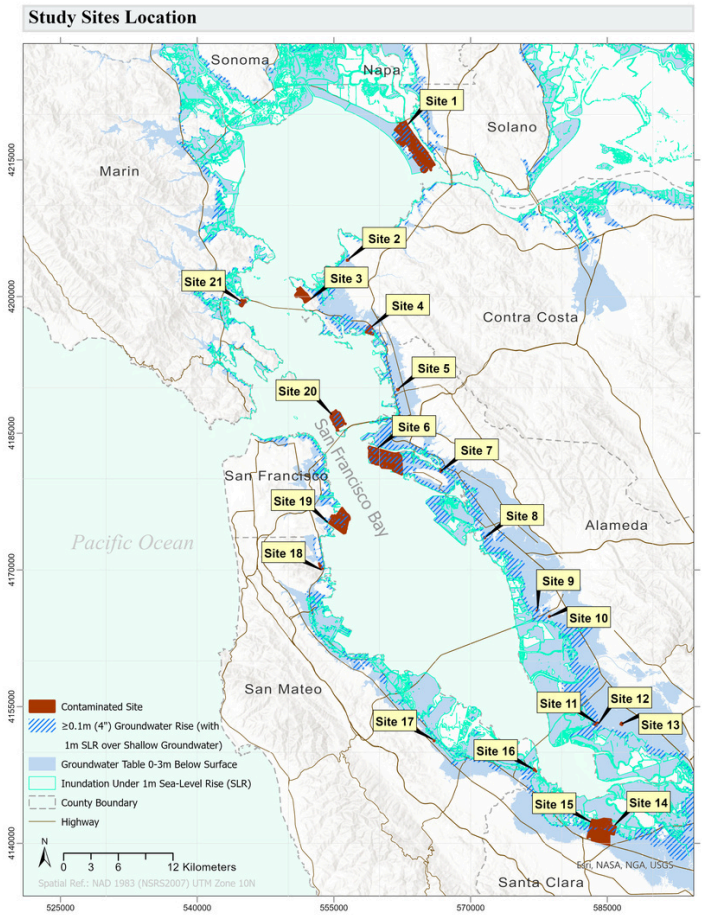
Understanding the Report

Characterizing Contaminated Sites in the San Francisco Bay Region and Their Exposure to Future Sea-Level Rise and Groundwater Flooding

Flooding from sea-level and groundwater rise will mobilize hazardous contaminants buried along the shoreline and increase the potential pathways for public exposure. In this study, we focused on understanding and predicting the widespread potential for volatile organic compounds (VOCs, which can exist as both liquids and gases) to spread from contaminated sites and come into contact with people. We developed a method to serve as a preliminary screening tool for prioritizing contaminated sites exposed to rising and increasingly saline groundwater. To assess the priority of each site, we generated a four-digit code that uses indexed values from 1-9 to represent ranges in social vulnerability, contaminant characteristics, site characteristics, and infrastructure characteristics.



Site 1: Mare Island Naval Shipyard
Site 2: Reaction Products
Site 3: Richmond (Point Molate) Naval Supply Center (NSC)
Site 4: Zeneca Richmond AG Products
Site 5: Berkeley Industrial Complex
Site 6: Alameda NAS [Naval Air Station]
Site 7: Former J.H. Baxter Facility, Alameda
Site 8: Associated Aerospace Activities, Inc.
Site 9: Electro-Forming Co., Hayward
Site 10: Fujicolor Processing
Site 11: FMC Corporation - Newark
Site 12: Ashland Chemical Co., Newark
Site 13: Safety-Kleen of California Inc.
Site 14: Sunnyvale NIROP
Site 15: Moffett Federal Airfield
Site 16: Romic Environmental Technologies
Site 17: G-C Lubricants Co.
Site 18: VWR Facility
Site 19: Hunters Point Naval Shipyard
Site 20: Naval Station Treasure Island
Site 21: San Quentin State Prison

Site Four-Digit Code

FIRST DIGIT

Social Vulnerability

Criterion #1: CalEnviroScreen 4.0
Criterion #2: BCDC Community Vulnerability Index
Criterion #3: Healthy Places Index

SECOND DIGIT

Contaminant Characteristics

Criterion #1: Contaminant Profile
Criterion #2: Number of Contaminant Classes
Criterion #3: Highest Current Contaminant Concentration
Criterion #4: Persistence of Contaminant

THIRD DIGIT

Site Physical Characteristics

Criterion #1: Depth to Groundwater
Criterion #2: Soil Permeability
Criterion #3: Impervious Surface/Surficial Material Permeability

FOURTH DIGIT

Infrastructure Characteristics

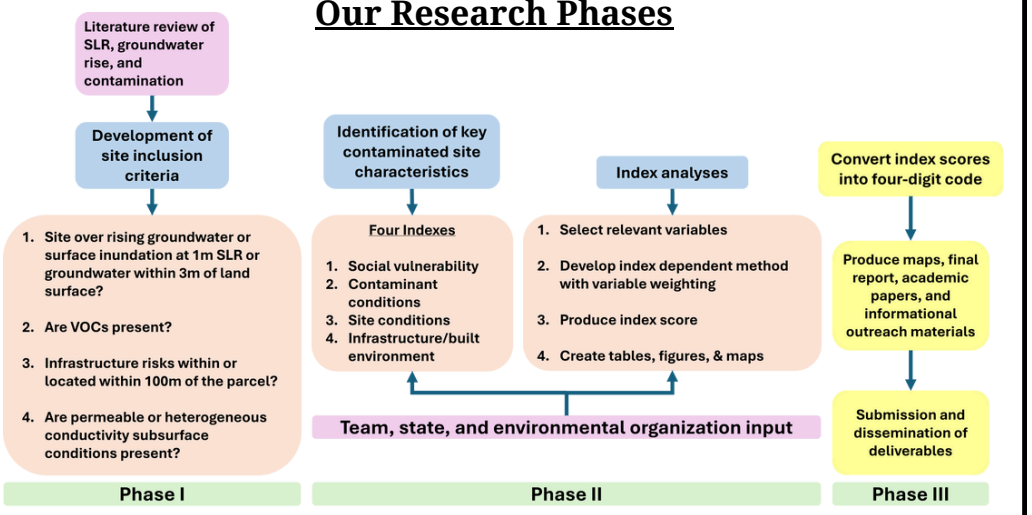
Criterion #1: Contaminant Flowzone
Criterion #2: Sewer Connectivity Model for Potentially Exposed Buildings
Criterion #3: Identifying and Characterizing Vulnerable Buildings

We identified four categories of characteristics most likely to influence the risk of new public health impacts from VOCs. Each category contains multiple criteria that are analyzed across a range of data sources and then converted into an index to produce a single numerical score (1-9). The four scores can be used as a four-digit code to characterize each site.

VOCs present imminent human health threats such as damage to the central nervous system, respiratory system, internal organs, and increased cancer risk. The contaminants can come into contact with people in unexpected ways via underground pipes and foundation cracks, and they can enter buildings such as homes and schools undetected. Our contaminated site screening method can be adapted and replicated in areas where VOCs are present, especially in previously contaminated areas proposed for development. This method, a shared framework based on public data and transparent analysis, can increase alignment among agencies that manage contaminated sites, local governments, and community health advocates.

Research Process & Findings

Our Research Phases



Example of a 4-digit Code

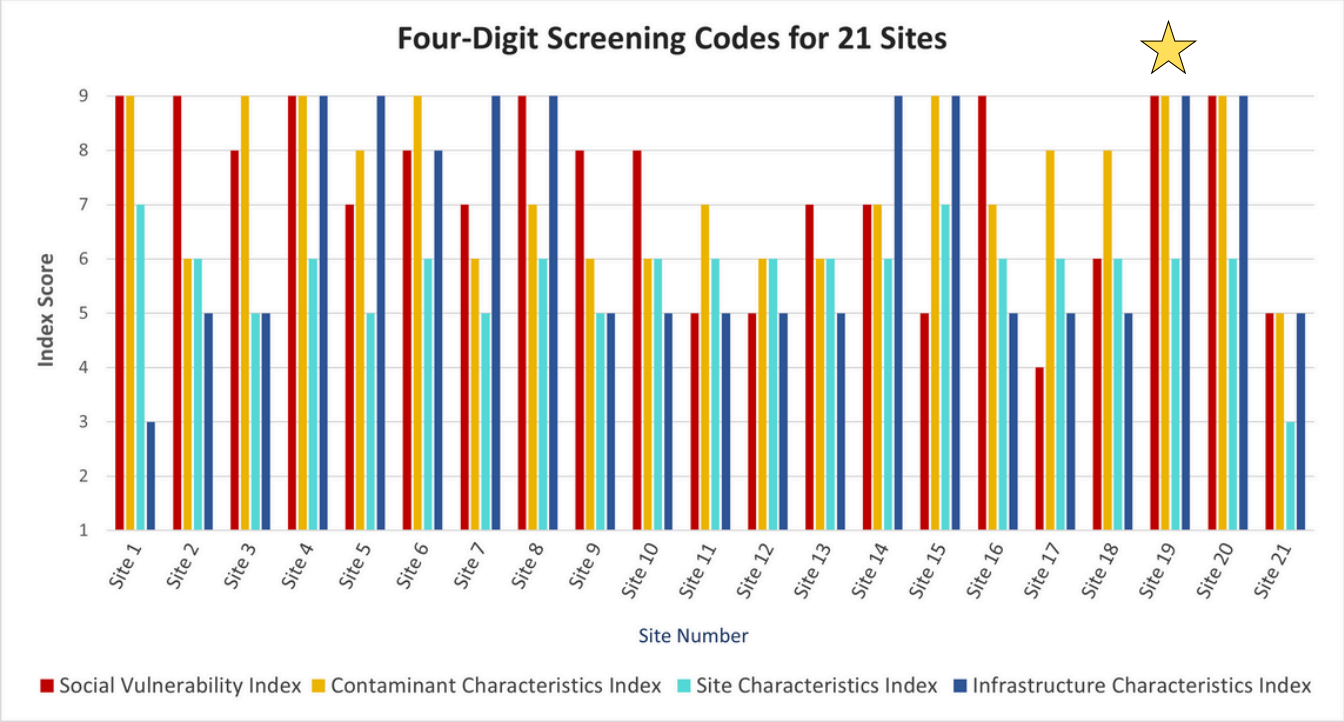
Site 19 (Hunters Point Naval Shipyard):

9 9 6 9 ★

This is an example of a site with high scores. The code shows which characteristics make the site most vulnerable. In this case, social vulnerability, contaminant characteristics, and infrastructure characteristics all scored 9s, indicating this site as a high-priority for further investigation.

We included 21 sites of community concern that met our site inclusion criteria in our study. We used each of the four indexing methods (defined in detail in our report) to produce four scores for each study site. The resulting four-digit site code represents the potential for new public health risks driven by VOC exposure as sea level and groundwater rise. Our results show moderate to high scores, validating community concerns.

The screening method we developed supports new research, encourages clarifications by site managers and owners to address future public health risks, and promotes active and informed dialogue with community advocacy groups. The method addresses the cumulative impact of legacy contaminated sites by framing social vulnerability as a core issue that should drive the prioritization of sites for additional investigation. Our site scoring method allows users to assess the potential for new public health risks in neighborhoods around VOC-contaminated sites and flags sites where there are uncertainties driven by a lack of relevant data. Our method can be adapted and scaled up to the state level or applied in other regions of the US and the world.



The report was prepared by researchers at the University of California, Santa Cruz (UCSC), the University of California, Berkeley (UCB), and Greenaction for Health and Environmental Justice with funding from the California Ocean Protection Council (OPC).