patterns were clearly observed, especially in sites with greater levels of contamination, but less obvious for BTEX.

High-levels of contamination found in soil vapor throughout brownfield sites provide a framework for potential future interventions.

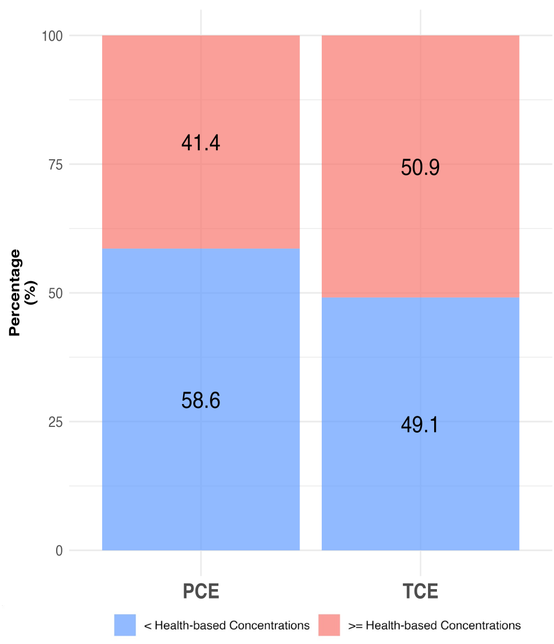

Figure 1. Percentage of sites with maximum PCE/TCE levels over health-based levels

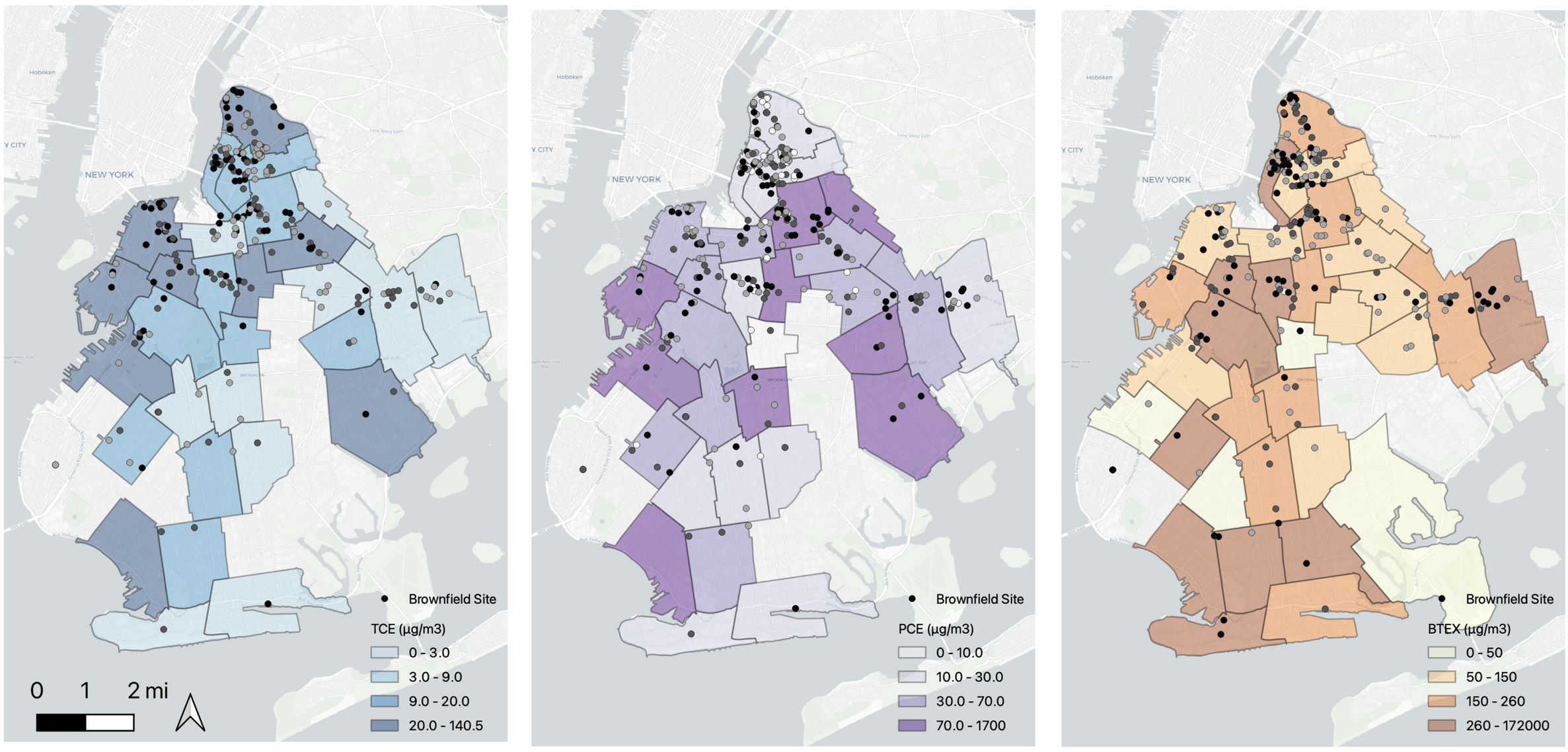

Figure 2. Distribution of New York City brownfield sites in Brooklyn and concentrations for TCE, PCE, and BTEX by zip code, 2011 to 2023

DISCUSSION

Area of Success

- Creating a complete range of methods that can be replicated
- Establishing available databases for future use
- Preliminary mapping of locations and clusters of chemical levels for future data exploration and analysis

Major Challenges

- No workable data repository – poor website setting for downloading; time-consuming process with manual operations
- Tedious process of data conversion from PDF files – hard to locate lab reports within thousands of pages for each site
- Heavy workload in data extraction and cleaning – codes customization and standardization for labs with different formats

Limitations

Due to limited time and huge workload

- Lack of accuracy checking (only checking randomly)
- Vague distinction between missing and ”not detected” values
- Incomplete analysis on site characteristics

RECOMMENDATIONS

- Establish more accessible online database with prompt updates.
- Continue to prioritize soil vapor assessments as part of overall evaluation of brownfield sites for cleanup and redevelopment, particularly for schools and residential buildings.
- Require soil vapor investigations for non-brownfield developments in neighborhoods with high levels of soil vapor contaminants.
- Involve community stakeholders in brownfield development to ensure transparency and equity.

RESOURCES

GitHub:
https://github.com/siyuegao1205/ehs_capstone_nycdoh

Data Source:
https://a002-epic.nyc.gov/app/search/advanced

Scan for full report

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