

Preliminary study of dose equivalent evaluation with OSL dosimeters for residents in Marumori

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1. Introduction

The magnitude 9.0 earthquake and tsunami in Japan on 11 March 2011, resulted in severe damage to the Fukushima Daiichi nuclear power plants (NPP). Aerial measuring results showed the radioactive plumes spread towards the north-west from the NPP, causing the radionuclide deposition. Marumori in Miyagi, a neighboring Fukushima prefecture, is located at 46 km north-west from the NPP. A distribution map of radioactivity concentration in the soil by the MEXT (Ministry of Education, Culture, Sports, Science and Technology, Japan) revealed that this area was strongly affected by the radioactive plumes. (Fig.1)

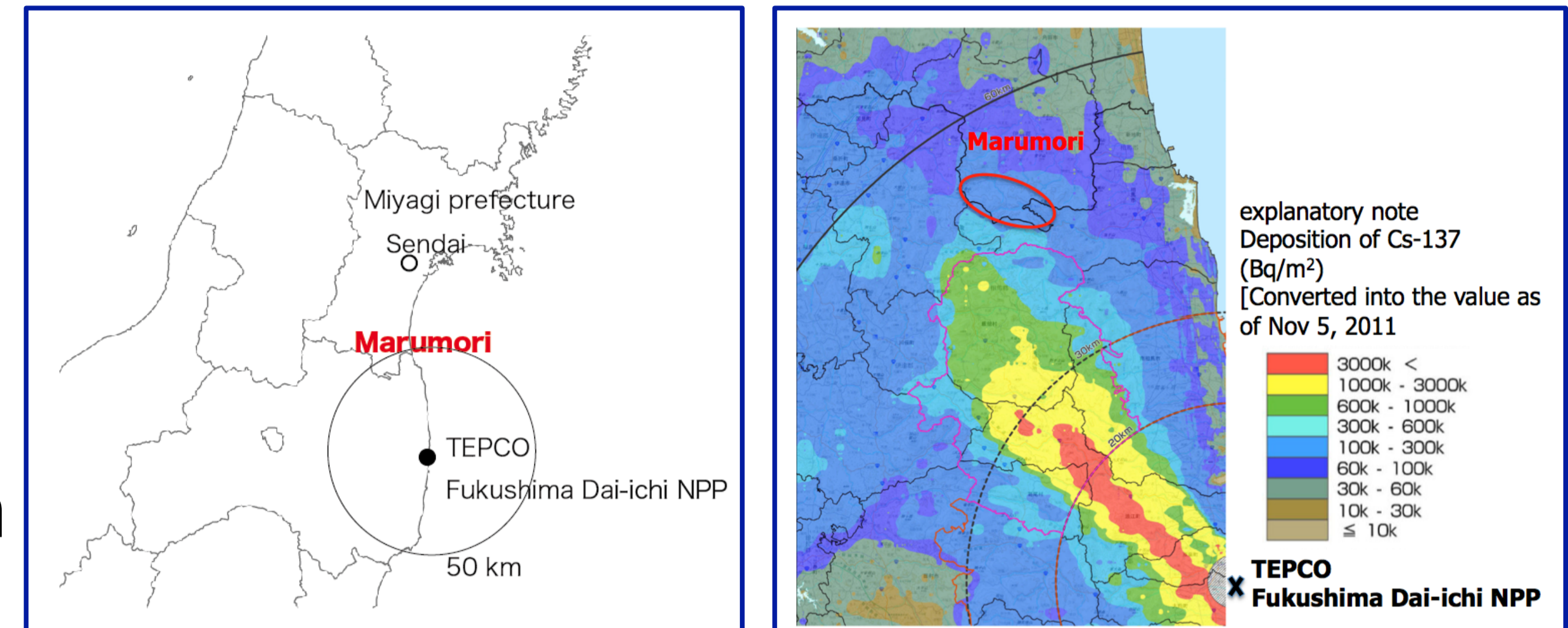


Fig.1 Location of Marumori (left) and distribution map of radioactivity by MEXT (right).

2. Objectives

To monitor individual external doses for residents in Marumori, external dose equivalent have been evaluated.

3. Methods

The measurements have been conducted for 36 residents of 15 families (11 infants, 13 children, and 12 adults) using OSL dosimeters and the OSL reader, Nagase Landauer InLight badge and microStar system. The dosimeters are small devices worn on a neck strap. (Fig.2) Worn close to the torso, they measure radiation coming to the body as a whole. The dosemeter wearing time was one and a half months. The results from Sep. 1st, 2011 to the middle of Jan., 2012 are presented in this study. Contamination with ¹³⁷Cs in the territories studied varies from 60 to 370 kBq/m². The territories studied are geographically divided into three regions, Kawadaira, Hippo, and Koya.



Fig.2 InLight badge system (left) and a badge worn on a neck strap (right).

For each individual, comparisons are made between the OSL readings and the readings of air dose rates outside and inside of the house, measured with NaI(Tl) scintillation survey meter, Hitachi Aloka Medical TCS-172, which has the built-in energy compensation circuit.

4. Results

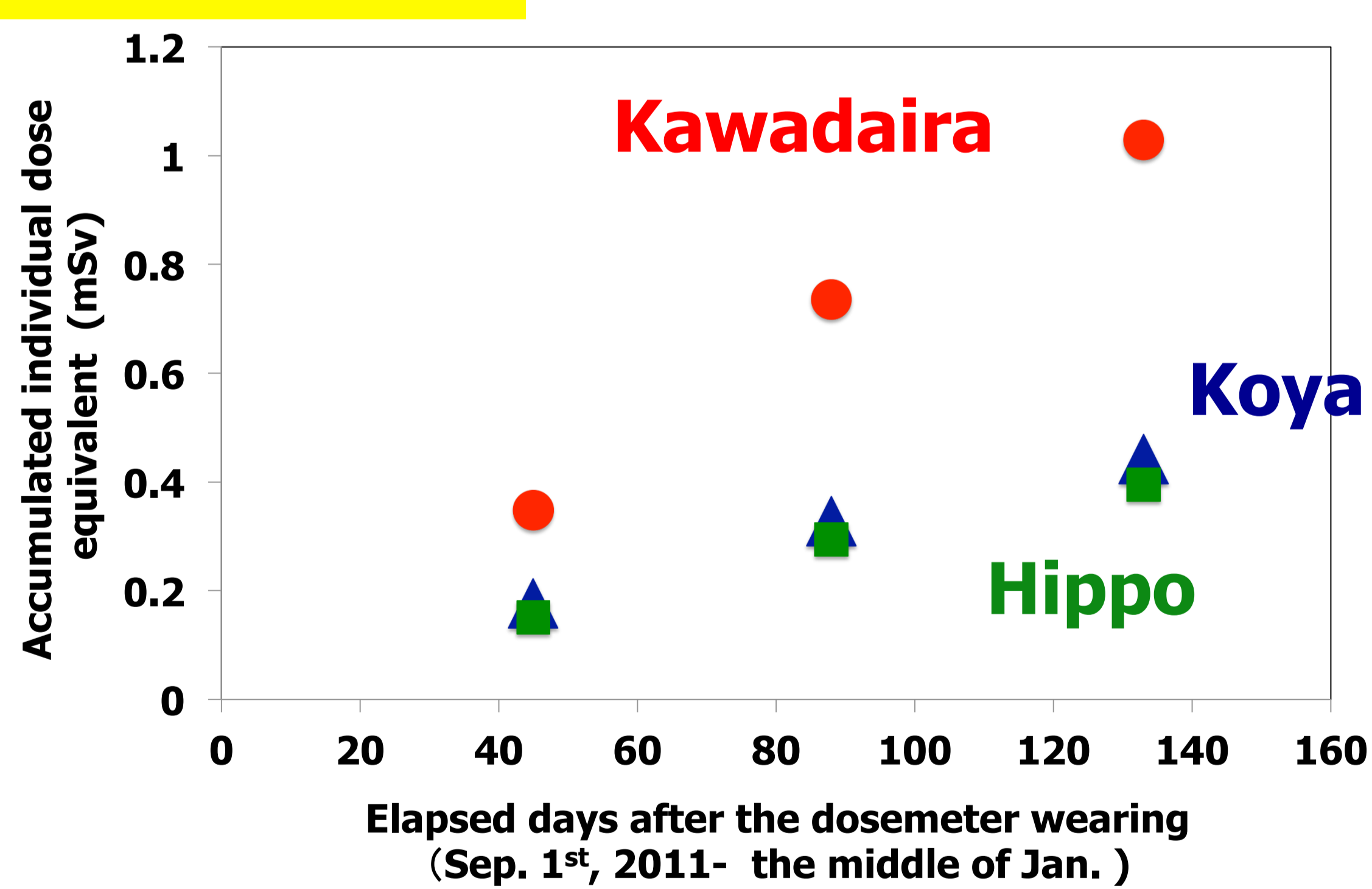
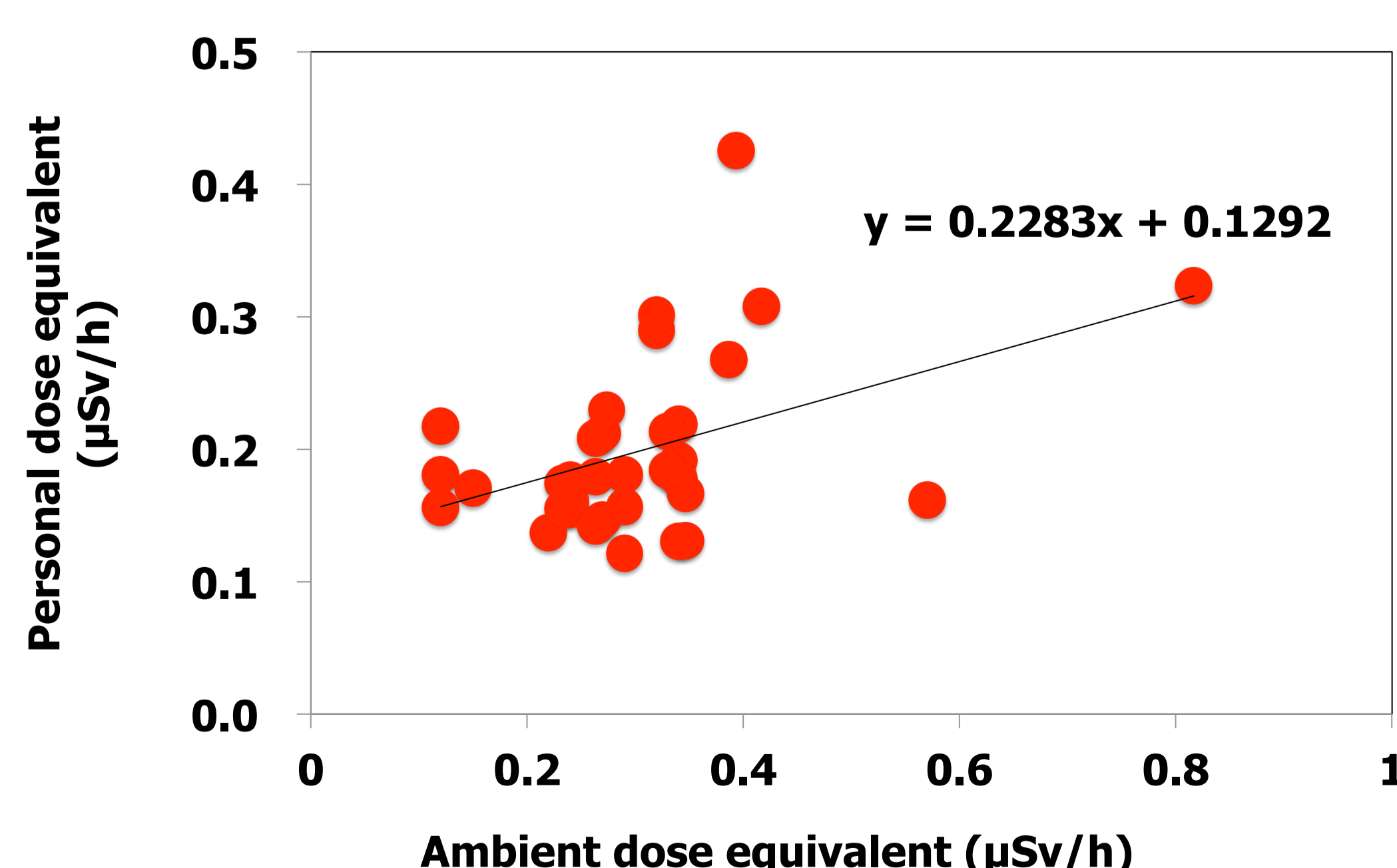


Fig.3 Relationship between the elapsed days and accumulated individual dose equivalent (mSv) after residents started to wear the dosimeter (Sep. 1st, 2011 to the middle of Jan.).



From a relationship between the readings of air dose rates outside and inside of the house for each family on March, a ratio of inside to outside was estimated as about 0.47.

Fig.5 Relationship between the ambient (outside) and individual dose equivalent rates. The latter were calculated from the OSL readings worn during the beginning of Dec. to the middle of Jan.

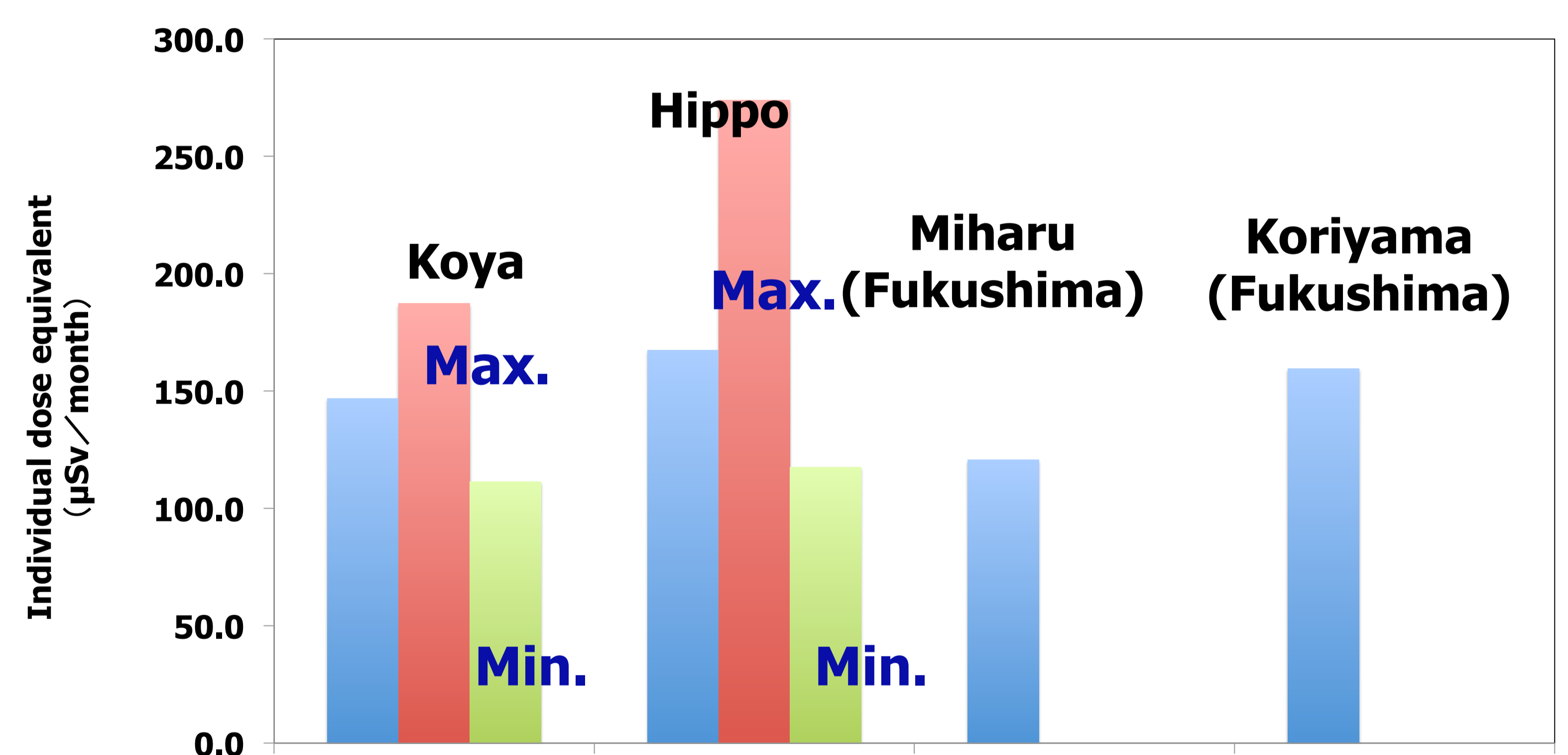


Fig.4 Comparisons of average individual dose equivalent (μ Sv/month) among four elementary school students of Koya, Hippo, Miharu, and Koriyama (shown in blue). All were measured with the OSL dosimeters. The two latter schools are located in Fukushima prefecture. (measured during Sep. to Oct., 2011).

5. Conclusions

Individual dose equivalent varied largely (more than three times) even in the small and closed areas in Marumori. Average individual dose equivalent of elementary school students was the same level or larger than those of Fukushima's school students.