

Project Profile

Project Name:	Integration of Ground Motions into Induced Seismicity Risk Management in the Kiskatinaw Area, NEBC
Project Number:	ER-Seismic-2022-01
Proponent:	Nanometrics Inc.
Funding Envelope:	Environmental Research—Induced Seismicity
Timeframe:	March 1, 2022 to January 31, 2023

Project objectives

The objectives of the study are twofold:

1. development of regional ground motion models for induced events, which can be used for the assessment of associated hazard in future, and
2. review of the existing magnitude thresholds of traffic-light protocols (TLPs) on the basis of ground motions for effective induced seismicity risk management.

Project approach

The project will investigate the incorporation of ground motions into traffic-light protocols (TLPs) for induced seismicity oversight with a focus on applications in the Kiskatinaw area. The study will consist of the following four phases:

1. Derivation of a ground motion prediction equation and site amplification map for the Kiskatinaw area:
 - Examine regional source and attenuation attributes of ground motions using the compiled data.
 - Use ground-motion simulations to investigate the scaling of ground motion for significant events where empirical data is sparse.
 - Develop a ground-motion prediction equation (GMPE) and a site amplification map for the region.
 - Incorporate recent observed attributes of ground motions and findings into the model.
 - Qualify uncertainties in ground-motion estimates based on residual analysis.
 - Generate shakemaps for notable induced events that were widely felt in the area and compare with felt reports for validation of the GMPE and site amplification map.
2. Definition of perception and potential damage thresholds:

- Investigate the shaking perception threshold for communities near oil and gas operations in the Kiskatinaw area. To this end, local vibrations generated by daily activities and felt induced-seismicity motions will be compared. Shaking perception and potential damage thresholds will be defined in terms of peak ground motions.
 - Conduct a literature review on the potential damage thresholds of ground motions.
3. Review of TLP magnitude thresholds on the basis of ground motions.
 - Generate shakemaps for a number of scenario earthquakes with variable magnitudes across the Kiskatinaw area, using the derived GMPE and site amplification map from Phase 1.
 - Identify the maximum magnitude that is unlikely to exceed the shaking perception and potential damage thresholds from Phase 2 with tolerable exceedance probabilities.
 - Generate the magnitude threshold map for shaking perception and potential damage across the Kiskatinaw area on the basis of peak ground motions and proximity to critical infrastructure and populated communities.
 4. Report and discuss findings.

Project deliverables

The deliverables from this project include the following:

1. Magnitude-threshold maps for perception and potential damage in the Kiskatinaw area for use as guidance and development of effective induced seismicity risk oversight strategies.
2. Final report—containing the following:
 - regional ground motion prediction equation and site amplification map applicable for induced events in the Kiskatinaw area.
 - shakemaps for notable induced events that were widely felt in the area.
 - recommended perception and potential damage thresholds in terms of peak ground motions.
 - review of existing TLPs on the basis of ground motions.