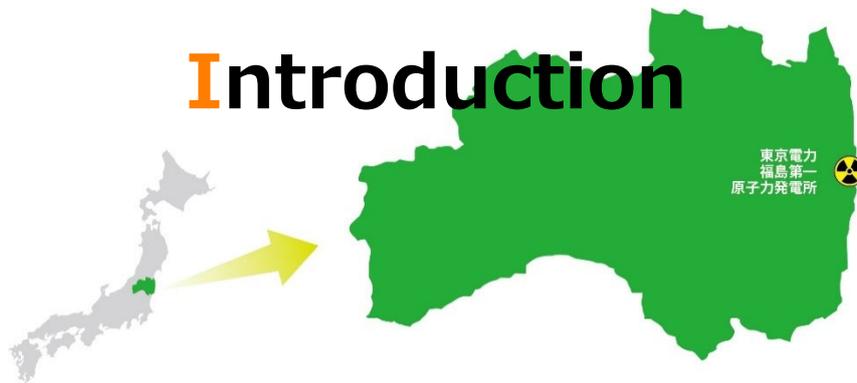


**Activity Reports of the
Radiation Pharmacist Committee, 2022**
For The Future of Fukushima

一般社団法人福島県薬剤師会
Fukushima pharmaceutical association

Introduction



The residents of Fukushima Prefecture have been suffering from the effects of a nuclear disaster since 2011. The disaster occurred on the east coast of Fukushima Prefecture. Enormous amounts of radionuclides were released from Tokyo Electric Power Company Fukushima Daiichi (TEPCO-F1) Nuclear Power Station because a hydrogen explosion caused by the tsunami produced by the Great East Japan Earthquake on March 11, 2011, caused the power station's control system to malfunction. A radioactive plume (air containing radionuclides) was dispersed, causing anxiety among the two million residents of Fukushima Prefecture, and hence, many people had to be evacuated. As the radioactive plume contained radionuclides with long half-lives, the effects of the nuclear disaster will persist long into the future.

Now, radiological protection systems, which are designed to help the residents of Fukushima live comfortable and healthy lives, are being run by the Japanese government. Advice regarding protection against radiation has been provided, and large amounts of radiological information has been published. However, many residents have occasionally been unsettled by confusing information and/or misinformation because the dynamics of radionuclides and the effects of low dose-radiation on health are complicated. The residents of Fukushima Prefecture need to improve their information literacy to obtain accurate knowledge about the dispersed radionuclides and the effects of ionizing radiation on health.

We decided to support residents with their daily activities by utilizing the skills of pharmacists living in Fukushima Prefecture. Pharmacists have to acquire fundamental knowledge about the fields of physics, chemistry, biology, and basic medical sciences in order to obtain their license. Therefore, by increasing their knowledge of radiological sciences, pharmacists will be able to support the residents of Fukushima Prefecture. In 2013, we launched the Radiation Pharmacist Project. As part of this initiative, we have developed a training course and prepared textbooks that will help pharmacists to study radiation and understand the latest situation regarding the aftermath of the nuclear disaster in the prefecture. As a result, more than 800 pharmacists have been trained and certified as "Radiation Pharmacists[®]", and they have been answering questions from residents about radiation. Over 1,400 Q & As have been recorded and classified.

To contribute to the improvement of the health of residents, we will continue these activities in pharmacies and schools in Fukushima Prefecture.



Outline of the Radiation Pharmacist Project

History of the Radiation Pharmacist Project

- Mar 2013:** The Radiation Pharmacist Committee was organized by the Fukushima Prefectural Pharmaceutical Association. A request to Dr. Hiroshi Ishihara (a specialist in radiological sciences at the National Institute of Radiological Sciences) to support the activities of the Radiation Pharmacist Committee was accepted.
- Oct 2014:** Training courses for Radiation Pharmacists commenced.
- Apr 2015:** Consultations with residents started.
- Dec 2015:** A training session was held with Fukushima School Pharmacist Association.
- Oct 2017:** A visit to the TEPCO-F1 plant to study the present situation regarding its decommissioning was organized.
- Jun 2018:** The Education Bureau of the Fukushima Prefecture Government participated in the Radiation BOSAI Forum.
- Nov 2019:** Radiation Pharmacist[®] was registered as a trademark.

Record of presentations and explanations of our activities

- Explanation provided in a meeting with visitors from France
- Explanation provided to Iwate Prefectural Pharmacist Association
- Explanation provided at a technical training course at the Shiken-kensa Center of the Japan Pharmaceutical Association
- Oral and poster presentations of our research at scientific meetings of the Japan Pharmaceutical Association
- Explanation provided at the Council of the Center for Information of Pharmaceutical Affairs in Hokkaido and the 6 prefectures of Tohoku.
- Explanation provided at a mobile seminar conducted by the Japan Woman's Pharmaceutical Association
- Explanation provided to the Council of Federation of Tohoku School Pharmacists
- Explanation provided to Tohoku Pharmaceutical Federation
- Explanation provided to Kagoshima Prefectural Pharmaceutical Association

Consultations



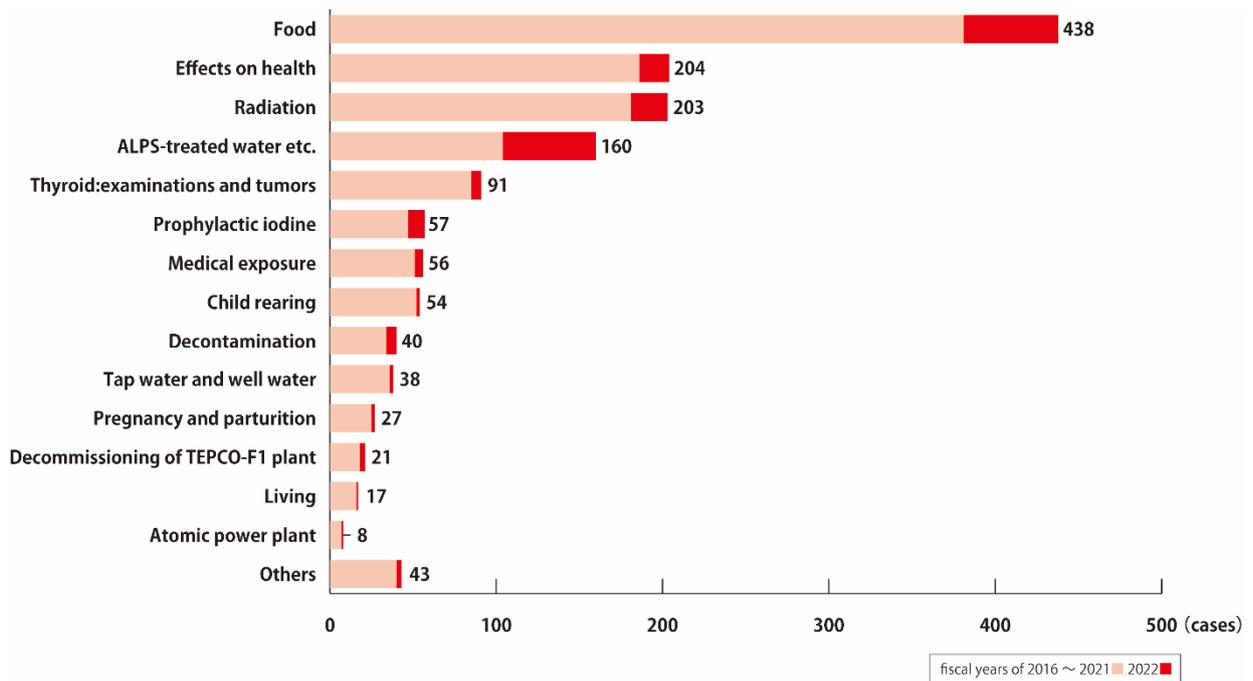
We have been providing consultation services at pharmacy counters since 2016. Various questions about radiation from the prefecture's residents have been answered.

Every year, we take part in nearly 200 consultations, and the total number of consultations had reached 1,457 by March 31, 2023.

The number of consultations about food is still numerous. Recently, questions about related to Advanced Liquid Processing System (ALPS)-treated water are increased, because a schedule to release ALPS-treated water from TEPCO-F1 into the ocean was published.

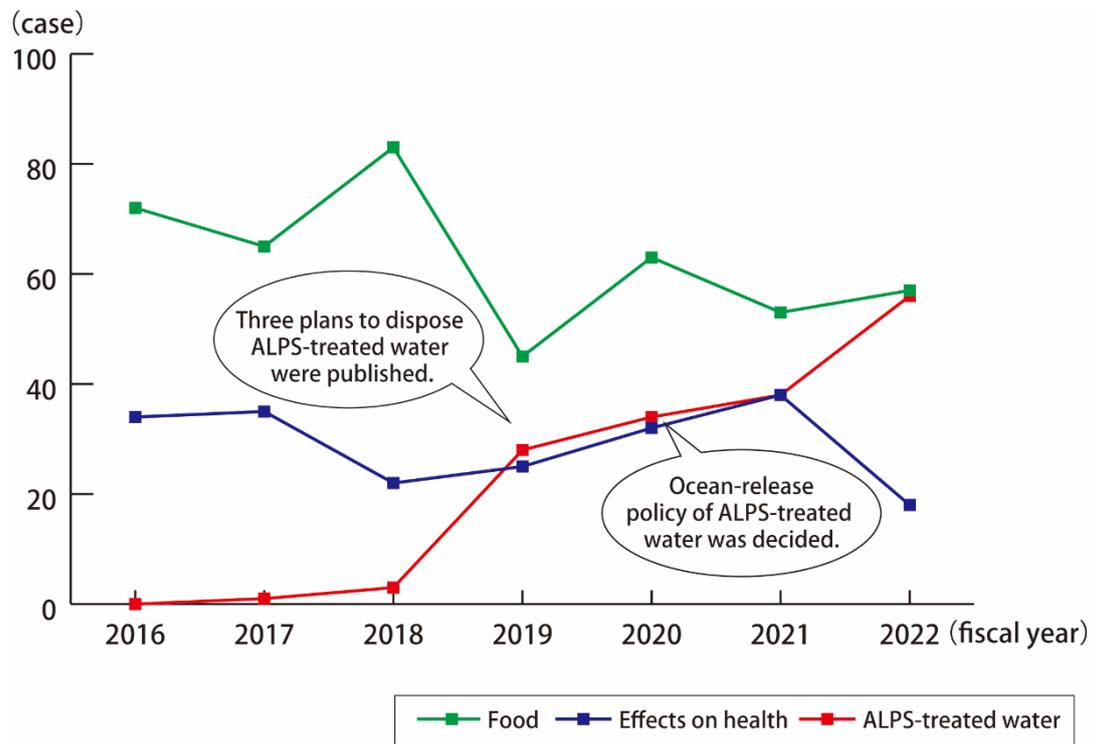


Categoryization



Total Q & A records: 1,457 cases (as of Mar 31, 2023)

Transition of the cases of the consultation



Examples of Q and A from the consultation services

Q Please teach me about tritium and its health effects.

A

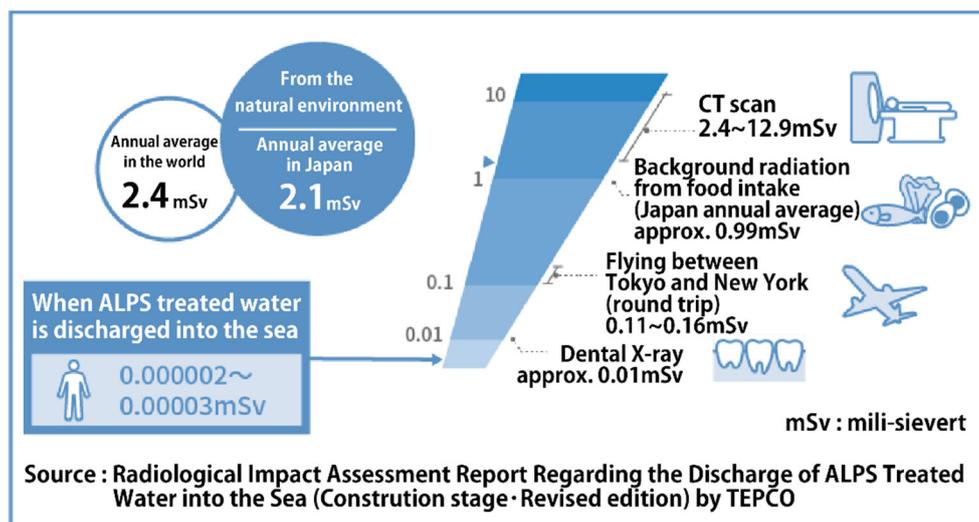
Tritium is generated by cosmic ray in natural atmosphere, and the most of it is converted to "Tritium water" by binding with oxygen. Thus, any water in the earth contains a faint amount of tritium water. Tritium is also generated in reactor of the atomic power plant artificially. There is no difference between the natural tritium and the artificial one.

Tritium is a radioactive nuclide radiating beta ray and its physical half-life is approx. 12 year. But the energy of beta ray is very low, so the ray is blocked by 5mm of air or a piece of thin paper. Because this beta ray can not permeate human skin, the effects of tritium beta ray by external exposure are ignorable level.

We always take in tritium from drinking water, and harbors tens Bq of tritium naturally in our body. Ingested tritium water are excreted from the body with the biological half-life of approximately 10 days. Health effects of tritium water are faint level, as ICRP has been estimated that the committed effective dose coefficient of tritium water is $0.000018\mu\text{Sv/Bq}$. For example, the level is only 1/344 of potassium 40 ($0.0062\mu\text{Sv/Bq}$ in the coefficient), one of natural radionuclide.

It has announced that ALPS-treated water is discharged into the ocean after its dilution with sea water until 1/40 level of the domestic regulation limit. Therefore the authority estimated that the health effects after the discharge are 1/70,000 to 1/1,000,000 levels of exposure with natural radionuclides.

Annual effects of radiation



Ministry of Economy, Trade and Industry, "Annual effects of radiation", Let's get to know and understand about ALPS treated water., (Retrieved August 18, 2023, https://www.meti.go.jp/earthquake/nuclear/hairo_osensui/english/shirou_alps/no5/)

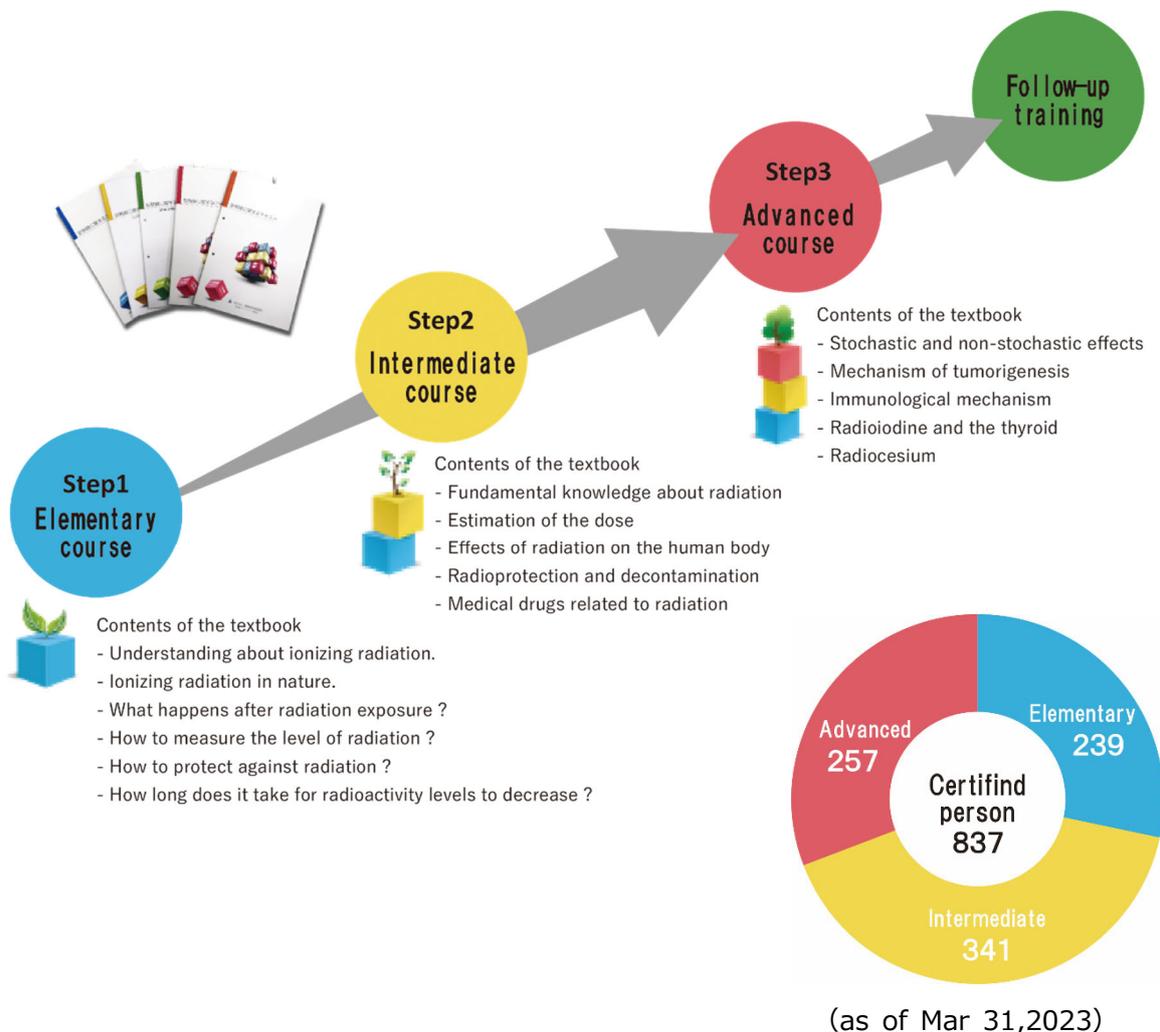
Q What is the "ALPS-treated water"?, How to discharge the "ALPS-treated water"?

A

I will explain published information about the ALPS-treated water and the plan how to release it into the ocean. Any water contaminated with various radionuclides in TEPCO-F1 plant is isolated and pooled as "radioactive waste water" in the plant. Government decided to release the water after decontamination to the ocean, similar to other nuclear plants in the world. Other than tritium, all the radioactive nuclides generated in TEPCO-F1 are removed using a decontamination plant of Advanced Liquid Processing System (ALPS). When the concentration of radionuclide is below the accepted level (called as "notification concentration", e.g. in the case of ^{137}Cs , 90Bq/L), the waste water is defined as the "ALPS-treated water." The ALPS-treated water still contains a certain amount of tritium, because it is impossible to remove any tritium physically. Because WHO guideline defines that tritium in drinking water should be below 10,000 Bq-tritium/L, the ALPS-treated water is diluted with sea water until tritium concentration becomes far below the guideline level, eg. below 1,500 Bq/L. After that, the diluted ALPS-treated water is released into the ocean, as TEPCO announced. Limit of total mass of released tritium will be less than 22 trillion Bq per year, based on the fact that TEPCO-F1 plant released 22 trillion tritium every year before disaster in 2011. TEPCO and the government announced that all the operations in TEPCO-F1 will be processed carefully, and that follow-up monitoring of the dispersion of released tritium in the ocean will be planned.

Training of Radiation Pharmacist[®]

Three types of training courses, "elementary", "intermediate", and "advanced" are held every year, and pharmacists chose an appropriate course based on their knowledge level about radiation. Each of the courses involves the use of original textbooks. Pharmacists that successfully complete a course are certified as a Radiation Pharmacist[®] of the corresponding level. Pharmacists can raise their levels by attending the relevant training course. The advanced Radiation Pharmacist[®] certificate expires within 3 years. After this period, pharmacists need to re-attend the advanced course, which will use the latest textbooks.



Published Brochures

The leaflet "Tell me, Radiation Pharmacist" aims to provide accurate intelligible information about radiation to the prefecture's residents. "About the Radiation Pharmacist" introduces the concept of Radiation Pharmacists and the associated training system because Radiation Pharmacists can help residents and schools with activities in Fukushima Prefecture. These leaflets are written in Japanese only.



"Tell me, Radiation Pharmacist"

●読んで！放射線ファーマシスト Vol.1

安定ヨウ素剤の役割ってなに？

原子力発電所で事故が起こった場合、大気中に放射性ヨウ素やセシウム、ストロンチウムなどの放射性物質が放出されますが、放射性ヨウ素による影響は、安定ヨウ素剤の服用が効果的なのは、どうしてですか？

甲状腺はヨウ素が好き？

ヨウ素は、甲状腺で分泌される甲状腺ホルモンをつくる材料になります。そのため、体内に入ったヨウ素の多くが甲状腺に集まりやすいのです。つまり、甲状腺にはヨウ素が必要なのです。

体内では、放射性ヨウ素が取り込まれても、普通のヨウ素と区別がつかないため、放射性ヨウ素も普通のヨウ素と同じように甲状腺に集まってしまいます。

放射性ヨウ素による甲状腺被ばくを防ぐには？

甲状腺に放射性ヨウ素を蓄めないためには、あらかじめ甲状腺をヨウ素で満たしておくことが必要です。

【満たされていない場合】
放射性ヨウ素が甲状腺に集まりやすいため、甲状腺に放射性ヨウ素が蓄積される。

【満たされている場合】
ヨウ素が足りているので、甲状腺に放射性ヨウ素が蓄積されず、尿中に排泄される。

安定ヨウ素剤服用の注意

- ・ヨウ素剤は、甲状腺の検査の結果、医師の指示に従って服用してください。
- ・次の症状が現れた場合は、安定ヨウ素剤の服用の可否について、医師と相談し、決めてください。
- ①ヨード造影剤検査の既往歴、②甲状腺腫瘍既往歴、③甲状腺癌既往歴、④甲状腺炎、⑤甲状腺機能亢進症、⑥甲状腺機能低下症、⑦甲状腺嚢腫、⑧甲状腺嚢腫、⑨甲状腺嚢腫、⑩甲状腺嚢腫、⑪甲状腺嚢腫、⑫甲状腺嚢腫、⑬甲状腺嚢腫、⑭甲状腺嚢腫、⑮甲状腺嚢腫、⑯甲状腺嚢腫、⑰甲状腺嚢腫、⑱甲状腺嚢腫、⑲甲状腺嚢腫、⑳甲状腺嚢腫、㉑甲状腺嚢腫、㉒甲状腺嚢腫、㉓甲状腺嚢腫、㉔甲状腺嚢腫、㉕甲状腺嚢腫、㉖甲状腺嚢腫、㉗甲状腺嚢腫、㉘甲状腺嚢腫、㉙甲状腺嚢腫、㉚甲状腺嚢腫、㉛甲状腺嚢腫、㉜甲状腺嚢腫、㉝甲状腺嚢腫、㉞甲状腺嚢腫、㉟甲状腺嚢腫、㊱甲状腺嚢腫、㊲甲状腺嚢腫、㊳甲状腺嚢腫、㊴甲状腺嚢腫、㊵甲状腺嚢腫、㊶甲状腺嚢腫、㊷甲状腺嚢腫、㊸甲状腺嚢腫、㊹甲状腺嚢腫、㊺甲状腺嚢腫、㊻甲状腺嚢腫、㊼甲状腺嚢腫、㊽甲状腺嚢腫、㊾甲状腺嚢腫、㊿甲状腺嚢腫

ヨウ素は、どんな食べ物に含まれているの？

ヨウ素は、海藻類や魚に多く含まれており、日本人は日常的に海藻類や魚を摂取しているため、ヨウ素を十分に摂取しているといわれています。

主な海藻類・魚のヨウ素含有量

わかめ(乾燥)	1人分(10g)	190μg
かつおの刺身	100g	25μg
さんま	1尾(100g)	21μg

※成人のヨウ素摂取量(目安) 前 130μg/日
成人のヨウ素摂取量(目安) 前 130μg/日

一般社団法人福島県薬剤師会
放射線ファーマシスト委員会 (2019.1.1作成)

Vol.1 How does prophylactic iodine work?

●読んで！放射線ファーマシスト Vol.2

事故前と放射線空間線量はどのくらい違うの？

東京電力福島第一原子力発電所の事故後、『放射線空間線量』をニュースやモニタリングポストなどで、目にすることが多くなりましたが、今の放射線空間線量は、事故前(平時)と比べて、どのくらい高い状態ですか？

除染も進み、ほぼ事故前に近い線量に

事故前(平時)の放射線空間線量と、今の線量を比べてみましょう。

地区	事故前(平時)	2011年4月	2019年1月	事故前(平時)
福島市	0.04	2.74	0.11	0.55
郡山市	0.04-0.06	2.52	0.08	0.42
白河市	0.04-0.06	0.80	0.07	0.37
南相馬市	0.05	0.92	0.07	0.37
いわき市	0.05-0.06	0.66	0.06	0.32
会津若松市	0.04-0.06	0.24	0.05	0.26
双葉郡	0.02-0.04	0.08	0.03	0.16

※単位: μSv/h。年間平均値(単位は mSv/年)
<世界の主要都市との比較> ※2019年1月現在

福島市では、平時よりもまだ少し放射線量が低いですが、避難区域を除いては、ほぼ平時の放射線空間線量に近づいています。世界の主要都市の線量とも変わらないうらいまで近づいています。

福島市の空間線量は、0.11 μSv/h ですが、年間どれくらい被ばくするの？

年間で平均(0.21 mSv/年)よりどれくらい追加被ばくするか、1日目のうち意外に8時間、屋内(窓へいどあたり)の空気中の放射線量(1.6時間滞在する生活パターン)を想定して、計算してみよう。被ばく量は、次の計算式で求めることができます。

毎時空間線量 × 屋外滞在時間 + 毎時空間線量 × 窓へいど効果 × 屋内滞在時間

$0.11 \mu\text{Sv/h} \times 8 \text{時間} + 0.11 \mu\text{Sv/h} \times 0.4 \times 16 \text{時間} = 1.584 \mu\text{Sv/日} \times 365 \text{日} = 578.16 \mu\text{Sv/年} \approx 0.58 \text{mSv/年}$

平時より5年間で約0.5 mSv追加被ばくすることになります。この量は、WHOの線量限度1回受けた被ばく線量3 mSvの約10分の1の線量です。

また、国が示している年間追加被ばく線量 1 mSv/年(空間線量率: 0.23 μSv/h)より低い値ですので、線量に影響を及ぼすほどではないと考えられます。

【年間追加被ばく線量とは】

自然放射線(日本平均 2.1 mSv/年)
年間 1 mSv/年(空間線量率: 0.23 μSv/h)

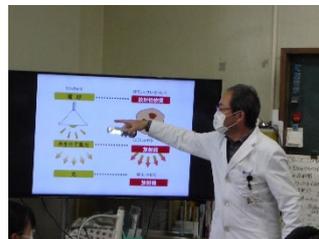
一般社団法人福島県薬剤師会
放射線ファーマシスト委員会 (2019.4.29作成)

Vol.2 How has the air dose rate changed since the disaster ?



Power point files for the Radiation Education for school pharmacists.

Together with anti-drug education in school children, radiation education by school pharmacist is recommended. To support the radiation education, we have prepared 10 pptx files. Using the files, school pharmacists with certificated Radiation Pharmacist[®] are teaching in schools in Fukushima Prefecture.



<theme>

- 1 Can we erase "ionizing radiation" ?
- 2 Why is "ionizing radiation" dangerous ?
- 3 Is "ionizing radiation" bad guy ?
- 4 Is "ionizing radiation" contagious ?
- 5 Is food safe ?
- 6 How to measure "ionizing radiation" ?
- 7 How to protect "ionizing radiation" ?
- 8 How much "ionizing radiation" did you receive by the TEPCO-F1 nuclear accident?
- 9 What kind of substance is tritium ?
- 10 Is it dangerous to release ALPS-treated water into the ocean? ?

