

Physics

Our department focuses on the science of radiation protection and medical physics. Research on radiation protection covers dosimetry, as well as emergency radiation medicine concerning historical nuclear disasters and present topics. Our research on medical physics covers methodology of dosimetry for nuclear and radiation medicine.

Professor

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Interests:

Radiation protection and dosimetry,
Emergency radiation exposure medical care,
Medical physics

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Interests:

Medical engineering & physics, Medical Information

1. Science for Radiation Protection

Dosimetry of residents in nuclear hazards was previously studied through physical methods. This entailed external and internal doses for residents being systematically evaluated by in-situ measurements for activities in environment, food, the human body, environmental radiation and laboratory sample analysis. Our findings resulted in the 2005 publication of *Nuclear Hazards in the World*.

The residents around the Mayak plutonium production complex in the former USSR were studied in situ in April-May 2000. The study indicated the presence of serious internal Sr-90 exposure. Beta ray measurements on the front teeth of the Rongelap people carried out in 2005 showed considerable doses of internal radiation produced by Sr-90. We applied similar tests for Sr-90 internal dosimetry on Japanese people in order to check for radioactive fallout from Chinese nuclear explosions. The maximum evaluated dose was 7mSv.

The largest critical radiation accident to date in Japan occurred at the uranium conversion facilities in the village of Tokai on September 30, 1999. This accident taught us the importance of dose evaluation and radiation protection, reading available information and lectures, and psychological care for the local population. We are studying ways in which we can be better prepared in the future to deal with these issues. We have analyzed anisotropic radiation distribution and evaluated the external doses for residents involved in JCO accidents.

In addition, we have conducted research in China, which has had 46 nuclear explosions with yields of 20 megatons over a wide area extending to more than 1000km along the Tarim Basin. Field studies for radiation were conducted in and around the Taklamakan Desert by our research group in 2012. These studies indicated there were lethal risks in the areas.

We also conducted a radiation hygiene survey after the March

2011 Fukushima Dai-Ichi nuclear power station disaster due to the tsunami caused by the enormous earthquake. Our survey has revealed that the public annual dose was 10 mSv following the disaster and in situ dose evaluations did not suitably address health hazards. This study has focused on internal dosimetries of iodine-131 in the thyroid and cesium-134,-137 in the whole body. We have especially been studying radiation hygiene in cattle livestock in Namie, a town located within the 20km evacuation zone around the Fukushima Daiichi nuclear power station. To date, we have found no problem regarding recovery prospects.

2. Medical physics

At present, medicine uses radiation as one of its important components. Its technology is rapidly progressing, especially in the past decade. Methods of delivering prescribed doses and accomplishing desired outputs in the radiation therapy of cancers and diagnostic applications have become more widespread and sophisticated. These include rapid arc radiation therapy, intensity modulated radiation therapy (IMRT), image guided radiation therapy (IGRT) and diagnostic applications such as interventional radiology (IVR). In any application, an essential factor is how precisely the dose is evaluated and also controlled. However, the accidental radiation exposures in medicine have been remarkable, due to mechanical, technical and/or human errors. In order to avoid such errors, quality assurance/quality control (QA/QC) activities have been conducted to assure and control precision in radiation usage. In these matters, medical physics is necessary when using radiation in medicine. In the course of our research, we describe how radiation protection has a considerable role in medical physics, especially in regard to radiation usage safety.

Based on this background, our department is working on medical physics research topics such as dosimetry, QA/QC and related topics, dose control for patients and medical workers

regarding various radiation diagnoses, and therapy including, among others, brachytherapy and neutron capture therapy. This research is carried out through both experiments and simulation calculations. Additionally, in cooperation with the department of Radiology, our department takes part in research and education activities. This joint effort is referred to as the "Cancer professional training plan."

Finally, we have determined three laws that define humans' relationship with radiation: 1) Life does not exist without nuclear energy from the sun, 2) low dose rate radiation is key to staying healthy and 3) low dose rate radiation is key to staying healthy.

List of Main Publications from 2014 to 2018

- 1) Nakamura Y. Takada J. Increase in colorectal cancer mortality by lack of sunlight exposure in Hokkaido, Journal of center for medical education of Sapporo medical University, 27-35, 2014 (in Japanese)
- 2) Tanaka K. Sakurai S. Endo S. Takada J. Study on detecting spatial distribution of neutrons and gamma rays using multi imaging plate system, Applied Radiation and Isotopes, 88, 143-146, 2014
- 3) Tanaka K. Endo S. Tateoka K. Asanuma O. Kamo K. Sato K. Takeda H. Takagi M. Hareyama M. Takada J. Measurement of the strength of iodine-125 seed moving at unknown speed during implantation in brachytherapy, Journal of Radiation Research, 55, 162-167, 2014
- 4) Tanaka K. Tateoka K. Asanuma O. Kamo K. Sato K. Takeda H. Takagi M. Hareyama M. Takada J. Benchmark of EGS5 for 125I brachytherapy in comparison to glass rod dosimeter and treatment planning system using AAPM-TR43U1 formalism, Progress of Nuclear Science and Technology (proceedings of workshop on computational medical physics, 4, 888-890, 2014
- 5) Takada J. Definitive Results from Fukushima Dosimetry Survey, The reality of the low radiation dose: returning to the 20km zone is possible, Radiation protection medicine, 10, 1-8, 2015 (in Japanese)
- 6) Tanaka K. Kamo K. Tateoka K. Asanuma O. Sato K. Takeda H. Sakata K. Takada J. A comparison of the dose distributions between the brachytherapy. I source models, STM1251 and Onco seed 6711, in a geometry lacking radiation equilibrium scatter conditions, Journal of Radiation Research, 56, 366-371, 2015
- 7) Takada J. Definitive Results from Fukushima Dosimetry Survey, The reality of the low radiation dose: returning to the 20km zone is possible, Journal of Radiation Protection Medicine 11, 1-10, 2015
- 8) Takada J. Dosimetry study of radiation hormesis cream, Radiation protection center, 1-42, 2015 (in Japanese)
- 9) Takada J. Determination version Radiation hygiene survey in Fukushima - The truth of Fukushima which was a low dose rate and reconstruction within 20 km, Iryokagakusha, 1-202, 2015. (in Japanese)
- 10) Takada J. The form of 6000 years ago coastline close to Sannai Maruyama Jomon village, Journal of center for medical education of Sapporo medical University, Vol. 7, 7-12, 2016. (in Japanese)
- 11) Takada J. Enhancement version, Study of radiation exposure in the world - the truth that the Japanese was not informed, Iryokagakusha, 1-244, 2016 (in Japanese)
- 12) Takada J. The reality of the low radiation dose in Fukushima Daiichi NPP 20Km zone. 14th International Congress of the International Radiation Protection Association, IRPA14 Cape Town, South Africa, 2016
- 13) Takatsuka S. Which hospital will you go? 2 hours each way or 4.5 hours each way? Hokkaido Development Association. Aug. (2016). 15-18. (in Japanese)
- 14) Takatsuka S, Yamaguchi T, Ohnishi H. Research of medical regional depending on road attributes. Research-aid papers of Hokkaido Development Association in 2016. 89-105. (in Japanese)
- 15) Takada J. Population estimates after Hokkaido Jomon period, Journal of center for medical education of Sapporo medical University, Vo. 8, 29-36, 2017
- 16) Takada J. Simulation of nuclear attack to Japan from North Korea", Seilon, August, 206—215, 2017
- 17) Takada J. Proud Japanese civilization, Seirindoh, 1-220, 2017 (in Japanese)
- 18) Takatsuka S, Yamaguchi T, Ohnishi H. Traffic evaluation on medical exam cross the border of secondary medical area based on GIS. Research-aid papers of Hokkaido Development Association in 2017. 145-164. (in Japanese)
- 19) Takada J. Galileo's holiday, from nuclear protection to Japanese civilization, 1-231, 2018 (in Japanese)
- 20) Takada J. Japanese detainees were made a dump of the Soviet nuclear development, WILL, August, 324-333, 2018
- 21) Takatsuka S, Yamaguchi T, Ohnishi H. The accuracy of the death section on health insurance claims data of the National Database in Japan. Japan Association for Medical Informatics Spring Conference 2018. 150-151. (in Japanese)
- 22) Takatsuka S. Medical exam and access road cross the border of secondary medical area in Hokkaido. Hokkaido Development Association. Apr. (2018). 33-37. (in Japanese)