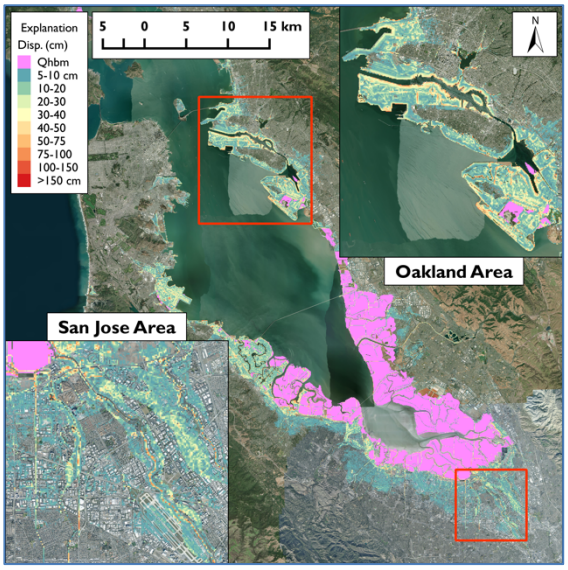
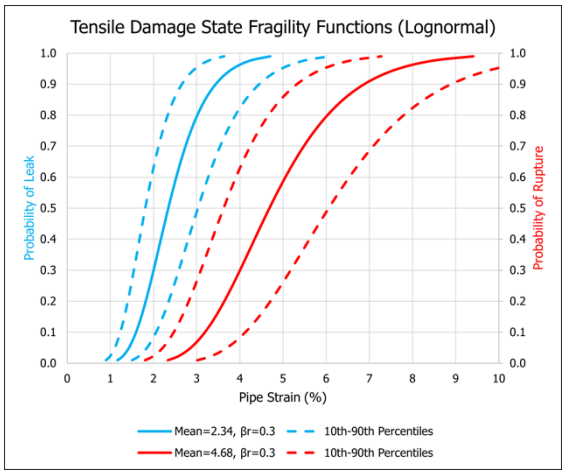
Seismic Safety through Enhanced Risk Management
https://peer.berkeley.edu/openSRA

OpenSRA – Enhanced Liquefaction and Ground Deformation Report

OpenSRA is a new open-source seismic risk assessment software tool for gas utility regulators and owners that will enable them to strategically address challenges posed by the risk from earthquakes. *OpenSRA* includes existing and new methods to assess the risk to buried pipelines from ground displacements due to surface fault rupture, liquefaction-induced lateral spreading and ground settlement, and seismic slope displacement. The pipe strain response to permanent ground displacements is estimated and fragility curves are evaluated to estimate the probability of pipe rupture.



Lateral Spreading Displacement Map



Pipeline Fragility Functions

Results

- New procedure developed to assess liquefaction triggering and lateral spreading at a regional scale.
- Procedures established to assess the following at site-specific and regional scales:
  - Liquefaction triggering
  - Liquefaction-induced lateral spreading and vertical displacement
  - Seismic slope instability and displacement
- Computational finite element model developed to assess the pipe strain response to permanent ground deformations.

Benefits & advantages

- Results compiled into *OpenSRA* to aid in studying earthquake scenarios, prioritizing mitigation efforts, and planning post-earthquake assessments of a buried pipeline system.
- Ability to assess earthquake-induced ground movements at different scales, with appropriate levels of reliability.
- Fragility curves developed for different failure mechanisms for pipelines.
- System-wide fragilities and prioritization of mitigation will provide *greater reliability* of the overall system. A methodical and rational approach to implementing mitigation *increases safety.*

Bain C., Hutabarat D., Bray, J.D., Abrahamson N., O'Rourke T.D., Lindvall S. 2022. Performance-Based Earthquake Engineering Assessment Tool for Natural Gas Storage and Pipeline Systems, Task B - Enhanced Liquefaction and Ground Deformation Report. California Energy Commission. July 2022. *[PEER research report in progress.]*