Review of External Event Considered of Each Licensing

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1. Introduction

The development of Nuclear power plant has several license stages to be followed. Those stages are act as a holding point, which is to ensure the risk on health and safety and to ensure adequate demonstration of safety and compliance with legal and regulatory requirements.

IAEA expressed in their guidelines recommends 5 steps of stage, started with siting and site evaluation, design, construction, commissioning, operation, decommissioning, and release license[1]. US-NRC recommends either way, they proposed two different licenses (1) multi step license, (2) combined license.

The siting process for a nuclear installation is generally consists of investigation of a large region to select one or more preferred candidate sites, followed by a detailed evaluation of those candidate sites[2].

An example on Fukushima accident showed how disastrous the external events imitate the failure of systems and components. Even though the site was selected as the most suitable site with low probability of hazard, but risk cannot be eliminated and there is always a possibility of external hazard even very small.

The U.S. Nuclear Regulatory Commission (NRC) agrees with the IAEA premise that vigilant oversight and ongoing reviews are essential in ensuring safety throughout the life of the plants.

2. External Hazard Analysis Related to Licensing

The licensing flow is expressed the figure below. This license flow is not binding; some countries have adopted and modified it in conformance with their own regulation and law.



Figure 2. Two types of US NRC licensing

United States based on their long experienced develop two types of license process developed Combined License (COL) and Multistep License (CP/OL), as depict below.

Site evaluation is conducted to investigate potential

hazard of the site characteristic that is driven by natural events and human induced events. Normally, the site evaluation is included to license of construction permit.

However, The hazard analysis is abide process, firstly performed during site selection to show suitability of site against hazard arising from any potential threat, recommendation and decision as a result from the site evaluation, should be the basis of decision on the next license stages, and of further evaluation when necessary.

3. Methodology

In this paper is emphasize on the license process recommended by IAEA, due to the majority of countries are the member's. The external hazards compose not only derived from natural hazard, but also risk from human induced.

3.1 Site Permit

Obviously this stage is the first time to perform site evaluation cooperated with hazard evaluation, and criteria for selecting is composed of the criteria related to safety and non-safety concern. Site evaluation is the process that extends from (a) the last stage of the siting process to (b) the detailed assessment of the selected site to confirm its suitability, its characterization and derivation of the site related design bases for the installation.

The purpose of performing siting process in this site permit is to investigate the acceptability and suitability of site to accomplish the predefined criteria

In order to perform siting process, IAEA uses term of exclusionary and discretionary criteria[3] on screening process, another term also applicable such exclusionary, avoidance, and suitable criteria by EPRI. General process of siting process is shown on the following figure 3. The hazard analysis result will be utilized for designing the plant corresponds to particular hazard that needs to modify. As loads and load combination input to Design Basis Criteria.



Figure 3. Screening Process of Siting Process

One example; load from aircraft hazard such mass,

heat, over-pressure, load time diagram which is used to design inner structure, vibration. Impact also generate explosion, which load should be considered are pressure wave, missiles, projectile, velocity as well.

3.2 Construction Permit

The site evaluation and assessment that have begun from the previous stage still have to be continued after the start of construction and before the operation of the plant to complete and refine the assessment of site characteristic. The site evaluation conducted during construction permit has to assure that the analysis from previous licensing confirmed the site as acceptable.

Investigation and monitoring for external events are performed, for example, such meteorological and hydrological events, seismic hazard event. All external event still continue to be evaluated, and any a change of the original design bases may lead to a significant impact on the design and, consequently, to important hardware modifications. A changing in the original design bases may be made for a new external hazard at the site or a change in the regulatory requirements regarding the consideration of particular hazard and design installation.

3.3 Operating Permit

The long operating lifetime of 60 years[4] and the new significant development of technology, safety standard and regulation are developed and some lesson learned been grab from operating experience or even accident experience are emphasize to improve the safety of utilizing the nuclear power generation and improve the methodology on assessing due to past obstacle to ensure safety of people and environment.

The objective to conduct site evaluation or monitoring of hazard is to determine the adequacy of protection, the prevention and mitigation action of the NPP against internal and external events by performed Pperiodic Safety Review (PSR) that should be carried out at regular interval, every 10 years. Table 1 shows the list of hazard subject to be monitored.

Table 1. External event to monitor during operation

External Event		
Natural	Human Induced	
 Flood, (including tsunamis) High wind, including tornadoes Meteorological hazards (extreme temperatures, extreme weather conditions, high humidity, drought, snow, buildup of ice) Hhydrological hazards (extreme groundwater levels, searches) Seismic hazards Volcano hazards Lightning strike 	 Aircraft crashes, external missiles Explosion Electromagnetic or radio frequency interference Vibration Traffic Fire Toxic and/or corrosive liquids and gases 	

The relevant of performing re-evaluation of site is to compare among current standard, plant condition, and site characteristic. Regarding the tsunami in Japan, the Kori site is equipped with sea wall with 10 m high to prevent wave propagation of tsunami's as protective measures.

3.4 Decommissioning Permit

Irrespective of the decommissioning strategy chosen, it is necessary to ensure the protection of workers and the public. However, the potential radiation doses to workers can vary depending on the option chosen.

Three methods are available which categorized by fuel treatment and dismantling[5]. The plant under decommissioning should be monitored for any radiological release, or contamination induced by hazard. Hazard Analysis is performed from external and internal initiating event, that potential to impact the plant safety. Meteorological monitoring is conducted to assess the wind direction, velocity, and pressure. The information gathered will be used to assess the risk of event so that protective measure can be performed and dispersion pathway of radiological release to public and environment. Another example, flooding, if happend, will spread of contamination into trench

Table 2. External event to monitor during decommissioning

	Natural	Human Induced
External Event	 Earthquakes Lightning Flooding Winds and tornadoes (meteo) Volcanoes 	 External explosions Aircraft crash Security

4. Discussion and Conclusion

Safety is not compromise if decided to develop the first NPP deployment. All site character parameter should be evaluated and investigated for whole license process, by PSR in operating licenses and included in the decommissioning plan.

The area of investigation could be different depending on the intention of license. In decommissioning license, activities incorporate with risk are significantly reduced due to removal of fuel assembly and spent fuel. Site evaluation continue troughout the entire lifetime of the installation to take into account the changes, in site characteristic, operational recors, regulatory approaches, evaluation methodologies and safety standards.

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