

Environmental radiation status in Kashiwa city (Chiba prefecture) after the TEPCO Fukushima Dai-ichi Nuclear Power Plant disaster

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Kashiwa city is located in the northwest part of Chiba prefecture in the metropolitan area of Tokyo, Japan. It is about 200 km to the south of the TEPCO Fukushima Dai-ichi Nuclear Power Plant. The population of the city was 404,252 as of April 1, 2012, and its area is 114.9 km². The local government has officially surveyed the environmental radiation status after the disaster in response to numerous requests from its citizens. The radiation surveillance in this area has been conducted by the radiation protection specialists. The two main goals of the surveillance are (1) to measure the ambient radiation dose (microsieverts per hour) at all the school yards, public parks, and representative measuring points selected by the local government, and (2) to measure the specific radioactivity (becquerels per kilogram) of drinking water and local food items. These data have been reported on the city website as well as in a bi-monthly report in the public relations magazine of the local government. This report presents the background status and technical information on the related activities, and the measured environmental radiation data.

The ambient radiation dose in the city has been surveyed since June, 2011. In the 1st period of the surveillance (from May to August, 2011) at a total of 210 survey points, the highest value of the ambient radiation dose was 0.65 $\mu\text{Sv h}^{-1}$ at the height of 1 m from the ground, the lowest was 0.08 $\mu\text{Sv h}^{-1}$, and the average was 0.25 $\mu\text{Sv h}^{-1}$. These values include the natural background dose rate detected by the survey meters. In the 4th period, the latest data around school yards were 0.30 at maximum, 0.04 at minimum, and 0.12 $\mu\text{Sv h}^{-1}$ on average. The ambient dose at 41 of 61 school yards and 47 of 635 parks has been reduced under the decontamination project by the local government, so far. The net dose reduction rate, without the natural background dose, was from 30%–80% in the school yards and the parks. Decontamination activity around residential areas has only recently been started.

The specific radioactivity of drinking water and local food items has been surveyed since March, 2011, and July, 2011, respectively. Thus far, one sample of service water showed 110 Bq kg⁻¹ of ¹³¹I on March 23, 2011. However, no water sample other than this has been shown to exceed the limits. As of the end of August, 2012, about 800 samples of local food items have been checked using a NaI(Tl) scintillation spectroscopy system. The lower detection limit on this measurement system for ¹³⁴⁺¹³⁷Cs was set as 25 Bq kg⁻¹. An outdoor bamboo shoot sampled in the city on April 9, 2012 showed 170 Bq kg⁻¹ as the specific radioactivity of ¹³⁴⁺¹³⁷Cs. In addition, a crucian carp sampled in Teganuma lake on June 23, 2012 showed 241 Bq kg⁻¹. Specific radioactivity of all of the surveyed samples, other than those mentioned above, have been below the limits.

Key Words: ambient radiation dose, specific radioactivity, Chiba

1. Introduction

Kashiwa city is located in the north-west part of Chiba prefecture in the metropolitan area of Tokyo, Japan¹⁾. It is roughly 200 km to the south of the TEPCO Fukushima Dai-ichi Nuclear Power Plant. The population of the city was 404,252 as of April 1, 2012, and its area is 114.9 km². The local government has officially surveyed the environmental radiation status after the disaster in response to requests from its citizens. The radiation surveillance in this area has been technically guided by radiation protection specialists. This activity has been based on the decision of a local forum of six cities including Kashiwa city as the “Conference on Radiation Countermeasures in the Tohkatsu area (CRCT)”²⁾.

This report presents the background status and technical information of the related activities, and the measured environmental radiation data.

2. Monitoring targets and methods

The two main targets of the surveillance are (1) the ambient radiation dose (microsieverts per hour) at all the school yards, public parks and representative measuring points selected by the local government, and (2) the specific radioactivity (becquerels per kilogram) of drinking water and local food items.

Based on the CRCT manual, the ambient dose rate has been monitored. The latest dose distribution data at the height of 5 cm (for identifying contaminated areas), 50 cm (for dosimetry of children) and 100 cm (for adults) from the ground in the cities can be seen against the background of a Google map on the government webpages¹⁾. Monitoring targets are all school yards (nursery schools, kindergartens, child centers, elementary schools, and high schools), parks and sports grounds, the exterior of local government institutions, bus terminals, city streets, city pools, and around sewage adjustment ponds and waste disposal sites. These are monitored by energy-response compensation gamma survey meters with NaI(Tl) or CsI(Tl) scintillation detectors. These survey meters are selected based on the CRCT discussion, and 512 survey meters are selected by the local government independently. The monitoring frequency for each investigation point was more than once monthly.

In addition to the ambient radiation dose rate, the city distributed one (or two) electric personal dose meter(s) to

all of the public and private schools. The purpose was to announce the monthly dose of children for their routine activities to the citizens, and to determine an actual annual dose based on the measured results. This is representative of a child’s personal dose, not the ambient dose. Unfortunately, at the early stages the citizens tended to be concerned about the effects of an extremely small area’s high contamination, the so-called “micro spot.” The city would like to do a quantitative analysis to show the actual level of the exposure dose in the “micro spot,” rather than a qualitative explanation. Electric personal dose meters in each school were given to a representative staff, and the meters were worn at the chest height of a typical child. The personal dose meter was operated all day long (24 h). At nights and on holidays the dose meters were placed in a room of the schools.

Local governments were strongly encouraged to monitor local food and drinking water under the present policy of “Local Production for Local Consumption.” In parallel with a national survey and the prefecture’s survey, Kashiwa city has been continuing the monitoring of various materials and announcing the results to its citizens. The monitored target materials are school lunch and food items, local food items, tap water, and supplied water, water in school or public pools, waste disposal, etc. For example, the actual lunch supplied for one week in each school was monitored by a Ge semiconductor spectroscopy system.

The sampling procedures of local food items are as follows: (1) The types of food to be monitored from the representative four areas of Kashiwa city are discussed and selected among agricultural cooperatives, farmers, and city officers; (2) city officers ask the selected farmers for basic information on these food items, for example, the planting season; and (3) local food items are sampled, weighed, and passed on to monitoring rooms. The food samples are then measured by a NaI (Tl) scintillation spectroscopy system (a 15 min measurement with a 500 mL Marinelli beaker, where the minimum detectable limit concentration is estimated as 6 Bq kg⁻¹). As of the end of August, 2012, about 800 local food samples have been monitored using this procedure.

These data have been reported on the city website as well as in a bi-monthly report in the public relations magazine of the local government.

3. Results and discussion

(1) Ambient radiation dose and personal exposure dose

The ambient radiation dose in the city has been surveyed since June, 2011. In the 1st period of the surveillance (from May to August, 2011) at a total of 210 locations, the highest value of the ambient radiation dose was $0.65 \mu\text{Sv h}^{-1}$ at the height of 1 m from the ground, the lowest was $0.08 \mu\text{Sv h}^{-1}$, and the average was around $0.25 \mu\text{Sv h}^{-1}$. These values include the natural background dose rate detected by energy compensation survey meters.

In the 4th period, the most recent data around school yards were 0.30 at maximum, 0.04 at minimum, and $0.12 \mu\text{Sv h}^{-1}$ on average. The ambient dose at 41 of 61 school yards and 47 of 635 parks has been reduced under the decontamination project by the local government. The net dose reduction rate, not including the natural background dose, has been 30%–80% in the school yards and the parks. Decontamination activity around residential areas has only recently been started.

Fig.2 shows the annual average dose at schools in Kashiwa city measured by personal dose meters from September 1, 2011 to August 31, 2012. The data recorded in this project have been announced on the official website in the city every month. This information greatly reduced the number of questions or requests for consultations from citizens on exposure to the “micro spot” area.

(2) Specific radioactivity

The specific radioactivity of drinking water and local food items has been surveyed since March, 2011 and July, 2011, respectively. One sample of service water showed 110 Bq kg^{-1} of ^{131}I on March 23, 2011, however, no water sample other than this has been shown to exceed the limits.

About 800 samples of the local food items, which was grown up and circulated in the city as of the end of August, 2012, have been checked using a NaI(Tl) scintillation spectroscopy system. The lower detection limit on this measurement system for $^{134+137}\text{Cs}$ was 25 Bq kg^{-1} . An outdoor bamboo shoot sampled in the city on April 9, 2012 showed 170 Bq kg^{-1} as the specific radioactivity of $^{134+137}\text{Cs}$. In addition, a crucian carp sampled in Teganuma lake on June 23, 2012 showed 241

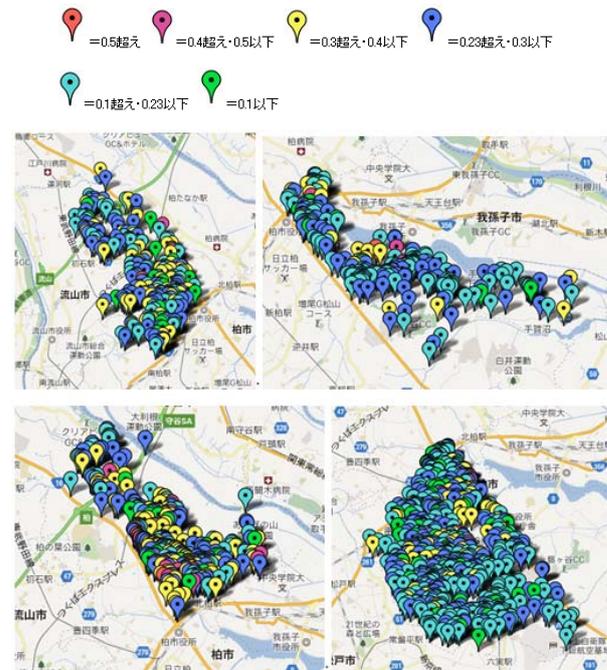


Fig.1 Ambient dose map of Kashiwa city in Chiba prefecture as of Aug. 27, 2012

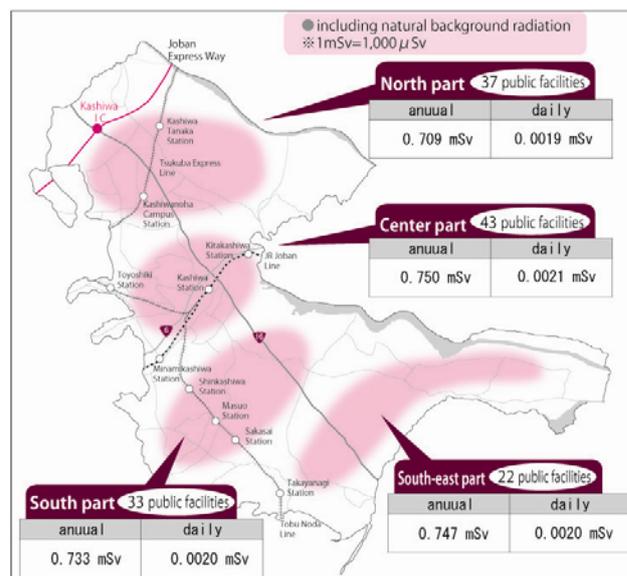


Fig.2 Annual average dose at schools in Kashiwa city measured by personal dose meters from Sep. 1, 2011 to Aug. 31, 2012

Bq kg^{-1} . Specific radioactivity of all surveyed samples, other than these three, has been below the limits.

4. Conclusion

An outline of the environmental radiation status in Kashiwa city of Chiba prefecture after the nuclear disaster of the TEPCO Fukushima Dai-ichi Nuclear

Power Plant has been presented. The background status and technical information of the related measuring activities and the estimated data were introduced.

Kashiwa city is now continuing monitoring the environmental radiation and operating a decontamination program following the local government policy. The newest data may be checked and traced through the official website of Kashiwa city.

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