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Impact assessment of nuclear security events using chemical explosives

It has become easier for terrorists to obtain chemical explosives in recent years, with the spread of the internet. Also, examples of terrorism at nuclear facilities have been reported around the world. Hence, various measures against terrorism targeting nuclear facilities with chemical explosives have been implemented in many countries. On the other hand, that fact indicates the need of consideration that terrorists steal nuclear and/or radioactive materials and attach chemical explosives to them to increase the scale of the damage, taking large-scale events such as the Olympic Games into account. That is to say, the necessity of the post-dispersion study. In those nuclear security events, it would be assumed that the explosion by chemical explosives destroys objects containing the nuclear and radiological materials, and their debris containing those materials scatters around. Since these debris are radioactive, it is thought that evaluating the scattering behavior of the debris is useful in the radiation exposure evaluation of surrounding environment.
The United States and Japan established a bilateral Nuclear Security Working Group (NSWG) to strengthen nuclear security worldwide. One of the goals that the group developed was Goal 9 "Joint Study on Management of HEU and Plutonium: Reduction of Material Attractiveness,"which establishes through science-based study, a mutual understanding of the risk from non-state actors conducting malicious acts involving nuclear material and facilities. Eventually, the study evaluates the number of deaths, number of injuries, and the economic impacts when nuclear security events occur, in order to consider overall consequences. Therefore, the data of such scattering behavior would be useful. However, such research has not been done or has not been published to date.
ISCN under the JAEA is developing nuclear security technologies by utilizing JAEA's knowledge, experience and technical capabilities in order to contribute to the peaceful use of nuclear energy. Based on the usefulness of the nuclear material scattering behavior mentioned above, ISCN analyzes the explosion and impact behavior of nuclear material in various forms by chemical explosives by simulation using ANSYS AUTODYN. The forms of nuclear material currently in the project scope are metals, oxides, powders and liquids. A benchmark experiment related to this is also planned. The application of the study would be to do the dose evaluation from scattered debris and create a map that shows the range of lethal dose, which possibly contributes for the Goal 9 study. In addition, based on such maps, it is possible to contribute to create an effective mitigation plan by response unit.

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