

WAC 173-180

Seismic Compliance for Oil Terminal Operators

What Washington State Requires — and How Powers Engineering Helps You Meet It

A general guide for Operations, Environmental Managers, and Terminal Leaders

The situation in plain English

Washington State requires oil terminal operators to assess the seismic risk of their above-ground storage tanks and demonstrate compliance to the Washington Department of Ecology (WA DOE). This is current law under Chapter 173-180 WAC, Facility Oil Handling Standards — not a future requirement.

The reason is straightforward: a seismic event can cause a storage tank to fail, overturn, or spill. The state wants documented proof that your tanks can withstand the design-level earthquake for your site, and that you have a plan if they cannot.

The good news: this work is well-defined, the standards are clear, and Powers Engineering has direct experience working within these requirements. We understand what the state expects to see in a complete, compliant submittal.

What the law requires

Who it applies to

The seismic storage tank requirements in WAC 173-180-330 apply to Class 1 facilities — those that transfer oil in bulk to or from a tank vessel or pipeline and are located on or near the navigable waters of the state. Class 2 facilities (vehicles and rolling stock used for small vessel fueling) are not subject to these seismic storage tank obligations. If your terminal transfers petroleum products — diesel, gasoline, crude, aviation fuel — in bulk from shore-side tanks, you are almost certainly a Class 1 facility and these requirements apply to you.

Five-year prevention plan (WAC 173-180-630)

Class 1 facilities must maintain a prevention plan, approved by WA Ecology and renewed every five years, that includes a formal risk analysis. WAC 173-180-630(13) requires this risk analysis to address seismic hazard — specifically, it must incorporate the results of seismic inspections required under WAC 173-180-330(4).

Seismic protection measures (WAC 173-180-330)

For tanks built before July 7, 2023, WAC 173-180-330(2) requires one or more of the following seismic protection measures to be designed, installed, and maintained:

- Flexible mechanical devices or sufficient piping flexibility between the tank and connected piping (WAC 173-180-330(2)(a))
- Foundation driven pilings (WAC 173-180-330(2)(b))
- Anchored storage tanks (WAC 173-180-330(2)(c))
- An alternative measure proposed by the facility and approved by WA Ecology — which may include demonstrating the tank meets API Standard 650 (2020) Annex E and section E.7.3 Piping Flexibility (WAC 173-180-330(2)(d))

The API 650 Annex E seismic design evaluation is the most rigorous of these pathways and the one WA Ecology is most familiar with for large tank farm operators. When a facility demonstrates its tanks meet API Standard 650 (2020) Annex E requirements that constitutes an approved alternative measure under option (d) above. This is the pathway PEI delivers. Note that any proposed alternative under option (d) must be submitted to Ecology's Spills Program for review and approval before implementation, with at least 120 days lead time.

The design-level earthquake

The applicable seismic standard depends on when the tank was built. For tanks constructed before July 7, 2023 using the API 650 Annex E alternative pathway, the design earthquake is typically determined per ASCE 7-16, and WA Ecology accepts Seismic Use Group I or II (Risk Category II or III equivalent). For tanks built after July 7, 2023, WAC 173-180-330(3)(b)(ii) explicitly requires ASCE 7-22 at Risk Category III or IV — a meaningfully higher standard. For all tanks, site class must be based on actual on-site soil properties; if no geotechnical report is provided, Ecology will default to the most conservative site class shown on the WA DNR geologic portal, which may be Site Class E rather than the commonly assumed D.

Compliance deadline (WAC 173-180-080)

This is the deadline most operators are not aware of. WAC 173-180-080(d) sets a hard compliance schedule for existing Class 1 tanks: seismic protection measures must be in place within 10 years of the rule's effective date (July 7, 2023) — so by July 7, 2033 at the latest — OR by the next scheduled internal API Standard 653 inspection, whichever comes first.

For most active terminals, the next API 653 inspection is the binding trigger — not the 2033 wall. If a tank is due for an internal inspection in 2026 or 2027, compliance measures must be in place by then, not by 2033. Facilities that wait until they feel the time pressure may find themselves trying to get Ecology approval for an alternative measure (which requires 120 days minimum) on the same timeline as an inspection outage. Starting the evaluation now closes that gap.

What a seismic evaluation checks

When using the API 650 Annex E alternative pathway, the full evaluation includes two components: the Annex E structural checks on the tank itself, and a section E.7.3 piping flexibility analysis to confirm the connecting piping can tolerate expected seismic movement without failure. The structural checks are:

Structural check	What it answers
Seismic uplift & overturning	Will the tank tip? Is additional anchorage needed?
Sliding force	Will the tank slide on its foundation during shaking?
Shell-to-bottom shear	Can the weld at the base handle the lateral load?
Shell compressive stress	Will the shell buckle under combined seismic and hydrostatic load?
Shell hoop stress (hydrodynamic)	What is the maximum safe fill height?
Freeboard / sloshing	How much liquid will slosh, and is there space above it?

The result is a maximum design liquid height — the safe fill level for that tank under seismic conditions. If the tank passes all checks at its current operational fill level, it is compliant. If it does not, we identify what remediation or operational restriction is required.

What WA DOE expects to see

Based on our accepted WA DOE submittals, the state expects:

- A formal engineering report with a PE stamp from a Washington-registered Professional Engineer
- API 650 Annex E and E.7.3 seismic design calculations using recognized software (AMETank output is accepted by Ecology); for existing tanks Ecology references API 650 (2020)
- Site-specific seismic parameters sourced from ASCE 7 mapped values for the facility location
- A clear pass/fail conclusion for each structural check, with max design liquid height identified
- Documentation that the facility's operational fill height stays within the calculated safe limit

Our reports are signed by Gary W. Powers, P.E. with calculations prepared by our certified engineering team.

Why submissions stall with the state

The most common reason WA DOE submissions stall is not that tanks fail — it is that operators submit incomplete packages. Common gaps:

- Reports signed by engineers not registered in Washington State
- Calculations missing the seismic use group determination or site class justification

- Fill heights in the report that do not match operational records
- Missing documentation of secondary containment (relevant to the freeboard / sloshing check)
- Submitting the API 650 alternative measure to Ecology without the required 120-day advance review period — Ecology must formally approve proposed alternatives before they count as compliance

PEI's process is designed to produce a submission-ready package the first time.

How we work — remote, fast, scalable

In most cases, no site visit is required. Here is the typical workflow:

Step	Who acts	What happens
1	You provide	Existing inspection reports, shell UT thickness data, tank as-built information, and current fill height. If data is missing we identify gaps; field mobilization is available if needed.
2	We analyze	API 650 Annex E seismic calculations using AMETank, with site-specific ASCE 7 seismic parameters for your exact facility location.
3	We deliver	Full engineering report with WA PE stamp, calculation appendix, pass/fail conclusions, and operational recommendations. WA DOE-ready.
4	You submit	Report goes into your prevention plan or directly to WA DOE as part of your compliance package.

We can run multiple tanks simultaneously — making this approach especially efficient for operators with large fleets across multiple terminals.

Pricing and scope

Our standard scope for a single-tank API 650 Annex E seismic evaluation can be completed on a fixed price. This includes:

- Review of existing inspection and tank data
- Full seismic calculation (API 650 Annex E + E.7.3 Piping Flexibility, per ASCE 7 and 2021 IBC)
- Engineering report with findings, pass/fail conclusions, and maximum fill height
- Washington State PE stamp
- One revision cycle if WA DOE requests clarification

Not included in base scope: foundation settlement analysis, pipeline flexibility studies, FEA stress analysis, or field mobilization (available at additional cost if needed).

For multi-terminal programs, volume pricing is available. Contact us to discuss a program-level engagement.

Next steps

The next step is simply sharing your tank list and whatever inspection data you have on hand. We will scope the work, identify any data gaps, and can typically get started within the week.

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