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Floating Nuclear Power Plants: Are They Safe and Secure?

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Synopsis

Floating NPPs may provide alternative energy supply to energy-scarce small states, port cities, and remote islands in the region. But just like with traditional land-based NPPs, would floating NPPs also come with potential risks to nuclear safety and security?

Commentary

NUCLEAR POWER generation in Asia has taken big strides with new land-based nuclear reactors currently being constructed or planned. China, for instance, now has 30 nuclear reactors in operation, another 21 under construction and 60 nuclear power plants (NPPs) that will be built over the next 10 years. Vietnam is set to commission its first NPP by 2028 while Malaysia, Indonesia, the Philippines and Thailand have been studying the possibility of using nuclear power.

But an interesting development is the possibility of deploying floating nuclear reactors. China aims to launch a series of offshore nuclear power plants to provide electricity to remote locations, including offshore oil platforms and its man-made islands in the South China Sea. Some commentators have also suggested that Southeast Asian countries may consider using floating NPPs. Floating NPPs may provide alternative energy supply to energy-scarce small states, port cities, and remote islands in the region. But just like with traditional land-based NPPs, would floating NPPs also come with potential risks to nuclear safety and security?

Floating an Old Idea

A floating nuclear reactor is not a new idea – one is under construction at a shipyard

in Saint Petersburg, Russia, which is expected to be the world's first floating NPP. The project began in early 2000s but operation is set for 2018 in Russia's Arctic region. China plans to build a small modular floating reactor by 2017 and it is expected to start generating electricity by 2020.

Proponents of a floating NPP have highlighted its distinct advantage, that it enhances nuclear safety and security as it would eliminate the possibility of land contamination and public exposure from severe nuclear accidents, and reduce the risk from terrorist threats. A nuclear reactor at sea is claimed to be accident-proof since it has abundant supply of cooling water which could prevent a Fukushima-like nuclear meltdown. Small floating reactors could be transferred or moved away from areas considered vulnerable to tsunamis to avoid potential disasters and also easily deployed to support areas with limited energy resources.

Nuclear Safety Risks

Despite the unique advantages cited by the proponents, there are still nuclear safety challenges associated with this technology. In the event of a nuclear accident, while a floating nuclear reactor would have plenty of cooling water readily available, it might not have access to off-site backup power which is present in land-based NPPs, and it would be more challenging to contain any radioactive releases than when an accident occurs at a land-based plant.

It would also be slower to launch accident response at sea-based NPPs than at land-based nuclear meltdown. Even though floating NPPs are not close to densely populated communities, radioactive plume from nuclear meltdown, even at a floating barge, can still be carried by winds to coastal populations. This concern remains relevant in the region especially after the Fukushima nuclear accident.

The environmental impact of floating NPPs on marine ecosystem should also not be ignored. While land contamination may be avoided, the floating nuclear accident scenario would entail radioactive contamination of marine resources underneath the damaged reactor. This may seriously affect the main source of livelihood of coastal communities in Southeast Asia.

Nuclear Disaster-related Risks

Most of Southeast Asia, including parts of the South China Sea, are prone to natural hazards such as earthquakes, tsunamis and typhoons. In the South China Sea, it remains to be seen if the precarious structures, including China's floating NPPs can withstand strong typhoons. China's nuclear safety standards remain a concern for many - even among Chinese nuclear experts.

With the intention of China to deploy floating NPPs in the South China Sea and in preparation for possible future deployment of offshore modular reactors in the region, ASEAN Member-States need to include nuclear accidents at sea as a potential scenario in their nuclear emergency preparedness and response framework. However, only a few countries such as Vietnam, Indonesia and the Philippines have actually begun conducting nuclear emergency preparedness and response field exercises.

The geographical features of Southeast Asia make the siting of NPPs in the region problematic, as most of the seas around the archipelagic states are situated on the traffic-heavy straits between Indonesia and Malaysia, Singapore, Thailand and Indochina.

Nuclear Security Risks

Just like land-based NPPs, floating NPPs would still generate radioactive waste which needs to be carefully managed and stored. There would still be an unresolved issue of how to deal with the spent fuel and the risk of radioactive leakage given the lack of final repository site for high-level radioactive waste.

The spent fuel from floating NPPs may still need to be transported back to land for it to be properly stored in order to prevent contamination at sea. In this regard, the security of the transportation of radioactive materials by sea as well as the physical protection of nuclear facilities, which would include floating nuclear reactors, from possible sabotage and terrorist attacks may face significant challenges in Southeast Asia.

Given the fact that Southeast Asia has maritime security issues such as piracy, territorial disputes, smuggling and hijacking, there is a question whether there is a greater security risk for floating NPPs compared to land-based NPPs. Also can a floating NPP be protected from cybersecurity attacks, as has been considered for land-based NPPs?

While floating NPPs may provide an attractive option in the future, it would not lessen the nuclear safety and security risks and considerations that are also applied to land-based NPPs. The questions raised on the safety and security with regard to floating NPPs should be part of the cost-benefit analysis by policymakers in the region when they seriously consider the possibility of using floating NPPs.

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