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Damage of oil storage tanks due to the 2003 Tokachi-oki earthquake and revision of design spectra for liquid sloshing

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ABSTRACT The 2003 Tokachi-oki earthquake ($M_w=8.0$) caused the severe damage to oil storage tanks such as tank fires, submergence of floating roof, and overflow of large amount of oil, due to large liquid sloshing more than 3 m excited by the long-period strong ground motions. According to the Japan fire service law for the maximum sloshing wave height at that time, the velocity response spectrum at a period of sloshing was about 1 m/s. Considering both predicted spectra at petroleum industrial complexes for earthquakes with maximum expected magnitude in each seismotectonic zone and damage pattern of oil storage tanks at Tomakomai, we proposed design spectra for liquid sloshing of oil storage tank in Japan by introducing the correction coefficients as a function of period and source region. The design spectra were adopted in the revised Japan fire service law enforced on April 2005.

Key words: Tokai-oki earthquake, Oil Storage tank, liquid sloshing, seismotectonic zone, design spectrum

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