Necessity of Monitoring the Sea Level and Temperature near the NPP site

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1. Introduction

Twenty units of Nuclear Power Plant(hereinafter NPP) are operating and six units are under construction in domestic regions. In particular, Kori unit 1 has been operating for over 30 years. All of the interior NPP are located in coastal areas and use the sea water for the cooling system. Therefore, the change of sea level and temperature could directly or indirectly affect the safety of NPP.

At the stage of the construction, the design basis sea level and the temperature of sea water are estimated and the safety of a NPP is confirmed. Because of the change of the coastal bathymetry and the shoreline and climate change after the construction of NPP, however, the possibility change in the sea level and temperature is higher. Thus, the continuous monitoring data of the sea level and temperature near the NPP site are required for re-evaluating the design basis flood and the temperature of sea water.

In this paper, the necessity on monitoring the sea level and temperature which are the key factors for the design basis flood and the temperature of sea water is reviewed.

2. Major Factors for the Change of Sea Level and Temperature

This chapter describes the principle parameters as well as the change of coastal profile and global climate which may affect the sea level and temperature near a NPP site.

2.1 Coastal Profile Change

IAEA Safety Standards Series No. NS-G-3.5[1] recommends that the change of coastal profile should be considered for re-evaluating the flood hazard with time and verifying the design basis flood.

2.2 Global Climate Change

In recent years, results from monitoring the sea level and temperature around Korea peninsula notified that climate change may have occurred. The rise of both the sea level and temperature is an important factor related with the determination of design basis flood and the temperature of sea water. Both IAEA Safety Standards Series No. NS-G-3.5[1] and IAEA-TECDOC-1341[2] recommend that parameters related with design factors such as the sea level and temperature and others should be reviewed. Also IAEA Safety Standards Series No. NS-R-3[6] states that the characteristics of the natural and human induced hazards as well as the meteorological and hydrological conditions of relevance to the nuclear installation shall be monitored over the lifetime of the nuclear installation. This monitoring shall be commenced no later than the start of construction and shall be continued up until decommission.

3. The Impact on the Safety of NPPs with the Change of Sea Level and Temperature

This chapter explains how the change of sea level and temperature may affect the design basis flood and the temperature of sea water evaluated at the stage of construction and operation of NPPs for the safety.

3.1 Coastal Profile Change

The activity such as the reclamation work, the construction of sea-dike and others at the coastal area highly affect the tidal current and the sea level[4]. The Maximum High Water Level(M.H.W.L) recorded from 1962 to 1999 at the Mokpo harbor showed the change of sea level before and after construction of the Youngsan River sea-dike in 1981, the Youngam seawall in 1991 and the Keumho seawall in 1994 [5](Fig. 1).

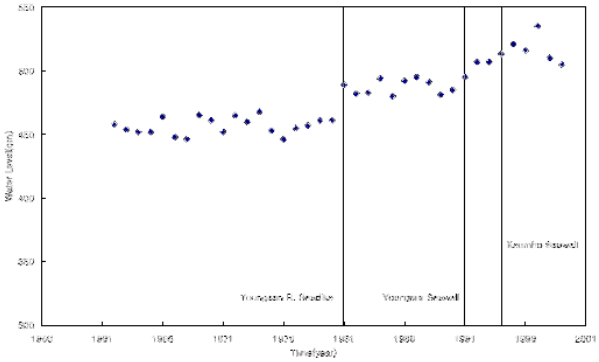


Fig. 1. Trend of M.H.W.L at Mokpo Harbor(modified from Ref. [5])

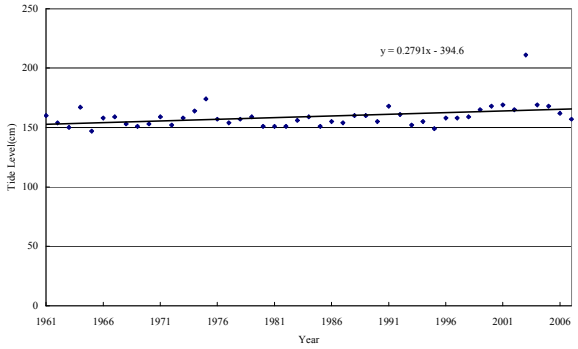
If those works are done near the NPP site, they may affect the rise of the sea level. Therefore, in verifying the design basis and reviewing the safety periodically, the coastal profile change needs considering.

3.2 Global Climate Change

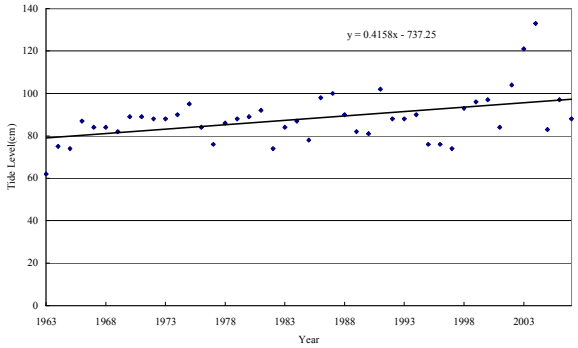
The re-evaluation for the flood hazards and the recirculation of discharged hot water is performed in the periodic safety review for domestic operating NPPs.

The long-term observation data of the sea level from a National Observatory(the distance between NPP site and station is actually very far, for example, the distance between reference tidal station and NPP site is about 34km from Busan and 21km from Ulsan to Kori, about 70km from Mokpo and 62km from Gunsan to Yeonggwang, about 38km from Pohang and 24km from Ulsan to Wolsung, and about 55km from Mukho and 46km from Hupo to Uljin) correlated to the NPP site was conservatively adjusted and used in the safety evaluation. The reference station for monitoring the temperature of sea water also is located far away from the site(for example, Uljin site uses the temperature data recorded from Jukbyun beacon station which is about 7km from site, Shin

kori 1,2 uses the temperature data from Ulsan and Shin kori 3,4 uses the temperature data from Busan and Ulsan).

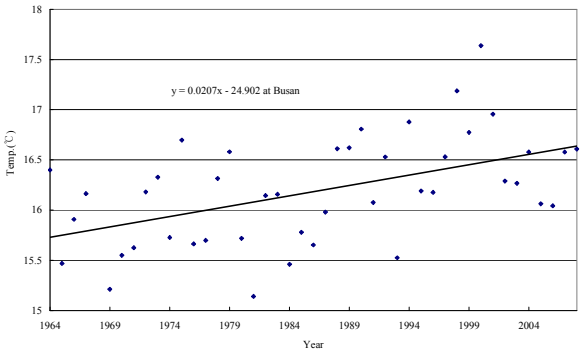


a) Extreme highest tide level in Busan(1961-2007)

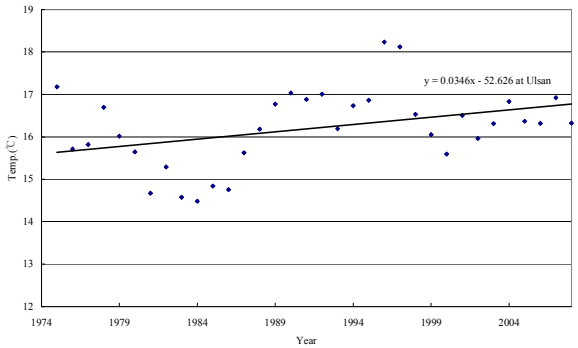


b) Extreme highest tide level in Ulsan(1963-2007)

Fig. 2. Trend of annual extreme highest tide level at each station(modified from Ref.[6])



a) Mean sea temperature in Busan(1964-2008)



b) Mean sea temperature in Ulsan(1974-2008)

Fig. 3. Trend of annual mean sea temperature at each station(modified from Ref.[6])

The recently published monitoring results show that the increase rate of the sea level(Fig. 2) and temperature (Fig. 3) is different from each monitoring site. Thus, for the data of sea level and temperature recorded from the National Station, which is located near the NPP site, and used to estimate the design basis flood and the temperature of sea water, its applicability for the tide and sea temperature conditions of a NPP site needs to be reviewed. If necessary, the sea level and temperature should be continuously monitored at each NPP site.

4. Conclusions

Since all of the interior NPPs use the sea water as the cooling water, they are located at the coastal area. Therefore, the flood and the temperature of cooling water are usually an issue in terms of safety of NPPs.

The safety margin has been taken into the Probable Maximum Height Level of flood and the recirculation assessment during the review of the documents submitted for construction permit(CP), operating license(OL) and periodic safety assessment. In addition, it is founded that the sea level and temperature are monitored at the intake structure to support the operation at all of NPPs.

Nevertheless, since the recent researches show that the sea level and temperature change with the coastal profile and climate change, the effect of its change may be extensive.

If the long term monitoring data, which are recorded from the National Station and reflects the climate change, uses to re-evaluate the design basis flood and the temperature of sea water for the NPP site, its applicability needs reviewing. When necessary, the continuous and systematic monitoring for the sea level and temperature at the NPP site may be require.

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