WSPA

Holli Johnson
Senior Coordinator NW Region

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Sent via: Email and USPS

Mike K. Harryman M.A.
State Resilience Officer
Officer of Governor Kate Brown
800 NE Oregon Street, Suite 965
Portland, OR 97232

Dear Mr. Harryman:

The Western States Petroleum Association (WSPA) appreciates the opportunity to provide an overview of the standards, pipeline integrity programs, and spill response capabilities the industry utilizes to address seismic risks in the Oregon Critical Energy Infrastructure Hub (CEI). WSPA is a non-profit trade association representing companies that explore for, produce, refine, transport, and market petroleum and petroleum products in five western states including, including Oregon. The CEI consists of refined fuel storage terminals, which is a critical source of more than 90% of the gasoline and diesel in the Oregon market.

The WSPA-represented storage tanks in the Critical Energy Infrastructure Hub are mandated by the U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) to comply with the API-650 standard that it was constructed to and inspected per the API-653 standards. These standards were developed by the American Petroleum Institute (API) for the design/construction and inspection/repair of above ground atmospheric storage tanks.

API sets robust standards for the industry on oil and gas operations and procedures. The standards are designed to improve operational excellence, ensure compliance and safe practices, and mitigate risks. They are developed by industry experts utilizing sound engineering and are continuously reviewed and revised approximately every three years.

Below is an overview of the standards:

API Atmospheric Storage Tanks Standards

API-650 addresses the design and construction of tanks and was amended--API 650 Annex E - Seismic Design of Storage Tanks—to include additional design features to reduce the likelihood of a complete storage tank failure and a release of its entire contents, by focusing on structural stability during a seismic event. The main design factors are diameter, height, product level, and tank anchors.

The design load requirements for the standard are derived from ASCE 7 (American Society of Civil Engineers - Minimum Design Loads for Buildings and Other Structures). ASCE 7 is based on a maximum considered earthquake ground motion defined as the motion due to an event

with a 2% probability of exceedance within a 50-year period (a recurrence interval of approximately 2500 years).

API-653 covers steel storage tanks built to the API 650 standard. It provides requirements for maintaining the integrity of tanks in service, focusing on inspection, repair, alteration, relocation, and reconstruction. The standard provides criteria for determining inspection intervals for both internal and external inspections. Internal inspection intervals are based on tank bottom corrosion rate. Typical internal inspections range from 10 to 20 years but can vary based on a tank's measured corrosion rate.

The storage tanks are inspected per API - 653 and evaluated per API-650 Annex E. Tanks built prior to are not required to be updated per Annex E. If a tank is taken out of service for an internal inspection, the standard recommends an upgrade to meet the current version of API-650.

Pipeline Integrity Program

A robust resilience plan also consists of mitigating risks associated with the pipelines that connect to the storage tanks. WSPA companies are developing geohazards program to mitigate the effects of geohazards, including seismic activities, on pipelines. The focus is on responding quickly and effectively in the event of an incident. Utilizing the U.S. Geological seismic data, which is instantaneously transmitted, companies can immediately isolate at-risk equipment, conduct manned and aerial surveys, and administer pressure tests to verify integrity. These response capabilities are also applied to storage tanks.

The effectiveness of the geohazard integrity programs has been tested by recent events in the U.S. Gulf coast region in response to hurricanes and flooding.

Spill Management

While prevention and mitigation are at the forefront of industry's best practices for storage tanks, a robust spill response in the event of a release is paramount, especially the coordination needed to bring in resources and personnel from out of state. Every company is required to administer a table-top simulation of the response needed to address the worst-case discharge specific to each site every three years.

The response requirements are dictated by the National Incident Management System (NIMS), which is developed and administered by the Federal Emergency Management Agency (FEMA), with coordination from the Coast Guard, EPA, US Forest Service, and the Department of Homeland Security. Coordination and engagement with the Oregon Department of Environmental Quality, Portland Fire Department, and tribal representation is also required.

Emergency response

During any emergency situation, it is imperative that resources and personnel from out of state are able to travel to the state where the emergency is occurring and help carry out the emergency response. In many cases, companies' employees with expertise in emergency response reside out of state. To help carry out the most effective response, the employees need

to be able to enter the state as soon as possible to be incorporated into the emergency response team structure.

Fuel supply disruptions are expected after a significant seismic event.. Fuel supply disruptions may be addressed by the early willingness to issue temporary fuel waivers for fuel standards. Temporary fuel waivers also ensure that emergency vehicles have an available fuel supply.

Thank you for your consideration of WSPA's comments. We welcome any questions or comments you might have. Please contact me at (360) 352-4506 or by email at hjohson@wspa.org.

Sincerely,

cc: Jessica Spiegel, WSPA
Jodie Muller, WSPA

API Standard 650, Annex E: Seismic Design of Storage Tanks

API Standard 650 (*Welded Tanks for Oil Storage*) Annex E addresses seismic requirements for aboveground storage tanks (ASTs). The 12th Ed., 3rd Addendum is the current publication. Standard 650 is one of four of API's major documents covering ASTs (there are about 15 other API publications covering storage tanks, as well).

Standard 650 establishes minimum requirements for material, design, fabrication, erection, and inspection for vertical, cylindrical, aboveground, closed- and open-top, welded storage tanks in various (large) sizes and capacities for internal pressures approximating atmospheric pressure, but a higher internal pressure is permitted when additional requirements are met (see 1.1.13). This standard applies only to tanks whose entire bottom is uniformly supported and to tanks in non-refrigerated service that have a maximum design temperature of 93 °C (200 °F) or less (see 1.1.20).

This standard provides industry with tanks of adequate safety and reasonable economy for use in the storage of petroleum, petroleum products, and other liquid products. This standard does not present or establish a fixed series of allowable tank sizes; instead, it is intended to permit the Purchaser to select whatever size tank may best meet his needs. This standard is intended to help Purchasers and Manufacturers in ordering, fabricating, and erecting tanks; it is not intended to prohibit Purchasers and Manufacturers from purchasing or fabricating tanks that meet specifications other than those contained in this standard.

Annex E provides minimum requirements for tanks subject to seismic loading. An alternative or supplemental design may be mutually agreed upon by the Manufacturer and the Purchaser.

Standard 650, Annex E

Standard 650, Annex E provides a number of design options requiring decisions by the Purchaser; standard requirements; recommendations; and information that supplements the basic standard. This annex becomes a requirement only when the Purchaser specifies an option covered by this annex or specifies the entire annex (or if a regulatory authority codifies it).

E.1 Scope

This Annex provides minimum requirements for the design of welded steel storage tanks that may be subject to seismic ground motion. These requirements represent accepted practice for application to welded steel flat-bottom tanks supported at grade.

The fundamental performance goal for seismic design in this Annex is the protection of life and prevention of catastrophic collapse of the tank. Application of this standard does not imply that damage to the tank and related components will not occur during seismic events.

This Annex is based on the allowable stress design (ASD) methods with the specific load combinations given herein. Application of load combinations from other design documents or codes is not recommended, and may require the design methods in this Annex be modified to produce practical, realistic solutions. The methods use an equivalent lateral force analysis that applies equivalent static lateral forces to a linear mathematical model of the tank based on a rigid wall, fixed based model.

The ground motion requirements in this Annex are derived from ASCE 7, which is based on a maximum considered earthquake ground motion defined as the motion due to an event that is expected to achieve a 1-percent probability of collapse within a 50-year period. Application of these provisions as written is deemed to meet the intent and requirements of ASCE 7. Accepted techniques for applying these provisions in regions or jurisdictions where the regulatory requirements differ from ASCE 7 are also included.

The pseudo-dynamic design procedures contained in this Annex are based on response spectra analysis methods and consider two response modes of the tank and its contents—impulsive and convective. Dynamic analysis is not required nor included within the scope of this Annex. The equivalent lateral seismic force and overturning moment applied to the shell as a result of the response of the masses to lateral ground motion are determined. Provisions are included to assure stability of the tank shell with respect to overturning and to resist buckling of the tank shell as a result of longitudinal compression.

The design procedures contained in this Annex are based on a 5 % damped response spectra for the impulsive mode and 0.5 % damped spectra for the convective mode supported at grade with adjustments for site-specific soil characteristics. Application to tanks supported on a framework elevated above grade is beyond the scope of this Annex. Seismic design of floating roofs is beyond the scope of this Annex.

Optional design procedures are included for the consideration of the increased damping and increase in natural period of vibration due to soil-structure interaction for mechanically-anchored tanks.

Tanks located in regions where *S*1 is less than or equal to 0.04 and *SS* less than or equal to 0.15, or the peak ground acceleration for the ground motion defined by the regulatory requirements is less than or equal to 0.05*g*, need not be designed for seismic forces; however, in these regions, tanks in SUG III shall comply with the freeboard requirements of this Annex.

Dynamic analysis methods incorporating fluid-structure and soil-structure interaction are permitted to be used in lieu of the procedures contained in this Annex with Purchaser approval and provided the design and construction details are as safe as otherwise provided in this Annex.

This annex defines an active fault as a fault for which there is an average historic slip rate of 1 mm (0.4 in.) per year or more and geologic evidence of seismic activity within Holocene times (past 11,000 years).

Annex E Specifically Addresses:

Site ground motion — Spectral lateral accelerations to be used for design may be based on either "mapped" seismic parameters (zones or contours), "site-specific" procedures, or probabilistic methods as defined by the design response spectra method contained in this Annex. A method for regions outside the USA where ASCE 7 methods for defining the ground motion may not be applicable is also included.

- Mapped ASCE 7 Method
- Site-Specific Study
- Sites Not Defined by ASCE 7 Methods
- Probabilistic Site-Specific MCE Ground Motion
- Site-Specific Spectral Response Accelerations
- Modifications for Site Soil Conditions
- Seismic Design Factors
- Anchorage of tanks
- Movement of liquid within the tank

See Standard 650, Annex E for the specific design and materials requirements and engineering calculations.