

RECOVERY FROM NUCLEAR DISASTER IN FUKUSHIMA: COLLABORATION MODEL

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Since 2011, Nagasaki University has been assisting the reconstruction efforts of Kawauchi Village in the Fukushima Prefecture, which was the first village to declare it safe for residents to return to their homes. In April 2013, Nagasaki University and the Kawauchi government office concluded an agreement concerning comprehensive cooperation toward reconstruction of the village. The present study evaluates the internal and external exposure doses of residents and conducted a risk communication based on each resident's radiation dose. Furthermore, researchers began a comprehensive support of Tomioka residents who have returned to their hometown in 2017. Based on the experiences in Kawauchi village, it is clear that the cooperation of residents, local authorities and specialists is essential for the recovery of areas affected by the nuclear disaster. Accumulated experiences and practices should be carefully evaluated and recorded to prepare for future unexpected nuclear disasters.

ESTABLISHMENT OF A SATELLITE OFFICE OF NAGASAKI UNIVERSITY IN KAWAUCHI VILLAGE

Immediately after the accident at the Fukushima Dai-ichi Nuclear Power Station (FDNPS) in March 2011, an evacuation order was issued, to minimize residents' external radiation exposure. On 11 March 2011, the Governor of the Fukushima Prefecture issued instructions for the evacuation of all settlements within 2 km of the FDNPS⁽¹⁾. That same day, the Director-General of the Nuclear Emergency Response Headquarters (Prime Minister) ordered the evacuation of all individuals within 3 km of the FDNPS, and then the evacuation radius was expanded to 20 km later that day. On 15 March 2011, instructions were issued ordering all people living between 20 and 30 km from the FDNPS to shelter in place^(1–3).

Kawauchi village, in the Fukushima Prefecture, is located within 30 km of the FDNPS (Figure 1). After the sheltering instructions were issued, almost all residents of the village evacuated, with 75% relocating to the city of Koriyama, where the Kawauchi government office had relocated its offices⁽⁴⁾. After the declaration of the termination of the accident by the Prime Minister in December 2011, the mayor of Kawauchi village decided to return to the town.

Nagasaki University has been assisting in Kawauchi village's recovery efforts through the evaluation of internal and external exposure doses and risk communication with residents based on their individual doses. In December 2011, we estimated the external radiation exposure

doses of residents of Kawauchi through the measurement of radiocesium concentrations in the soil samples collected from the residential areas of the village. The estimated external effective doses from soil samples were 0.0011–0.38 μ Sv/h (0.010–3.3 mSv/y) within the 20–30 km radius from FDNPS. We could show that the risk of external radiation exposure of residents was sufficiently low in Kawauchi Village⁽⁵⁾.

In March 2012, the village office of Kawauchi relocated its function in the village, and the residents started returning back. In May 2012, a public health nurse from Nagasaki University stayed for an extended period to conduct individual consulting on radiation exposure and health⁽⁶⁾. And in April 2013, a comprehensive agreement was concluded between Nagasaki University and the Kawauchi village office, and a satellite office of Nagasaki University was established in the village. From this satellite office, researchers have been working with residents and village office⁽⁶⁾. This article reports on recent activities in Kawauchi village and the town of Tomioka, whose residents returned home in April 2017.

FOLLOW-UP OF RADIOCESIUM CONCENTRATIONS IN WILD MUSHROOMS AND EDIBLE WILD PLANTS

Based on the experiences of the Chernobyl accident, it is well known that radiocesium concentrates in wild mushrooms⁽⁶⁾. However, Kawauchi village was known for wild mushrooms even before the accident,

and its residents have enjoyed collecting and eating various mushroom varieties. After the accident, many residents had concerns about recovering their ‘mushroom culture’. The researchers discussed this with residents of the village and began a collaboration, known as the ‘mushroom map’ project, in 2013, aiming to clarify the situation of radiocesium contamination of mushrooms in the village. Residents were asked to bring in the mushrooms they collected in the village and the concentrations of radiocesium were measured^(7, 8). Researchers also calculated the committed effective doses and reported the results to residents. Recently, data on the results of the mushroom map project between 2014 and 2015 have been reported. They show that,

in more than 90% of mushrooms, concentrations of radiocesium were still detectable (Figure 2)⁽⁸⁾. We noticed that most species showed relatively higher concentrations of radiocesium and that several species showed relatively lower concentrations. This suggests that the concentration of radiocesium might depend on the species of mushroom. Usually, habitat varies depending on species. Yoshida and Muramatsu⁽⁹⁾ found that the habitat of the mycelium seemed to be one of the most important factors controlling radiocesium concentration in mushrooms. Since habitat is closely associated with each particular species, it is suspected that species type is also associated with radiocesium concentrations in mushrooms.

In addition to wild mushrooms, it has been clarified that radiocesium is also frequently observed in edible wild plants^(10, 11). With this in mind, the researchers also evaluated the concentrations of edible wild plants collected in Kawauchi village by residents and found that 10% of them showed concentrations of radiocesium at a level of 100 Bq/kg.

Regular meetings are held with residents to report these results and to discuss the future direction of the projects aiming for the recovery of the village. We emphasized that although radiocesium was detected in most mushrooms collected in the village, committed effective doses are limited even if residents consumed them several times. Such communications, based on collaboration between residents and specialists, have become one of the leading models for recovery from the nuclear disaster, and we noticed that ‘face to face discussion’ based on own ‘dose’ of each resident is very important during the recovery phase after the nuclear disaster.

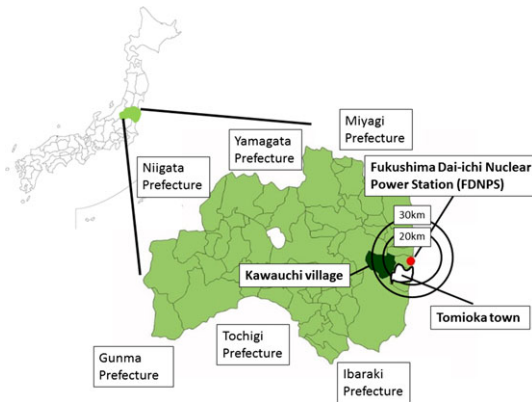


Figure 1. Kawauchi village and Tomioka town.

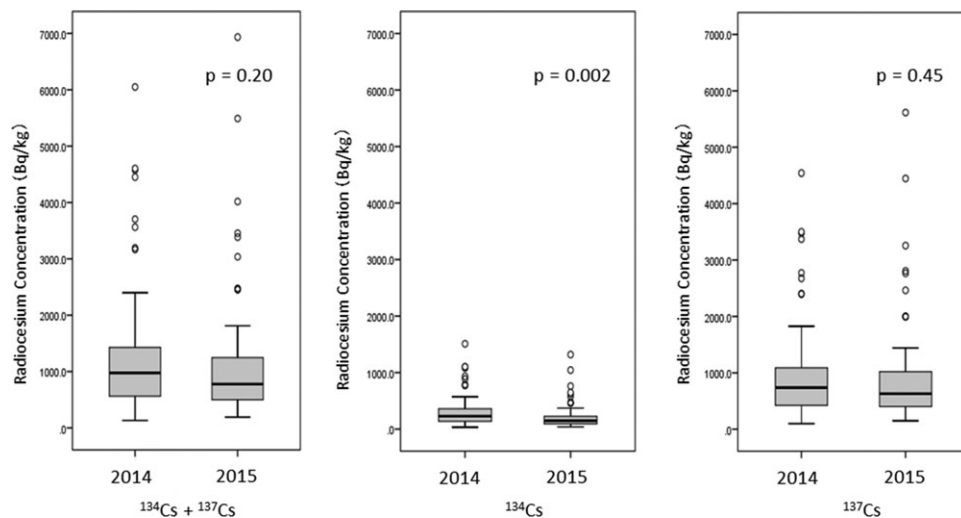


Figure 2. Comparison of concentration of radiocesium of *Sarcodon aspratus* collected in 2014 and 2015⁽⁸⁾.

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