Questions raised over testing methods for thyroid gland doses in Fukushima

February 14, 2013 2

By YURI OIWA/ Staff Writer

Researchers have announced safe radiation doses in thyroid glands for the vast majority of residents living around the stricken Fukushima nuclear plant. But their studies are based on estimates, assumptions and a calculation method that many experts have called into question.

A mountain of challenges must be overcome before the doses can be evaluated more accurately. Some obstacles could be removed simply through improved coordination in sharing information.

One of the biggest problems is the scarce availability of data for radioactive iodine, which has a short half-life of eight days, in the period immediately following the nuclear disaster that began on March 11, 2011.

The researchers were forced to depend on other data resources just to estimate the iodine doses in thyroid glands. The Environment Ministry commissioned the task to the National Institute of Radiological Sciences (NIRS), which has relied on two methods to assess the doses.

One method estimates iodine doses on the basis of abundantly available data on the internal doses of radioactive cesium, which has a much longer half-life. The other method relies on simulations of the spread of iodine from the disaster at the nuclear plant.

Presenters at a symposium in late January focused largely on the method that uses the cesium doses. The symposium was held to show the results of the central government's thyroid gland study in Fukushima Prefecture that started last year.

They said the thyroid gland doses were 30 millisieverts or less in 90 percent of 1-year-olds in the village of Iitate, the group with the highest doses. The corresponding figures for other communities were between 27 millisieverts and 2 millisieverts or less.

All those figures fell short of the 50-millisievert international standard for taking iodine tablets to prevent thyroid gland irradiation.

Their estimates were based largely on their perceived iodine-to-cesium ratio in human bodies. Ideally, the team of researchers would have used data on subjects who were tested for both radioactive substances. But such information was scarce.

Instead, the team relied on thyroid gland iodine tests conducted by the central government in late March 2011 on 1,080 children in Iitate, Kawamata and other communities, and whole-body cesium dose data for about 300 adults from Iitate and Kawamata who were tested by the Japan Atomic Energy Agency.

On the basis of that data, the researchers assumed the iodine-to-cesium ratio was 3:1 in human bodies. The estimate was used to evaluate thyroid gland doses for residents who were living in other communities where cesium tests were conducted.

Many pointed out during the symposium that the ratio should be studied further.

The Nuclear Regulation Authority and other sources have said the iodine-to-cesium ratio was 10:1 in airborne materials spewed out by the Fukushima reactors. The corresponding ratios in soil are believed to have been 10:1 northwest of the nuclear plant and 50:1 south of the plant.

However, the iodine-to-cesium ratios were between 1:1 and 50:1 in the internal radiation doses of about 50 researchers who measured radiation levels around the Fukushima No. 1 plant immediately after the nuclear disaster started. The median value was 11:1.

Furthermore, the iodine-to-cesium ratios were less than one in five residents from the town of Namie who were tested in April 2011 by a group led by Shinji Tokonami, a radiology professor at Hirosaki University.

"We have to attune the iodine-to-cesium ratios after studying why they are not the same in human bodies and in the environment, including in soil, and why they differ among individuals," said Osamu Kurihara, head of the NIRS Internal Dosimetry Section and leader of the research team.

Tokonami questioned the wisdom of using one ratio for all residents to determine the thyroid gland doses.

"The ratios in the bodies of subjects do vary, depending on when they inhaled iodine contained in a radioactive plume and which direction the plume was flowing," Tokonami said. "The ratio estimates should at least be different between the areas northwest of the nuclear plant and the areas south of it."

Sharing existing data poses another challenge. The central government holds all the thyroid gland iodine dose data on the 1,080 children. Separately, the Fukushima prefectural government is in possession of all the whole-body cesium dose data.

It is unknown if any of the 1,080 children were also tested for cesium doses. Such double-tested subjects could be sources of information that would certainly enhance the accuracy of the ratio estimates.

"The dose estimates should be based on more studies on the iodine-to-cesium ratios and should take the subjects' whereabouts (in the immediate aftermath of the nuclear disaster) into consideration," said Toshimitsu Homma, head of the JAEA Nuclear Safety Research Center.

The governments of Russia and the United States tested their citizens in Japan for thyroid gland doses shortly after the Fukushima disaster.

Russian researchers said a team of experts visited Japan in April 2011 at Moscow's behest to test staff of the Russian Embassy in Tokyo, their family members and other Russian citizens. Iodine was detected in three of the 268 subjects tested.

The thyroid gland dose was estimated at 2 millisieverts for an adult and 4 millisieverts for a 1-year-old, the Russian scientists said.

About 7,000 people were tested for thyroid gland doses at U.S. military bases across Japan. Measurements on U.S. airmen at Yokota Air Base in Tokyo led to the estimation that a subject who spent 24 hours outdoors was exposed to an average thyroid gland dose of 5.3 millisieverts, sources said.

By YURI OIWA/ Staff Writer