# Review of Japan's Law Framework

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Japan is located near multiple tectonic plate boundaries including the Eurasian Plate, the Philippine Sea Plate, and the Pacific Plate, contributing to an extensive history of seismic events (Hasegawa, 2013). The Great Kanto Earthquake of 1923 destroyed around 450,000 buildings and left more than 140,000 people dead or missing, and in 1924 Japan instituted the first requirements for structures to consider seismic forces, the "first such requirement in the world" (Hasegawa, 2013, p. 12). Since 1924 Japan has instituted and continually updated a framework of laws designed to facilitate national and local resilience to earthquakes, fires, and winter storms, constantly learning from disasters to improve those regulations.

This review attempts to summarize Japan's legal framework for the Oregon DEQ's SB1567 rulemaking process. However, many of Japan's laws are not available in English, so, when available, presentations or other documents including academic sources which explain the laws are used. Additionally, none of the ministerial ordinances and industrial standards to which Japan's laws refer are reviewed in this document due to a lack of available English translations or due to their exceeding the scope of Portland State's policy review, leaving us with an incomplete picture of performance standards and other geotechnical expectations. Despite these limitations, this review articulates Japan's framework of structural seismic resilience, fire safety, and response capability requirements that have proven highly effective at protecting lives during seismic events. This report begins with a high-level summary of the risk context of Japan before moving through each of those three components: structural seismic resilience, fire safety, and response capability requirements. The report then concludes with an examination of some known gaps and ongoing efforts to eliminate them.

## Japan's Risk Context

As mentioned, Japan has a long history of seismic events which have caused extensive harm to people and damage to property. Two future seismic events are of

particular concern, the risk of a megathrust earthquake from the Nankai Trough, which is anticipated to occur in the first half of the 21st century, and the risk of an inland earthquake underneath Tokyo. These earthquakes are each estimated to "damage between 940,000 to 2,400,000 buildings and cause 30,000 to 320,000 deaths" based on calculations made in 2012 (Hasegawa, 2013, p. 184). Many of Japan's petrochemical facilities are located on constructed islands in coastal regions which are susceptible to significant liquefaction and tsunami risk. Known colloquially as "combinatos," these islands have multiple chemical companies co-located with sometimes dozens or more aboveground tanks on any given island (See Figures 1 and 2).

Despite these significant risks, the success of Japan's seismic resilience efforts showed during the M 9.0 Tohoku Earthquake in 2011. In an analysis of damage to industrial facilities following the Tohoku Earthquake, Krausmann and Cruz (2013) found that although the earthquake was the "dominant accident trigger" at industrial facilities, "it caused mostly incidents of minor severity in contrast to the tsunami impact which was severe" (p. 815). Since the Tohoku Earthquake, Japan has been implementing a two-level hazard system for earthquakes and tsunamis to ensure that industrial facilities remain in operation or are quickly repairable following earthquakes with a recurrence rate less than 1,000 years, which includes magnitude 9 megathrust earthquakes (Krausmann & Cruz, 2021). To accomplish this, facilities adopt both "hard and soft countermeasures" and assume that "some level of damage is inevitable" (ibid., p. 13).

**Figure 1: Part of the Kawasaki Port, Source: Google Maps**

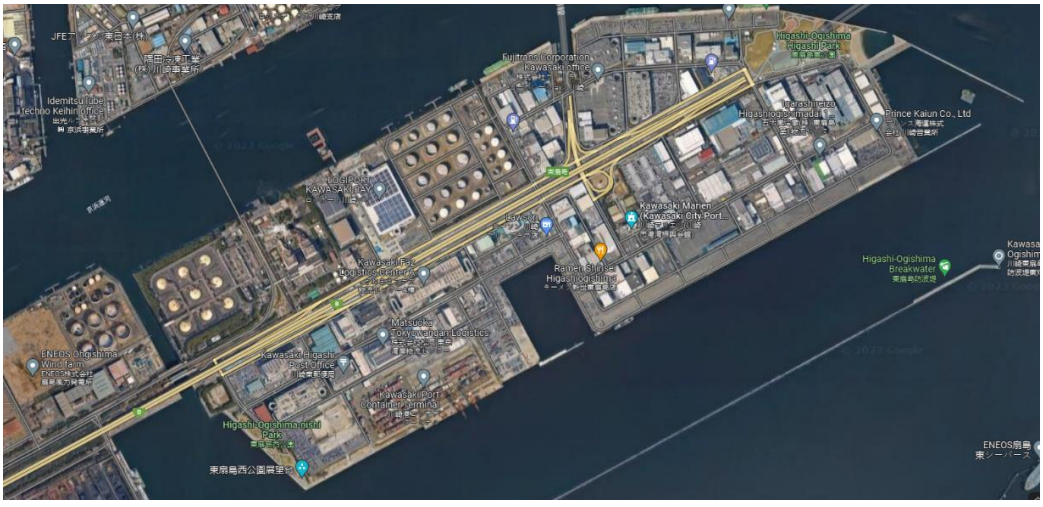

**Figure 2: Combinato in Sakai Osaka, Source: Google Maps**


**Facility Seismic Resilience**

Petrochemical facilities in Japan are subject to myriad technical standards established by the Ministry of Economy, Trade, and Industry (METI), as well as the Japanese Industrial Standard (JIS), which are either unavailable in English or fall beyond the scope of Portland State's law and policy review. The High-Pressure Gas Safety Law (HPG Law), for instance, requires that high-pressure gas (HPG) storage and manufacturing facilities use only equipment created by accredited manufacturers and that meets the technical standards of METI. The HPG Law provides the relevant regulatory authority with the ability to require repair, improvement, relocation, or shutdown of plants if they are in violation of the required standards. As for soft-mitigation measures, the LPG Law requires that LPG facilities draw up a hazard prevention rule and institute a variety of safety policies and personnel positions over and above those required by the Fire Service Act. Facilities storing petrochemicals at atmospheric pressure in aboveground storage tanks must meet METI and JIS ordinances and standards but are not subject to the

same degree of requirements in terms of accredited manufacturing set by the HPG Law.

For more general purposes and building stock, Japan has the Building Standards Act and the Act for Promotion of Seismic Retrofitting of Buildings. The Building Standards Act sets requirements for the quality of materials used in construction according to the JIS, land use zoning requirements, fire prevention requirements, and hygiene and accessibility requirements. In combination with the JIS and other ministerial ordinances, the Building Standards Act is the fundamental building code for all structures in Japan. The Act for Promotion of Seismic Retrofitting of Buildings stipulates special structures (i.e., buildings used by many people, critical facilities, those buildings close to emergency transportation routes, etc.) are "obliged to make sincere effort at seismic assessment and seismic retrofitting," with a deadline for all large buildings and critical facilities to have undergone a seismic assessment by 2015. This Act provides local governments with the authority to require retrofits for buildings at risk of collapse during an earthquake and fining owners for failure to do so. Japan's initiatives to promote seismic retrofitting apply to many of the administrative buildings associated with industrial facilities, even if not petrochemical storage containers themselves.

The most recent addition to Japan's laws which relates to the seismic resilience of facilities is the Basic Act for National Resilience, which "requires the adoption of comprehensive countermeasures to ensure that major industrial parks remain in operation following large earthquakes and tsunami" (Krausmann & Cruz, 2021, p. 13). The law articulates that industrial facilities must "develop their understanding of and interest in the significance of national resilience and endeavor to offer cooperation with measures concerning national resilience," and the law supports initiatives including the promotion of "countermeasures against collapse" and other forms of building failures. Cruz (Verbal Communication, January 17, 2023) reports that companies negotiate with the government to establish a timeline for their conducting of vulnerability assessments and mitigation plans. For example, the Kawasaki Port has a 30-year plan as it is so large that the investments needed are immense and cover hundreds of tanks. The Kawasaki Port facility owners are developing plans to see which portions of the port can go offline for a few years at a

time to conduct mitigation efforts. It is worth noting that the Kawasaki Port and the performance criteria it is expected to meet cannot be directly equated with the CEI Hub's present vulnerability-state or the mitigation actions that will be necessary and as such the example of a 30-year timeline for the Kawasaki port is not directly transferable to the CEI Hub.

**Fire Safety and Prevention**

Alongside requirements for building fire-resistance classifications established by the Building Standards Act, most of Japan's fire prevention requirements are outlined in the Fire Service Act. This act aims to "prevent, guard against, and suppress fires… and to reduce the damage arising from fires or disasters such as earthquakes." Facilities must ensure that the storage and handling of hazardous materials is done in accordance with the technical standards of ministerial and cabinet orders and enables the regulatory authority to temporarily halt plant operations or otherwise require that facilities come up to the appropriate fire codes.

To ensure safe facility operations, a Hazardous Materials Safety Supervising Manager who has the appropriate accreditation must be installed at the facility with the necessary support staff. Facilities must establish "fire prevention rules," undergo periodic inspections, and establish a "fire defense force." Much like the U.S. and Oregon Community Right to Know and Protection Acts, Japan's Fire Service Act establishes requirements for reporting and responding to hazardous materials releases and for the subsequent investigation of those releases. Finally, special buildings and hazardous facilities must install and operate the appropriate "equipment used for fire defense, a water supply for fire defense, and facilities necessary for fire extinguishing activities." The Act on the Prevention of Disasters in Petroleum Industrial Complexes, outlined in the following section, expands the resource and design requirements for petrochemical facility fire safety.

**Emergency Response Capabilities**

The Act on the Prevention of Disasters in Petroleum Industrial Complexes, as described by Japan's Extraordinary Disaster Management Office's (2017; alternative translation: Extreme Disaster Management Headquarters) presentation, establishes

an "extended, comprehensive, and integrated disaster risk reduction system" (p. 14.) Facilities must maintain a risk reduction plan, and co-located facilities must work together to "set up a private disaster protection organization" and provide it the "materials and equipment" necessary to respond to fire or spills at the industrial complex (p. 14). This joint disaster response organization must have response resources on-site including chemical fire response trucks with foam capabilities, a high-capacity foam storage and distribution system, long distance water-feed systems, oil booms, and oil recovery vessels.

In addition to supporting this joint disaster response organization, facilities must abide facility layout requirements which ascribe minimum distances between zones on the industrial facilities (e.g., minimum distances between manufacturing, administrative, and storage zones). Each zone has requirements for fire access routes and vacant areas for staging firefighting operations. Facilities must install specific disaster protection equipment including multiple layers of secondary containment, outdoor water storage and distribution facilities, and emergency reporting equipment (i.e., emergency radios).

Facilities must also install a disaster protection manager and adopt disaster risk reduction policies and operational procedures including sufficient financial support, human resources, and employee complaint/problem reporting channels to enable those risk reduction efforts to operate effectively. Personnel must have the appropriate training and be made aware of the risks associated with the chemicals stored at their facility as well as what to do in the event of a release.

Japan's Basic Act for National Resilience provides additional support for the investment by industry and local and national governments into response capabilities. This includes initiatives to protect human life during disasters such as evacuation and swift rescue operations, disaster victim support, support for personnel and technology, and the promotion of disaster education and learning from past disasters. The law states that "advance preparation is necessary to ensure that sources, such as personnel, materials and funds, are [ready] to be allocated intensively on a large scale to areas with high priority" in the first 72 hours following a large-scale disaster.

**Gaps and Additional Efforts**

Scholars have noted continued gaps in Japan's disaster reduction efforts at petroleum complexes. These include the "need for better preparedness of local residents" and more and better risk communication from officials (Krausmann and Cruz, 2021, p. 13); the need for better communication plans and systems for when telephones are not working following a disaster to hasten response operations (Krausmann & Cruz, 2013); and the continued occurrence of domino effects and fires spreading within and between facilities due to their close proximity (ibid.).

These gaps and others are the focus of passages in the Basic Act for National Resilience, which aims to support swift recovery and reconstruction efforts following disasters, increasing "the power of local residents so that they can protect themselves," and striving for substitutability in and distribution of critical infrastructure and other critical social functions to minimize the societal risks arising from natural disasters.

## References

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