Chemical Spill Scenarios Construction due to the Disaster and Accident and Disaster Prevention and Mitigation Strategy

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[Abstract]

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The risks associated with chemical release from industrial sites caused by natural disasters or unforeseen events pose grave concern worldwide. Previous research and practices focused mainly on loss prevention and mitigation of human casualties, equipment, construction, and the environment. Therefore, local governments and business operators that possess hazardous chemicals have for years prepared for and developed technical tools for predicting the impacts of chemical releases and practical manuals for responding to releases. However, these studies mostly overlook the impacts on social activities. For example, when a large amount of toxic chemical stored at an industrial area leaks to a public area, activities and operations of hospitals, schools, water supply facilities, and other critical infrastructure are damaged, which can halt the operations and services. The social impacts on stakeholders caused by environmental pollution should be minimized, but a framework that can effectively address the risks in terms of prevention, mitigation, response, and recovery has not been suggested.

The purpose of this study was to analyze social risks from environmental pollution caused by chemical released from chemical industrial sites and to develop and suggest social risk treatments and a strategy against environmental pollution to stakeholders for disaster prevention and mitigation.

We developed a new framework of social risks from environmental pollution caused by chemical release. The framework focuses mainly on risk treatments for the stakeholders for the purposes of prevention, mitigation, response, and recovery. To develop the framework, we investigated the environmental impact of natural disaster-induced chemical release events, which are referred to as Natech events. The investigations were summarized in a Natech database. Subsequently, we identified risk scenarios of environmental pollution to stakeholders using master logic tree, event tree, and fault tree methods. The results of the scenario identification were analyzed and summarized to develop and recommend guidelines for risk treatments by all stakeholders. In addition, we developed sophisticated preventive and mitigative methods: a runaway reaction prediction technique and a real-time atmospheric dispersion simulator. We also made an animation video to introduce concerns about social risks from environmental pollution that directly and indirectly cause knock-on effects on social activities by stakeholders.

Finally, we published the Natech database, the guideline of social risks, and the video on the website of the Center of Creation of Symbiosis Society with Risk, Yokohama National University, to advertise to the public to contribute to the effective development and implementation of disaster prevention and mitigation strategies by all stakeholders.

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