



Impacts of Fuel Releases from the CEI Hub Due to a Cascadia Subduction Zone Earthquake

EXECUTIVE SUMMARY

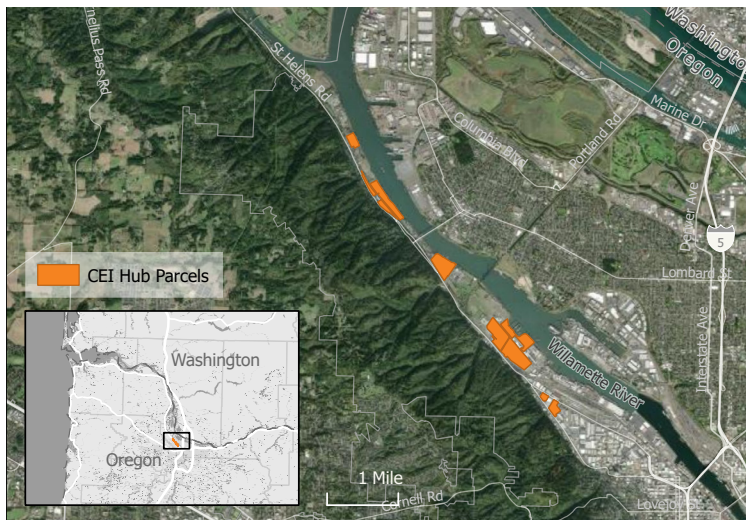
The purpose of this study is to identify the magnitude and extent of potential fossil fuel releases at the CEI Hub from a CSZ earthquake and to evaluate the resulting damages. ECONorthwest, Salus Resilience, and Enduring Econometrics prepared this report for the City of Portland and Multnomah County. For more information about this report, contact: Laura Marshall, Project Manager at marshall@econw.com.

WHAT IS THE CEI HUB?

The Critical Energy Infrastructure Hub (CEI Hub) is a six-mile area in Northwest Portland along the Willamette River (Figure ES-1). There are 10 companies on 31 properties located at the CEI Hub that vary in size from 0.1 to 31.27 acres for a total of 219.85 acres. The CEI Hub facilities are critical to Oregon’s fossil fuel infrastructure – over 90 percent of the state’s liquid fuel supply is transported through CEI Hub facilities, including gasoline and diesel. The CEI Hub supplies all the jet fuel to Portland International Airport. There are over **150 different types of materials** stored at the CEI Hub, most of which are petroleum-based. There are **630 tanks** of varying sizes throughout the CEI Hub holding a combined active storage tank capacity of at least **350.6 million gallons**.



FIGURE ES-1. Location of CEI Hub Properties



Source: Created by ECONorthwest.

WHAT IS THE RISK?

The CEI hub is located on unstable soils that are subject to liquefaction and lateral spreading in an earthquake, and the tanks are vulnerable to seismic activity because many were built prior to modern knowledge about earthquake risk. The proximity of the CEI hub to natural assets, like the Willamette River and Columbia River, and the dense urban core in the City of Portland, make the risk of accident, spill, or major failures due to a seismic event particularly concerning.

A magnitude 8 or 9 Cascadia Subduction Zone (CSZ) earthquake would impact the CEI Hub with ground shaking, liquefaction (soil softening and movement), lateral spread (horizontal soil movement), and landslides. The earthquake would disturb tanks and their contents and tanks that were not built to modern seismic design standards pose risk of failure. Additional fuel releases could occur due to connection failures and other incidental damages. There are containment walls in place on many CEI Hub properties,

however, in many cases, these containment structures will be insufficient to contain the potential cumulative volume of releases from multiple tank failures that would occur in a CSZ earthquake.

In total, 397 tanks could release stored materials as a result of the CSZ earthquake.¹ **The total potential releases from the materials stored in tanks at the CEI Hub range from 94.6 million to 193.7 million gallons** (Table ES-1). Approximately 57 percent of the total potential releases would be released onto ground and 43 percent have the potential to flow into the Willamette River. The estimates of fuel releases from the CEI Hub are the same magnitude as what was released in the Deepwater Horizon spill of 2010 — the largest oil spill in U.S. waters to date.

WHAT WILL HAPPEN IF FUELS ARE RELEASED?

Releases of fuel from the CEI Hub into the air, ground, and water would pose threats to the resources near, downstream, and downwind of the facilities. The fuel releases are likely to cause explosions and fires which pose immediate threats to people on-site at CEI Hub facilities and on adjacent properties. A petrochemical fire poses significant risk to the surrounding areas because containment and suppression may not be possible in the aftermath of the earthquake. If the fire spreads to other properties there are very large threats to human life, safety, physical structures, and natural resources. The fumes from fires and chemical materials will also create health hazards for those who are exposed. People who are in the immediate area as well as emergency responders and clean-up personnel are most at risk from high exposure levels.

The fuel that is released into the Willamette River will behave differently depending on the type of material released. Light and medium oils, such as gasoline and diesel, float in water and will travel downstream until they are contained or evaporate. Heavier fuels will sink and travel as sediment in the river. The further the fuels travel in water, the more environmental resources they will degrade, and more properties will be impacted by oiling. The Lower Willamette River and Lower Columbia River provide habitat to an abundance of species that could be affected by fuel releases. The rivers are also transportation channels, and fuel releases would cause closures for clean-up, which would result



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in economic losses for the navigation industry as well as cut off supply chains from the river when they are critically needed after the earthquake. Harms to natural resources would also result in a loss of cultural resources that are of particular importance to Tribal populations for subsistence, transportation, commerce, and ceremonial purposes.

WHAT WILL BE THE DAMAGES AND COSTS OF FUEL RELEASES?

The minimum costs to society of potential fuel releases at the CEI Hub range from **\$359 million to \$2.6 billion** (Table ES-2). Because not all costs were monetized, this range of costs represents only a portion of the total costs likely to be imposed on society from fuel releases from the CEI Hub.

These costs do not include any costs caused by an inability to perform earthquake recovery efforts due to fuel shortages. To the extent that fuel scarcity impedes emergency response activities, there will be financial and non-financial costs, including injury

TABLE ES-1. Summary of Total Potential Releases by Location

Spill Location	Number of Tanks with 50–100 percent failure	Number of Tanks with up to 10 percent failure	Volume Released Min (gal)	Volume Released Max (gal)
Ground	269	21	53,882,252	111,183,900
Water (Including potentially in water)	96	11	40,751,753	82,503,352
Total	365	32	94,634,005	193,687,251

Source: Created by Salus Resilience (see Appendix B).

¹ This value excludes empty tanks from the active tanks that could release materials.

Category of Costs	Summary of Costs	Range of Monetized Costs for the Modeled Scenario
Direct Impacts to People	Assuming an explosion occurs, between 0 to 7 people could be killed and 2 to 80 people could be injured. The range of costs for mortality and morbidity are between \$49,000 to \$74.1 million, with an average cost of \$37.1 million.	\$49,000 to \$74.1 million
Impacts to Property	Assuming fuels in the water travel downstream to the Longview Bridge, the potential impact on residential property values is up to \$35.4 million. There is \$2.5 billion in total riverfront property value in the downstream area.	\$11.8 million to \$35.4 million
Impacts to Navigation	A one-week closure of the shipping channel between the I-405 bridge and Longview Bridge would result in additional operating costs for commercial vessels of between \$11.8 million and \$17.8 million.	\$11.8 million and \$17.8 million
Impacts to Fisheries	To the extent that fuel releases reduce reproduction or cause direct mortality to aquatic species there will be a reduction in income to the fishing industry, impacting owners, employees, and suppliers who rely on these funds. Increases in hatchery production would likely be needed, which would result in additional costs.	Not Monetized — Potential for significant mortality to commercial fisheries species and loss to commercial fishing entities
Impacts to Recreation	Average per-trip values of recreation for participants (i.e., consumer surplus) are between \$68 to \$130 per person per day. Recreationalists contribute spending to local economies at an average value of between \$98 to \$478 per trip. Canceled recreational trips due to fuel releases would reduce both value for the participant and economic activity for the businesses that rely on the recreational spending. A one-month closure of the Lower Columbia River and Lower Willamette River for salmonid fishing would result in a loss of consumer surplus of \$3.4 million and a loss of \$3.2 million in direct trip spending.	Not Monetized — Damage to recreational resources that cannot be easily rebuilt, such as fire damage to Forest Park, will result in long-term losses to recreation.
Impacts to Human Health	The health costs of exposure to toxins for nearby people and response workers is \$121 million to \$249 million for both acute and chronic conditions. The primary health costs are increased risk of heart attack, decreases in productivity, and lost workdays. Additional costs would be borne from evacuations and strains on emergency response services.	\$121 million to \$249 million — with potential for additional costs to mental health and non-documented physical health costs.
Impacts to Habitats and Species	Habitats and species would be harmed from fuel releases. The costs of habitat restoration as compensation for habitat injury would require between 175 and 418 acres of wetland to be restored. An additional 39 to 1,219 acres of constructed wetland could be needed to compensate for injuries to bird populations. There is also the potential for compensation needed for aquatic and mammal species that are injured by the event. The expected total costs for habitat restoration are between \$39.7 million and \$304.3 million, depending on whether the spill occurs in the summer or in the winter. Total damages from injury to habitats and natural resources and required compensation are expected to range between \$87 million to \$669 million, depending on whether the spill occurs in the summer or in the winter.	\$87 million to \$669 million
Cleanup Costs	Cleanup costs are projected to be between \$109 million to \$1.4 billion.	\$109 million to \$1.4 billion
Impacts to Cultural Values	Fuel releases in the Willamette River and Columbia River would harm cultural resources that are of particular importance to Tribal populations for subsistence, transportation, commerce, and ceremonial purposes. Impacts to this area would perpetuate historical inequities to a water resource already contaminated as part of the Portland Harbor Superfund.	Not Monetized — Impacts to waterways and aquatic species like salmon would result in large cultural losses.
Impacts to Fuel Prices	Releases of fuel from the CEI Hub would reduce the supply of fuels needed for transportation and commercial activity in Oregon. The effects of the earthquake on transportation infrastructure will alter the demand for fuels. A lack of fuel could constrain emergency response activities. The total economic cost to consumers of the higher fuel prices and reduction is between \$18.8 million and \$120.8 million. The lost value of consumption from fuel scarcity would be \$11.7 million for a three-day period.	\$18.8 million to \$120.8 million — with additional costs from loss of consumption and delays in recovery efforts
Total Monetized Costs		\$359 million to \$2.6 billion


Source: Created by ECONorthwest.

and loss of life. The costs to society also do not include fines, penalties, lost revenue, or equipment replacement costs borne by the CEI Hub operators. Not all costs are able to be monetized due to lack of data, uncertainty, confounding variables caused by the earthquake, and/or difficulty valuing the resource. The costs are based upon a multitude of assumptions and scenarios about the type and magnitude of fuel releases, emergency response actions and timelines, and natural phenomenon like air, water, and fire dispersion — these assumptions are detailed in the full report.

WHO WILL BE LIABLE AND HOW WILL COSTS BE PAID FOR?

The Oil Pollution Act of 1990 (OPA), passed by Congress and signed into law in the wake of the Exxon Valdez oil spill, is the established liability structure to recover damages from oil spills. Under OPA, “Responsible Parties” are liable for removal costs and damages that are attributable to their release of oil. Fuel releases from the CEI Hub could exceed the statutory liability limits established under OPA or deemed an “Act of God” (making the responsible party not liable). For these situations, OPA established the Oil Spill Liability Trust Fund to pay for any excessive or unfunded liabilities.




“Under OPA, onshore facilities like the CEI Hub have liability limits of \$672,514,900 PER SPILL for each responsible party.”



All damages and costs of fuel releases from the CEI Hub report are potentially recoverable under OPA, with the exception of personal injury/wrongful death, which would be potentially recoverable under separate civil action. However, what will actually be paid out to people who are harmed by fuel releases could be less than the full amount that would be required to compensate them for the damage due to transaction costs and inefficiencies. Uncompensated damages may be distributed inequitably across injured parties due to existing structural inequities in the legal system. Uncompensated damages are most likely to occur for claimants with damages that are more difficult to prove.

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