Investigating the effects of radiation dose reduction in a variety of buildings

Development of a technique for a detailed mapping of dose rates in a building

The Japan Atomic Energy Agency (JAEA) has developed a technique for analyzing dose rate in various buildings, such as houses, schools and hospitals, in detail. Decreasing effect of dose rates in the buildings and degree of dose reduction compared with the outside have been studied using this technique. It was found that shielding effect of concrete walls is high and therefore the dose rates in concrete buildings are low. In contrast, while the shielding effect of wooden houses is low, their dose rates depend on the size of their site areas and accordingly are lower in wooden houses with large site areas. As a next step, influence of the surrounding environments such as neighboring houses and geographical features on the dose rates in buildings is planned to be analyzed in detail. The obtained data will be utilized for the countermeasures to reduce the radiation exposures.

This technique was developed by Dr. Takuya Furuta and Dr. Fumiaki Takahashi in Research Group for Radiation Protection, JAEA. They selected 27 different types of typical buildings according to surveys of buildings in Fukushima area, and modeled each building in three dimensions. By simulating transport of gamma-rays emitted from radioactive cesium in ground soil and entering inside of these buildings by means of the latest computational simulation method, they examined how the dose rates are reduced in each building in comparison to outside. Also, they validated the analyzed data comparing to the published measured values.

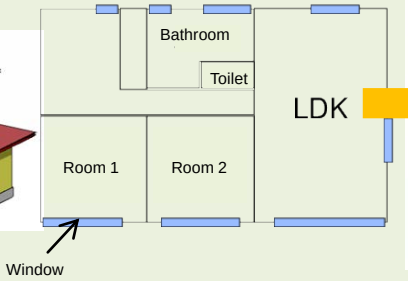
As a result, they found that in a wooden house, the wider the ground-floor area of the house is, the lower the dose rate becomes. That radioactive cesium does not exist in the soil beneath a house results in reduction of dose rates in a wooden house.

In a concrete building, on the other hand, they found that the dose rate near the window is much higher than that in the center of the room. This is because the shielding effect of the glass window is lower than that of concrete. In the case of wooden houses and concrete buildings in open space without inner walls, the dose rate decreases with distance from the outer wall and windows. The dose rate was the lowest around the center of the building.

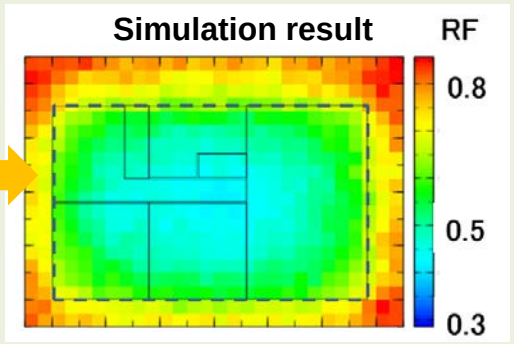
The Research Group for Radiation Protection will further study the effect of surrounding environments on the dose rate in a building, considering actual living environments such as residential district composed of a few neighboring houses and district with a slope near-by. They are also planning to investigate possibility of an effective way to reduce the dose rate in buildings by setting the radiation shield around buildings.

Wooden house

Plan of the ground floor



Simulation result



Assuming a two-storied wooden house constructed with a conventional method

・In the right figure, the region in the dotted line is the area under the house.

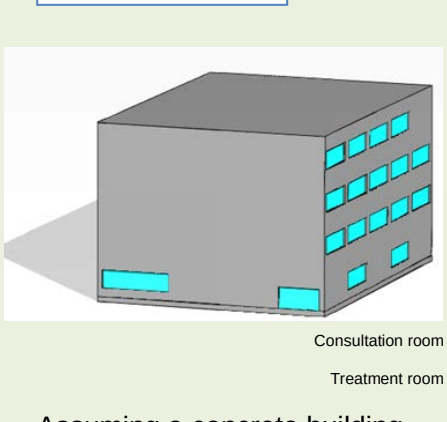
・The ground below the house is not contaminated by radioactive cesium, which keeps the dose rates inside house low.

・The dose rate at the center of the house is lower than that near the outer wall.

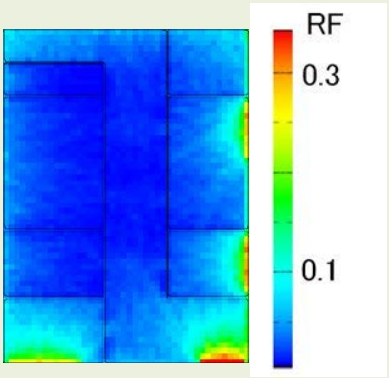
*RF is the ratio of the dose rate in the building to that on the outdoor ground.

Hospital

Plan of the ground floor



Simulation result



Assuming a concrete building

・The shielding effect of the concrete building is greater than that of the wooden building.

・As the shielding effect of the window is small compared to that of the concrete, the dose rate near the window is high.

TOPICS Fukushima No.45

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