

● このスライドの著作権は、原則として著作者に帰属します。著作権法上認められた場合を除き、その利用には原則として著作者の許諾が必要です。

As a general rule, the copyright of the slides belongs to the author. In principle, the author's authorization is required for their use, except in cases recognized by the copyright law.

2026年 福島県立医科大学「県民健康調査」国際シンポジウム

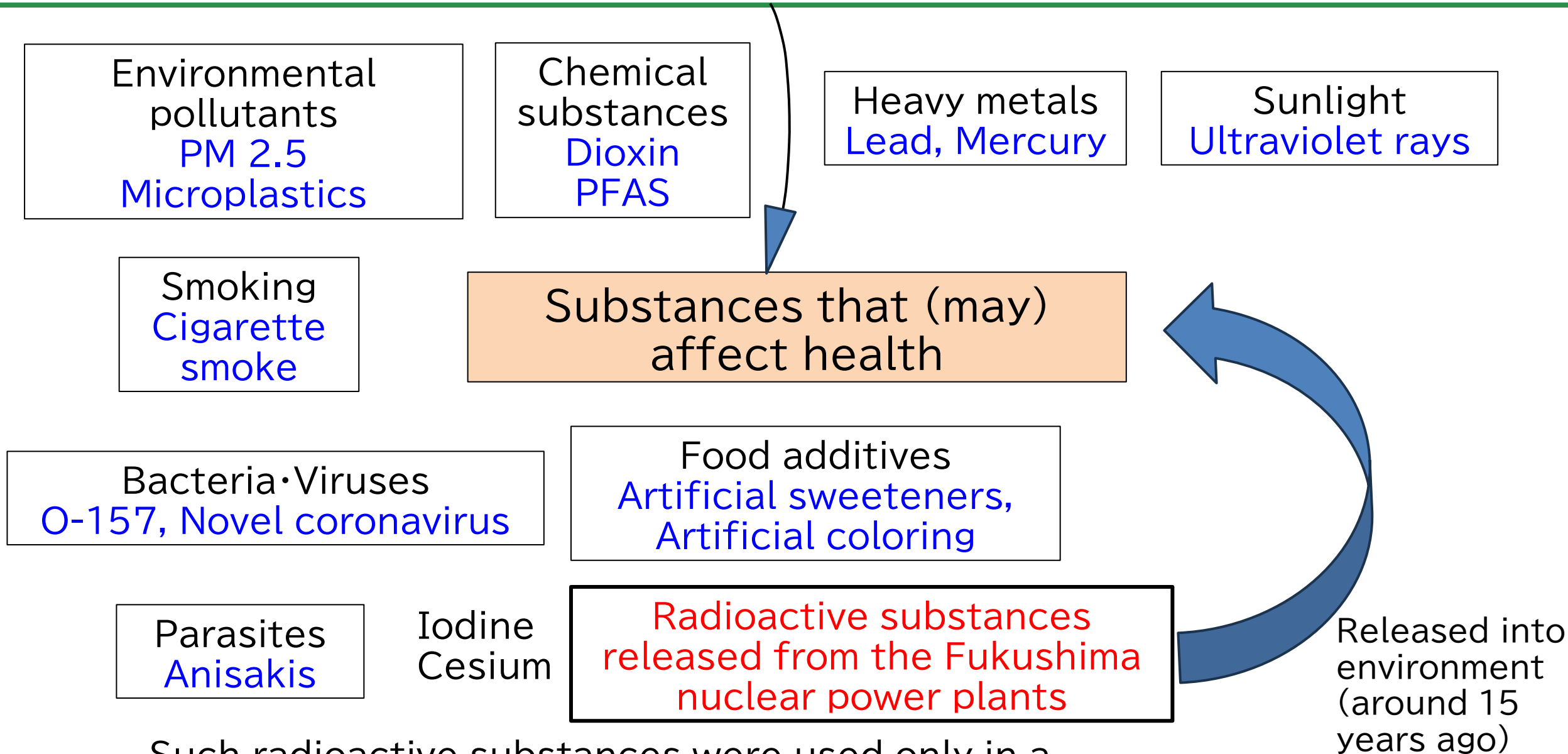
2026 Fukushima Medical University International Symposium on the Fukushima Health Management Survey

Radiation: what I want to reemphasize

ISHIKAWA Tetsuo

Radiation Medical Science Center
for the Fukushima Health Management Survey
Fukushima Medical University

Various health hazards in our surroundings

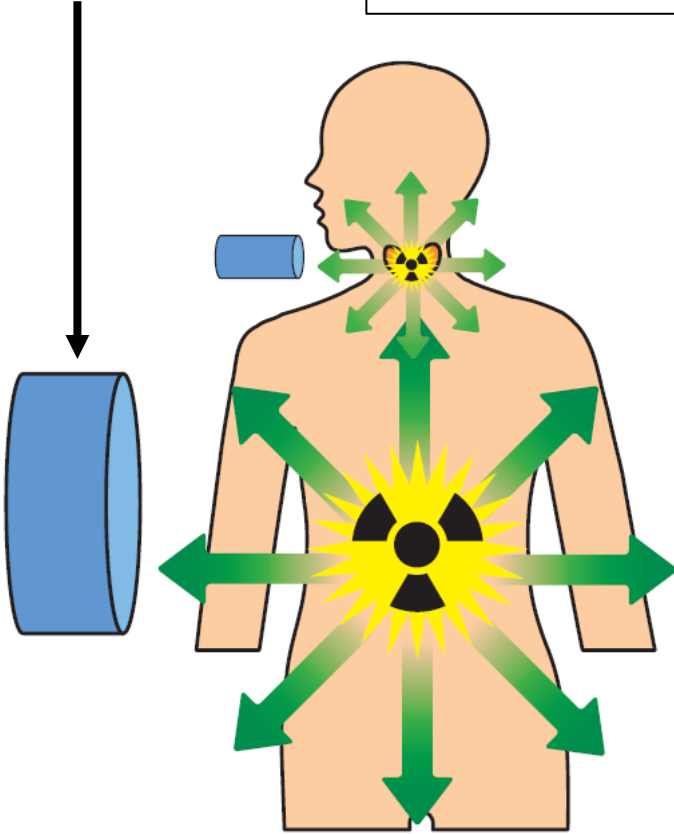


Such radioactive substances were used only in a limited number of laboratories before the accident.

Radioactive substances are relatively easy to detect

Radiation from radionuclides incorporated in the body can be detected.

Whole-body counter



Can we detect microplastics accumulated in the body?



Can we detect flu virus or novel coronavirus in a room?

The radiation level in a room can be measured using a simple device.

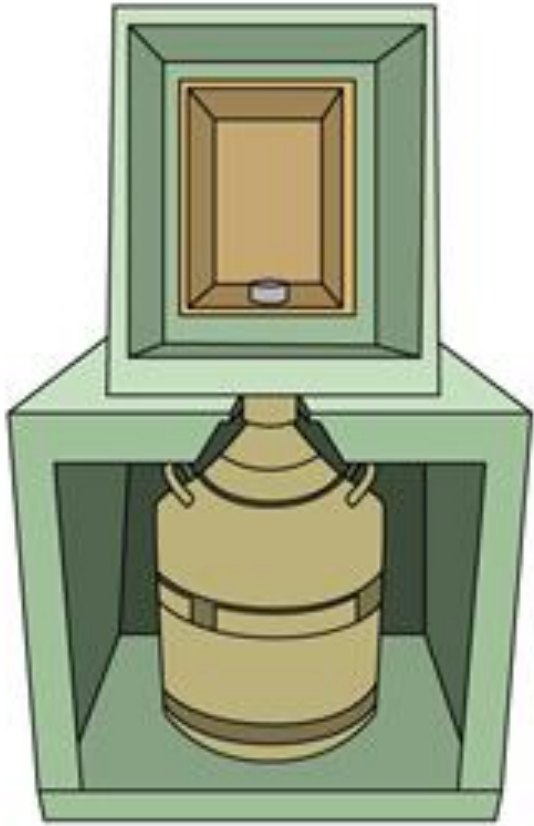


Radiation is easily measured. By evaluating exposure doses based on measurements, it is possible to roughly estimate the extent of potential health effects.

Reference: Document on Education and Self-Study Related to Radiation Medicine in Medical Education April 2012 The National Institute of Radiological Sciences

Examples of radiation detectors

Generally, radiation detectors are highly sensitive. They can measure even minute amounts of radiation that have almost no effect on the human body.



Ge semiconductor detector

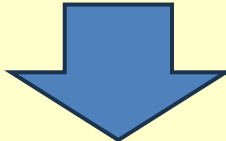
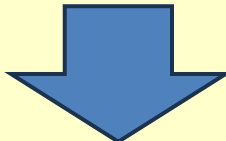


NaI(Tl) food monitor

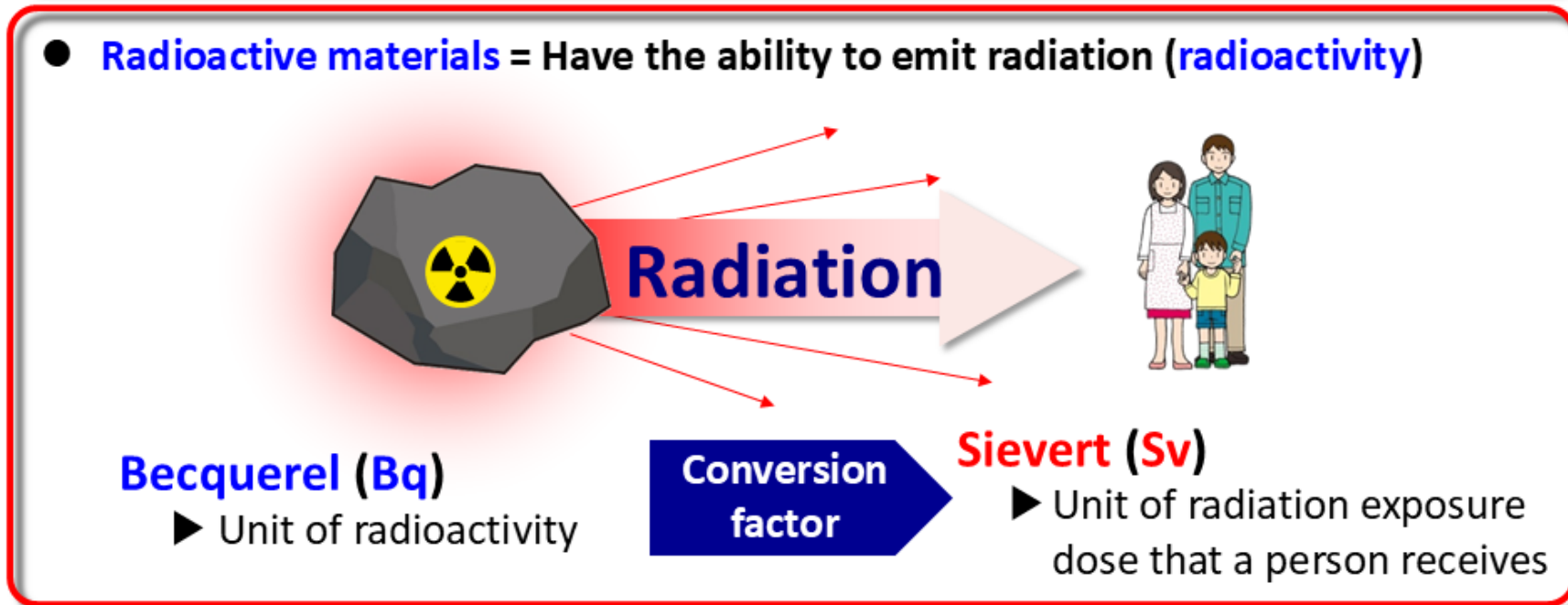
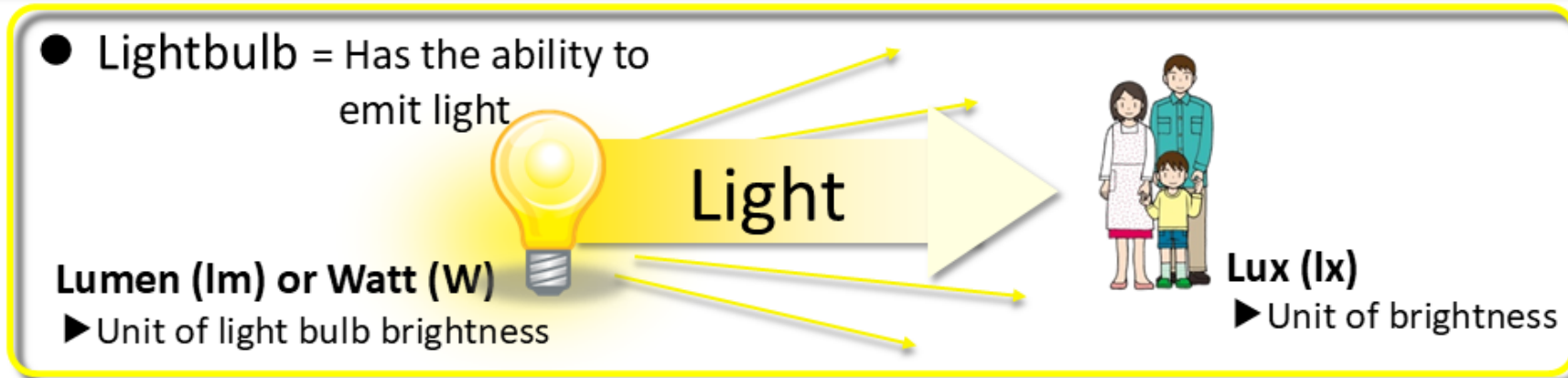


Personal dosimeters

Detection of radiation/presence of radioactive substances does not mean it is harmful.

- Radioactive materials are relatively easy to detect. Generally, radiation detectors are highly sensitive and can measure even minute amounts of radiation.

- Detection of radiation or the mere presence of radioactive substances does not necessarily have any health consequences.

- To assess health effects of radiation, it is important to focus less on the source of radiation and more on the recipient(s) of radiation (next slide).

Sources and recipients of radiation



*Sievert is associated with radiation effects.

※Although Gray is sometimes used as a unit of radiation dose, today's lecture will not cover topics related to Gray.

Radiation in everyday life (example of a common radiation source)

Ingredients of a vegetable juice pack (200 mL)

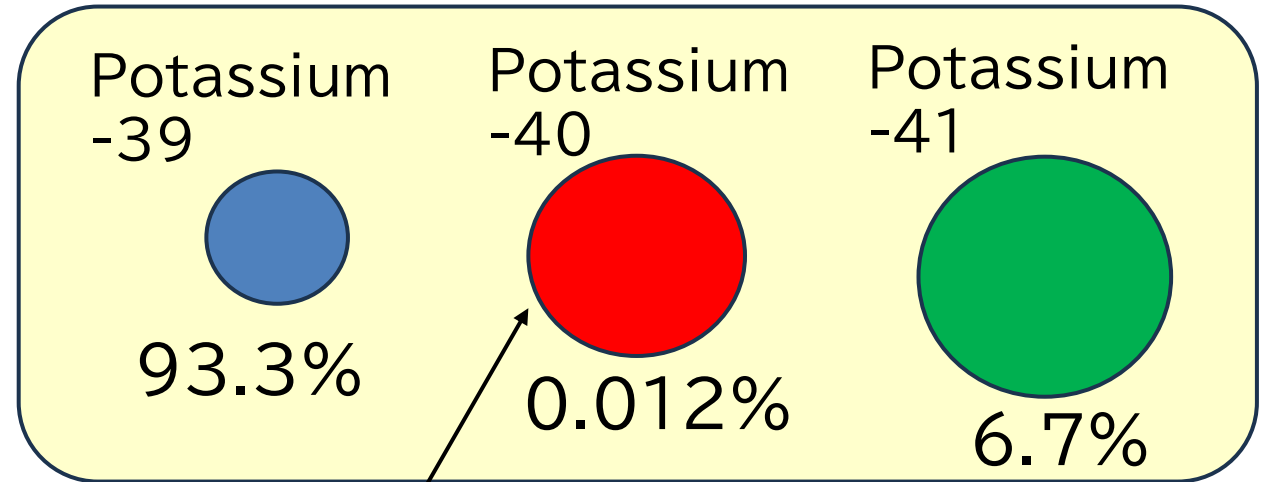
Energy	XX kcal
Protein	2.3 g
Fat	0 g
Carbohydrates	16.0 g
....	
Potassium	645 mg
Calcium	135 mg
....	



Potassium 645 mg

Natural potassium is a mixture of three isotopes of potassium atoms with slightly different masses.

Potassium



(For ease of understanding, this diagram shows slightly different atomic masses as noticeably different sizes.)

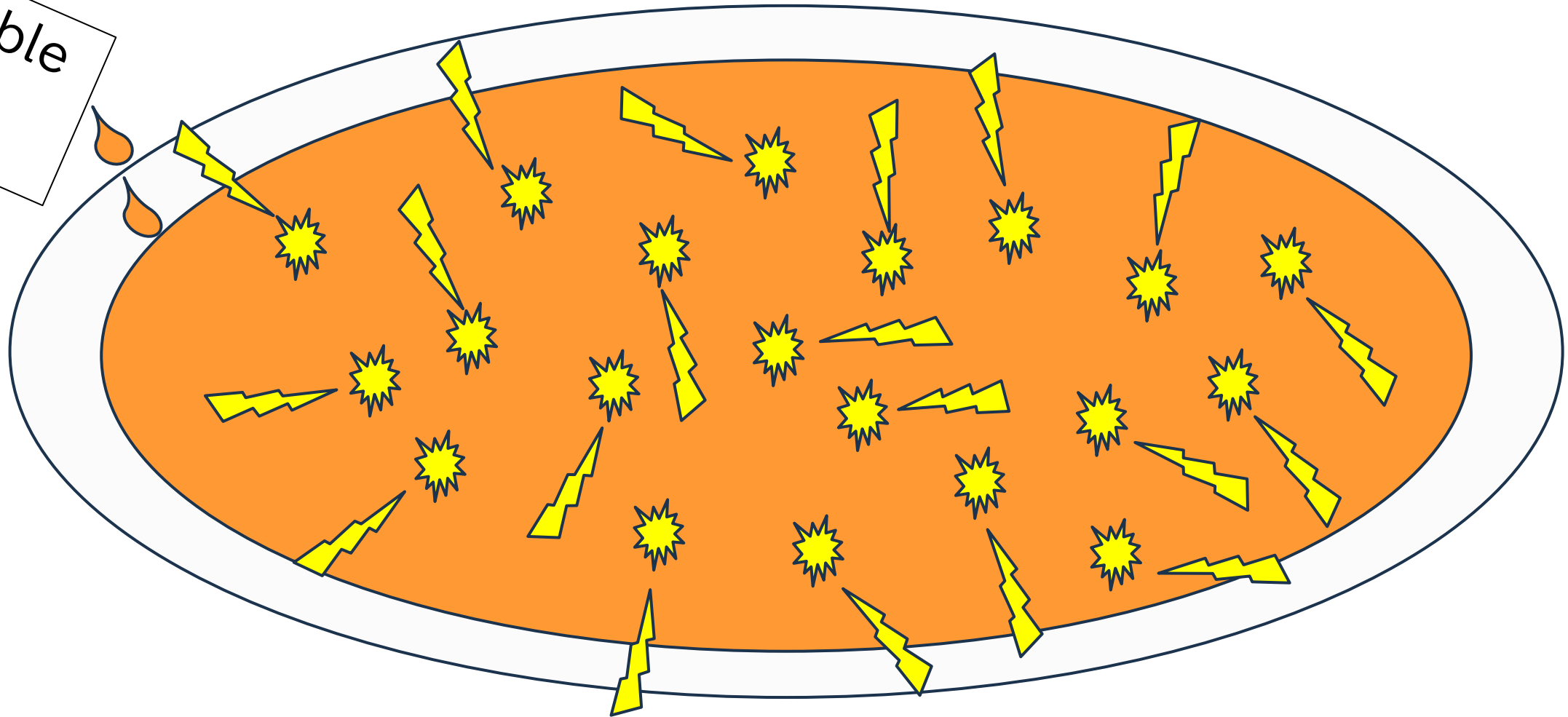
Potassium-40 is a substance that emits radiation. It is impossible to isolate potassium-40 from dietary potassium.

Radiation in everyday life (example of a common radiation source)

Potassium 645 mg \Rightarrow around 20 Bq in terms of Potassium 40 activity

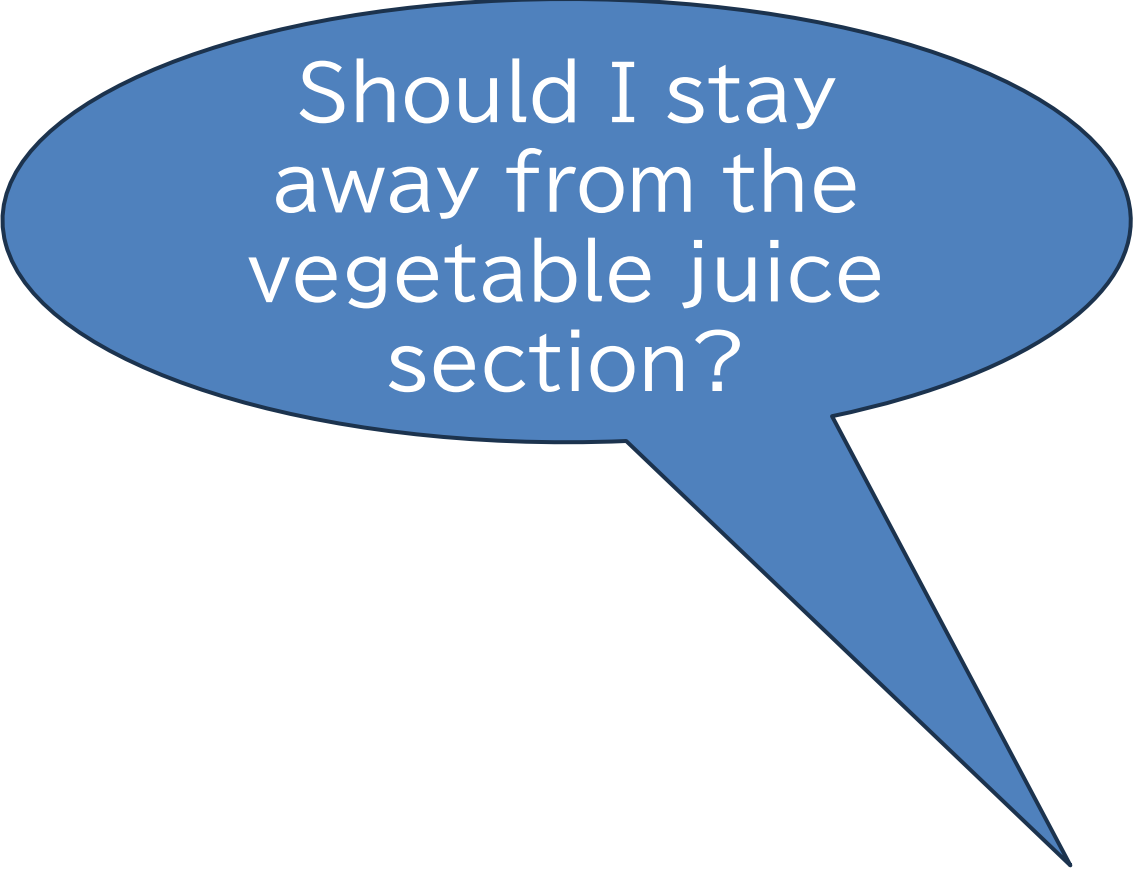
Around 20 radiation beams are emitted per second.

Vegetable
juice
200 mL

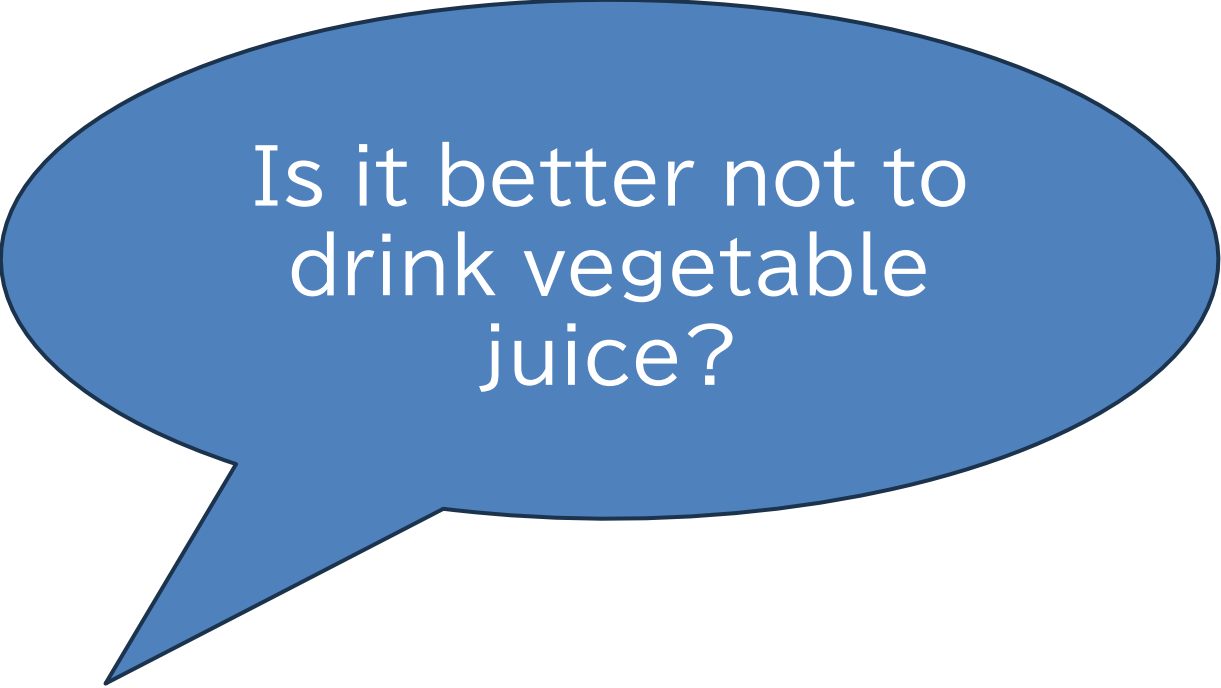


Radiation in everyday life (example of a common radiation source)

If you focus on radiation sources (becquerels or number of radiation beams emitted)...



Should I stay away from the vegetable juice section?



Is it better not to drink vegetable juice?

Comparison of figures expressed in terms of Bq and Sv

- Around 20 radiation beams per second are emitted from 200 mL of vegetable juice.
- Even without drinking vegetable juice, the human body contains approximately 2 grams of potassium per kilogram of body weight due to the potassium ingested through daily meals.
- The body of an adult weighing 60 kg contains approximately 3,600 becquerels of potassium-40 (it varies from person to person). In other words, about 3,600 radiation beams are emitted per second.

When converting becquerels (Bq) to sieverts (Sv)...

Annual dose due to potassium-40 in the body: 0.17 mSv
(not depending on what you eat)

Health effects must be considered based on exposure doses

- If you ingest 1 kg of food with a Cs-137 concentration of **100 Bq/kg** (a standard limit for radioactive cesium),

The internal dose will be **1.3 μ Sv**

The distribution of food containing concentrations exceeding this standard limit is regulated.

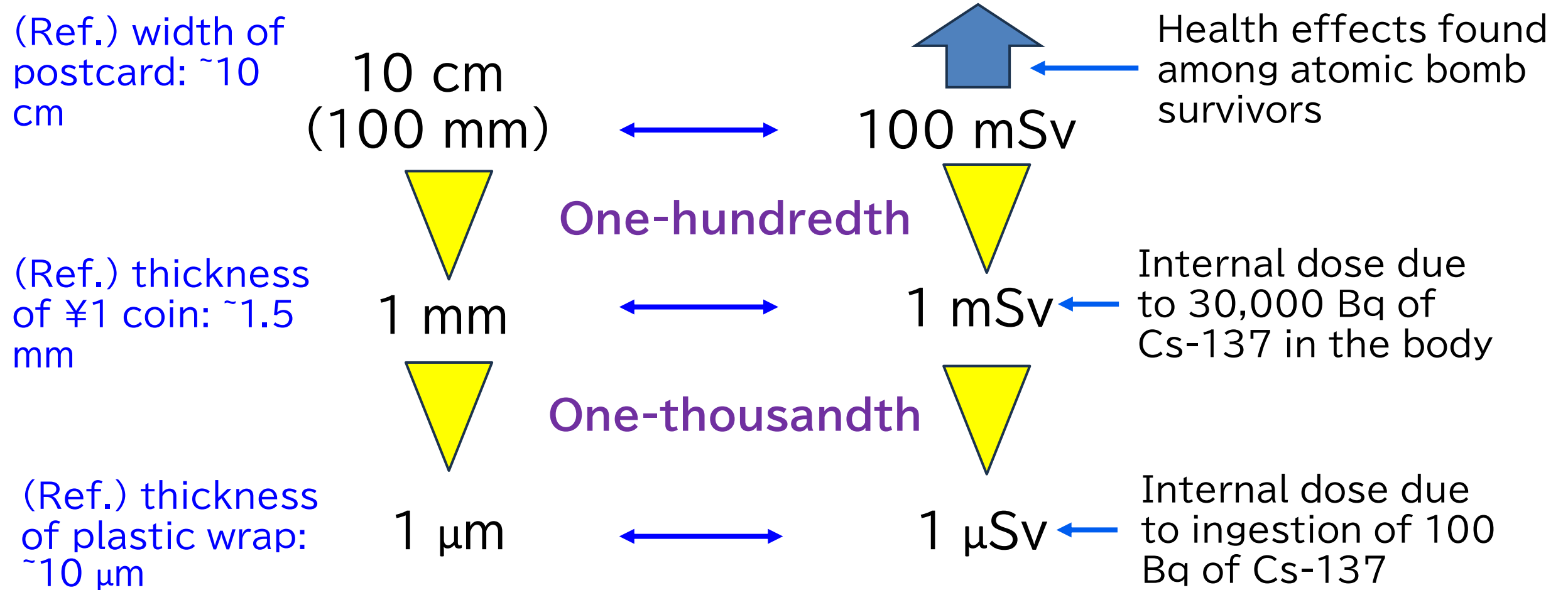
- As a result of chronic intake of Cs-137 throughout a year, the amount of Cs-137 in the body reached to **30,000 Bq**.

The internal dose will be around **1 mSv**

Although the Bq value is large, the Sv value is small.
(The relationship between values in Bq and Sv depends on the particular radionuclide.)

Conversion to the sievert unit is necessary to evaluate health effects.

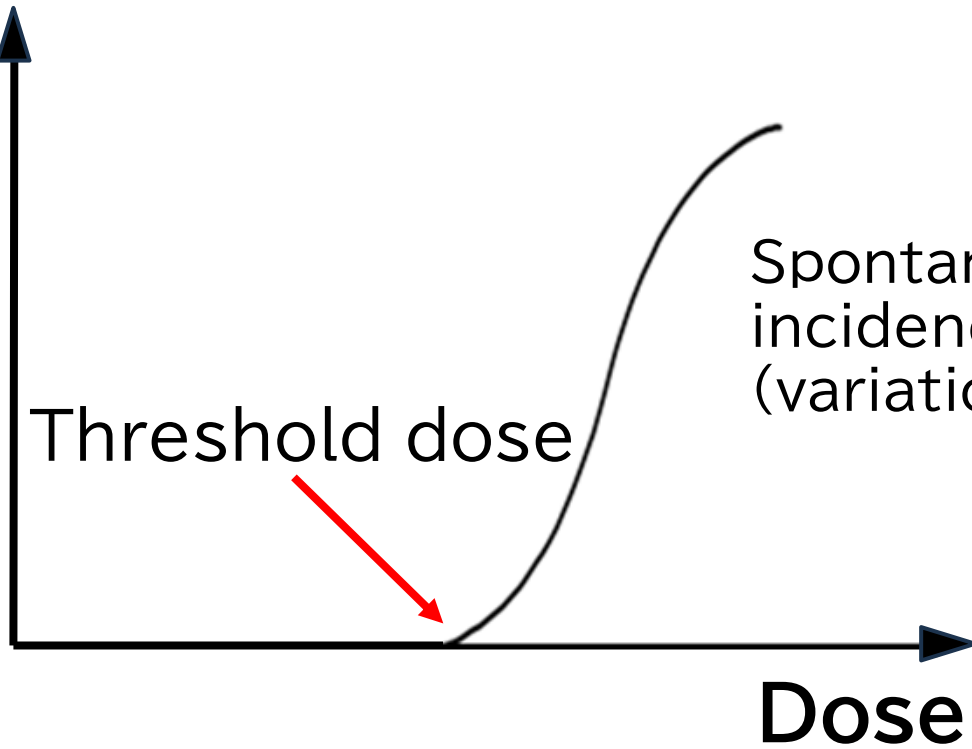
Understanding differences from milli (m) to micro (μ)



Relationship between dose and health effects

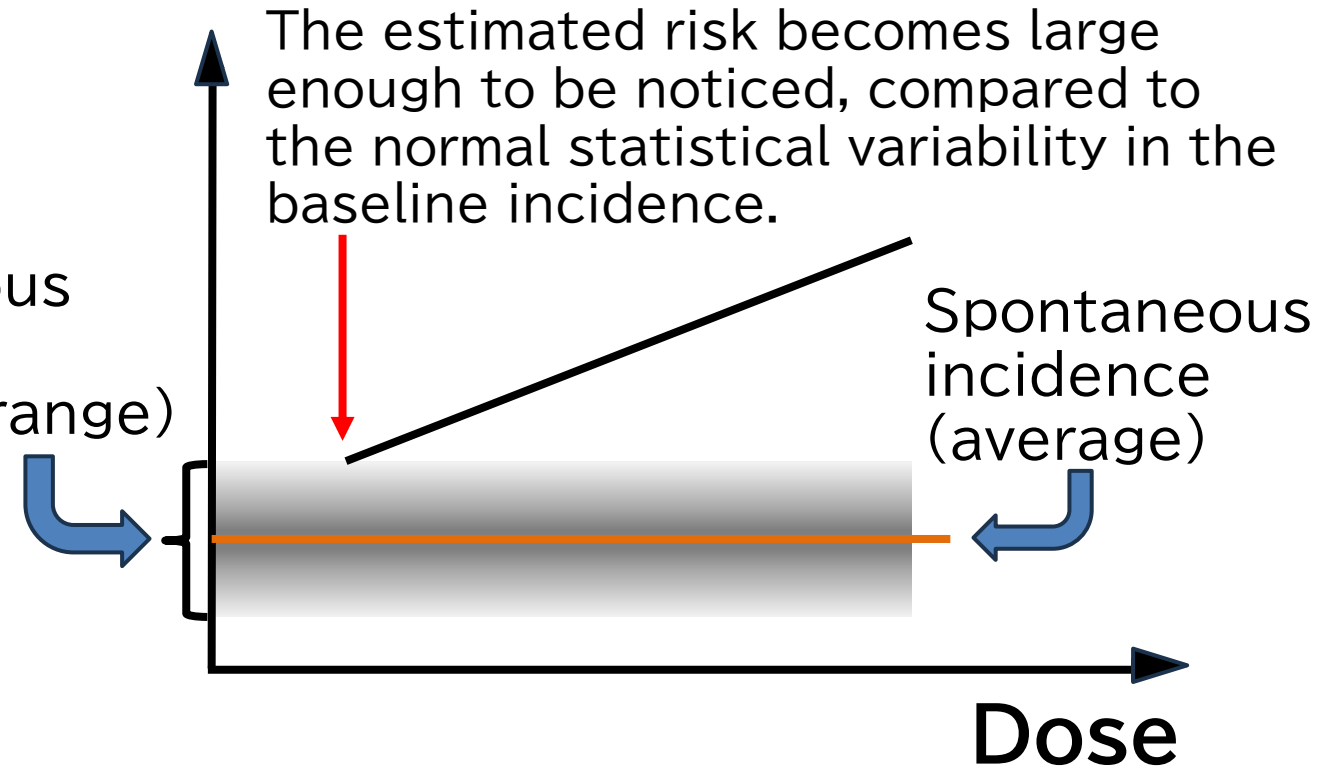
Hair loss, skin injury, etc.
(acute disorders, which
appear within several
weeks)

Incidence
of effects



Cancer (late-onset disorders,
which appear after the lapse
of more than a few years)

Incidence
of effects

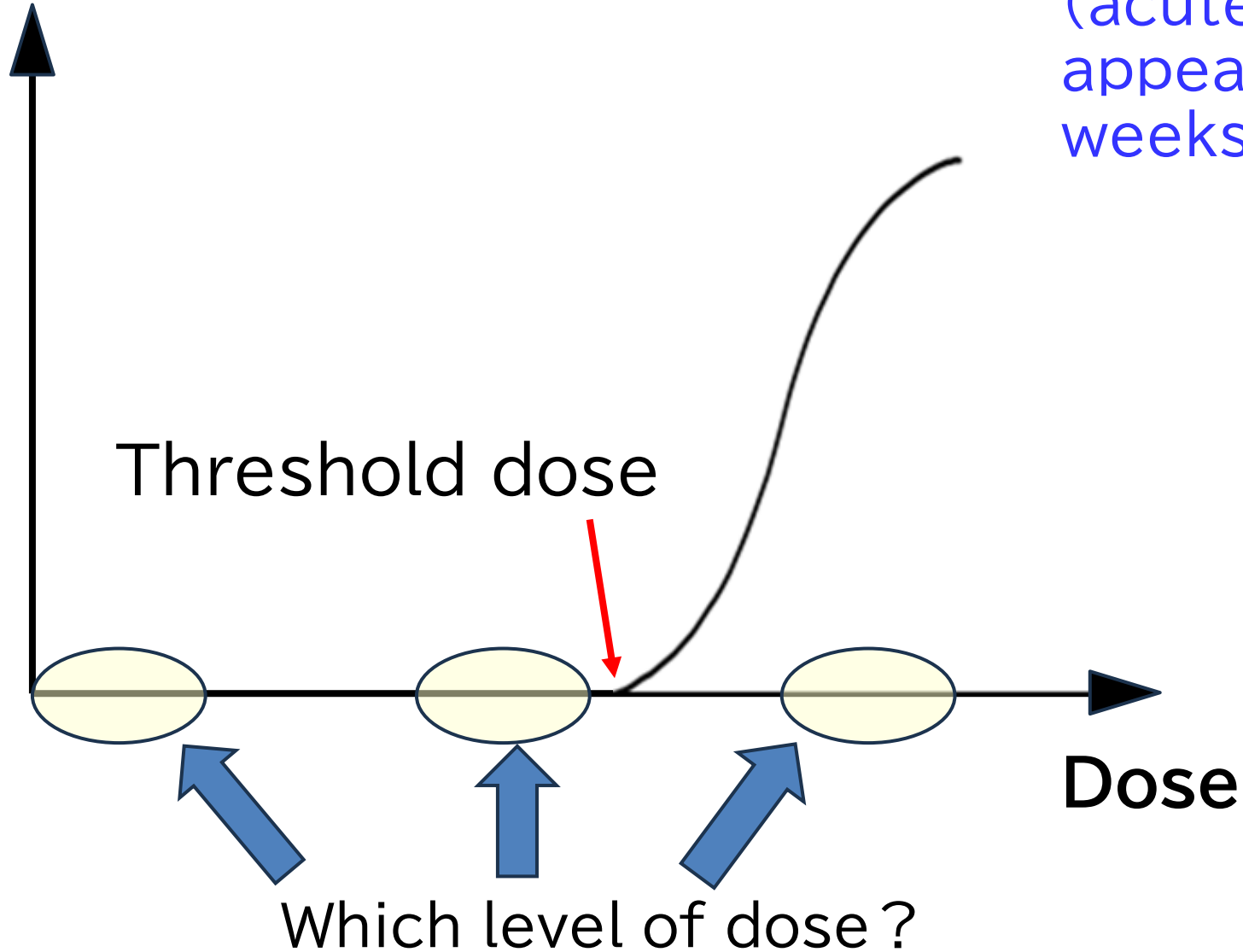


For relatively high levels of radiation exposure, there is some knowledge regarding the extent of effects at certain doses.

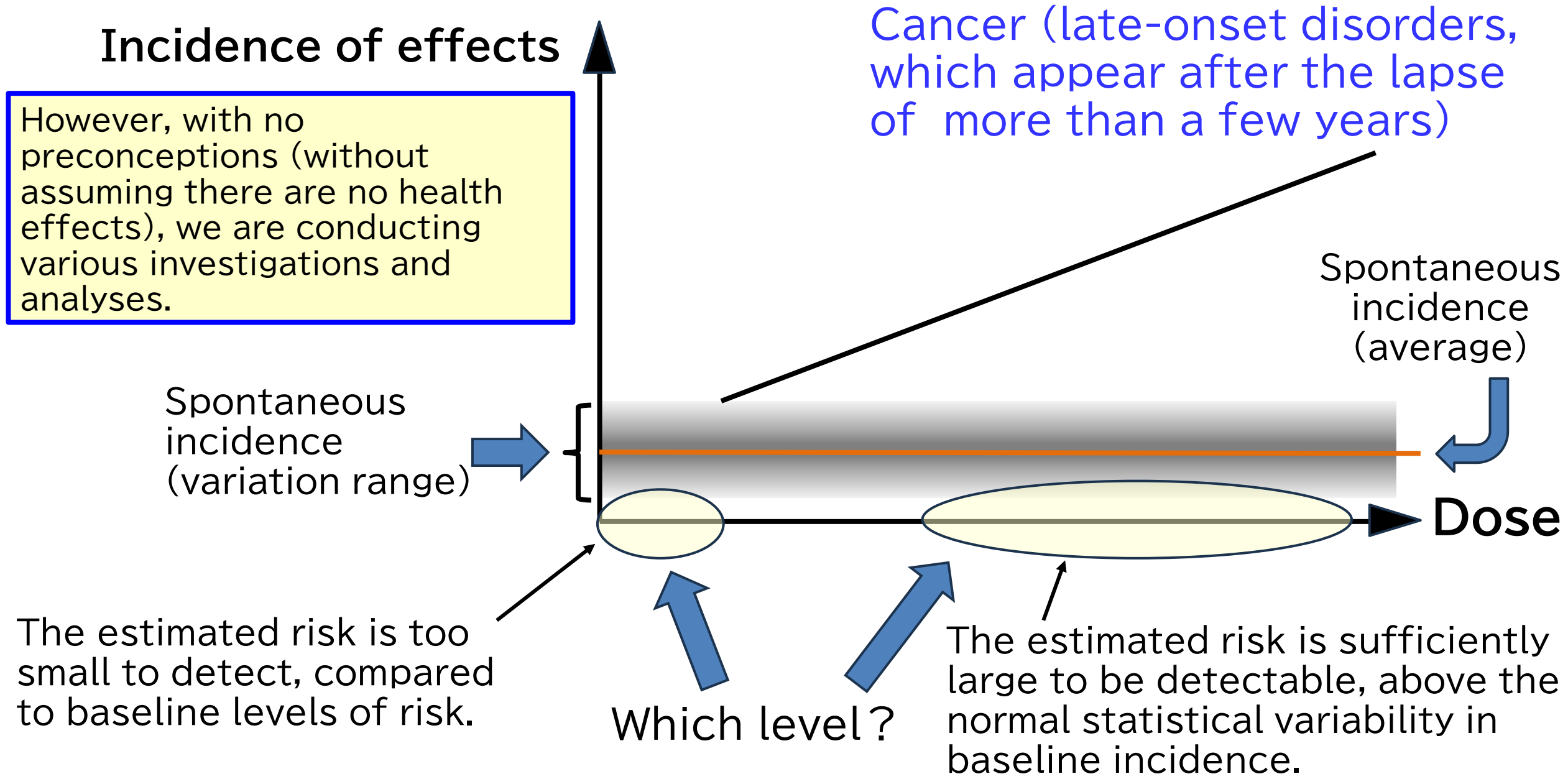
Levels of doses received by the public after the Fukushima accident

Incidence of effects

Hair loss, skin injury, etc.
(acute disorders, which appear within several weeks)



Levels of doses received by the public after the Fukushima accident



Summary

- Various substances that may potentially affect health exist around us. Among them, radioactive substances are relatively easy to detect.
- Because of this sensitivity, radiation detectors can generally measure radiation down to levels that have almost no effect on the human body.
- When considering the health effects of radiation, it is essential to think in terms of doses expressed in sieverts rather than the source's intensity (number of radiation beams or becquerels).
- Knowledge exists regarding the effects of radiation at certain higher dose levels.
- Reports from international organizations indicate that the likely exposure doses after the Fukushima nuclear accident did not cause acute health effects among Fukushima residents, and future health impacts are also unlikely to be detected. However, various investigations and analyses continue without preconceptions.

● このスライドの著作権は、原則として著作者に帰属します。著作権法上認められた場合を除き、その利用には原則として著作者の許諾が必要です。

As a general rule, the copyright of the slides belongs to the author. In principle, the author's authorization is required for their use, except in cases recognized by the copyright law.