Decree
-Radiation Hazard Prevention Law-

Radiation Hazard Prevention Law

(1) Regulation by law

Radiation, radioisotopes, dose limits

(2) Place safety management (facility standard)

Radiation facilities, structures, controlled areas, signs

(3) Human safety management

Education training, health examination, exposure measurement

(4) Handling safety management (standard of conduct)

Use, storage, disposal, transportation

Atomic Energy Basic A

- Research, development and utilization of nuclear energy is limited to the purpose of peace
- Prevent radiation damage
- Ensure public safety

Radiation regulation law

Prevent radiation hazards and ensure public safety by regulating the use of radiation, radioisotopes (RI) and radiation generators, and the disposal of materials contaminated by RI based on the Atomic Energy Basic Law.

The purpose of Act on Prevention of Radiation Hazards due to Radioisotopes, etc.

- **Ensuring worker safety**

(1) Radiation limit in the work room
(2) Limit of concentration in air
(3) Contamination measurement
(4) Worker's dose limit

Control radiation and radioactive materials in the workplace

- **Ensuring public safety**

(1) Dose limit at the boundary of controlled areas and the boundary of business establishments
(2) Exhaust and wastewater conce
(3) Contamination inspection room

Control leaks of radiation and radioactive materials from radiation facilities

Established the above dose limit and concentration limit values based on the recommendations of the ICRP (International Commission on Radiological Protection)

The subject of Act on Prevention of Radiation Hazards due to Radioisotopes, etc.

- **Radiation**
  - Alpha rays, proton beams, other heavily charged particles and beta rays
  - Neutron rays
  - γ-rays and characteristic X-rays (only characteristic X-rays generated by orbital electron capture)
  - Electron beam and X-ray with energy of 1 MeV or more
- **Radioisotope**
  - Those that emit radiation and exceed the specified quantity and concentration
  - Excludes nuclear fuel materials, nuclear source materials, and radiopharmaceuticals
- **Radiation generator**
  - Linear accelerator, cyclotron, etc.
  - Not applicable to X-ray generators with less than 1 MeV

Radioisotope

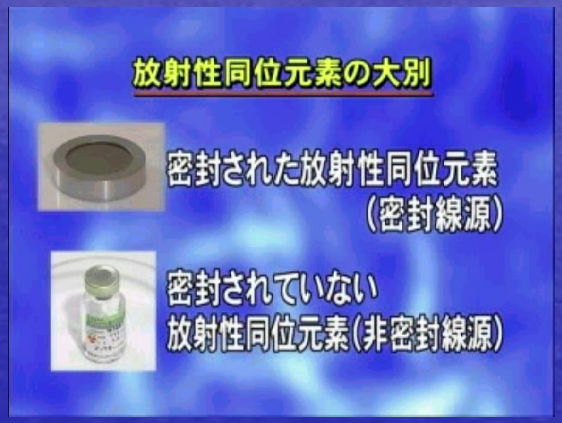
Nuclide name	Lower limit quantity (MBq)	Lower limit concentration (Bq/g)
H-3	1,000	1×10^6
S-35	100	1×10^5
P-32	0.1	1,000
Ni-63	100	1×10^5
I-125	1	1,000
Co-60	0.1	10
Cs-137	0.01	10
Sr-90	0.01	100

※It is stipulated in the "International Basic Safety Standards (BSS)" commonly formulated by international organizations such as the International Atomic Energy Agency (IAEA).

※ It assumes a certain exposure scenario and is calculated for each nuclide based on scientific evidence after setting the exposure dose standard (effective dose) to 10 μSv per year in normal times and 1 mSv per year in the event of an accident.

Sealed Radioisotope

- The isotopes that emit radiation contained in **one radiation source** (one set or one set for one set or one set) are subject to regulation when the minimum quantity is exceeded.



For example …

In the case of Co-60 with a minimum quantity of 100 kBq

Even if there are 10 Co-60 sources with 50kBq per unit, it is not subject to regulation.

Unsealed Radioisotope

- Only one type of unsealed radioisotope: If **the total amount possessed by one business establishment exceeds the lower limit**, it is subject to regulation.

- Two or more unsealed radioisotopes: If **the sum of the ratio of quantity by nuclide to notification quantity exceeds 1**, it is subject to regulation.

For example, in the case of H-3 with a minimum quantity of 1000MBq and S-35 with a minimum quantity of 100MBq ... Even if each nuclide does not exceed the lower limit quantity, if the sum of the ratios exceeds 1, it is subject to regulation.

$$\frac{300\text{MBq}}{1000\text{MBq}} + \frac{80\text{MBq}}{100\text{MBq}} < 1$$

H-3

S-35

The sum of the ratios is important

Radiation generator

- Cyclotron
- Synchrotron
- Synchrocyclotron
- linear accelerator
- Betatron
- Van de Graaff accelerator
- Cockcroft-Walton accelerator

An X-ray generator of less than 1 MeV is not a radiation generator under Act on Prevention of Radiation Hazards due to Radioisotopes.

Effective dose limit (general public)

- Public **1 mSv / year**

(Excluding exposure to natural radiation and medical care)

Important

People cannot measure the dose

It is necessary for the radiation handler to control and measure the radiation and make sure that it does not exceed it.

Reference

	(World average)	(Japan average)
Natural radiation	2.4mSv / yr	1.5mSv / yr
Medical exposure	0.6mSv / yr	2.3mSv / yr

Effective dose limit (radiation workers)

Important

Effective Dose limit	Other than the following	100mSv / 5 years 50mSv / yr
	Women	5mSv / 3 months
	Women during pregnancy	Internal exposure 1mSv from pregnancy to childbirth
Equivalent Dose limit	Lens of the eye	150mSv / yr
	Skin	500mSv / yr
	Abdominal surface of women during pregnancy	2mSv from pregnancy to childbirth

Place safety management

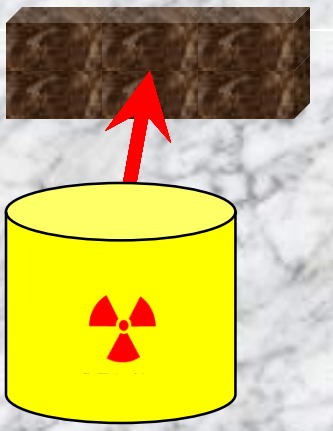
Places where there is little risk of landslides and inundation

Main structural parts are made of fireproof structure or non-combustible material

Office boundary

Office

Radiation facility



Effective dose

250 μ Sv / 3 months

Set up the shield wall

Adjust usage

Public limit

1 mSv / yr

Office boundary

Effective dose

1mSv/week

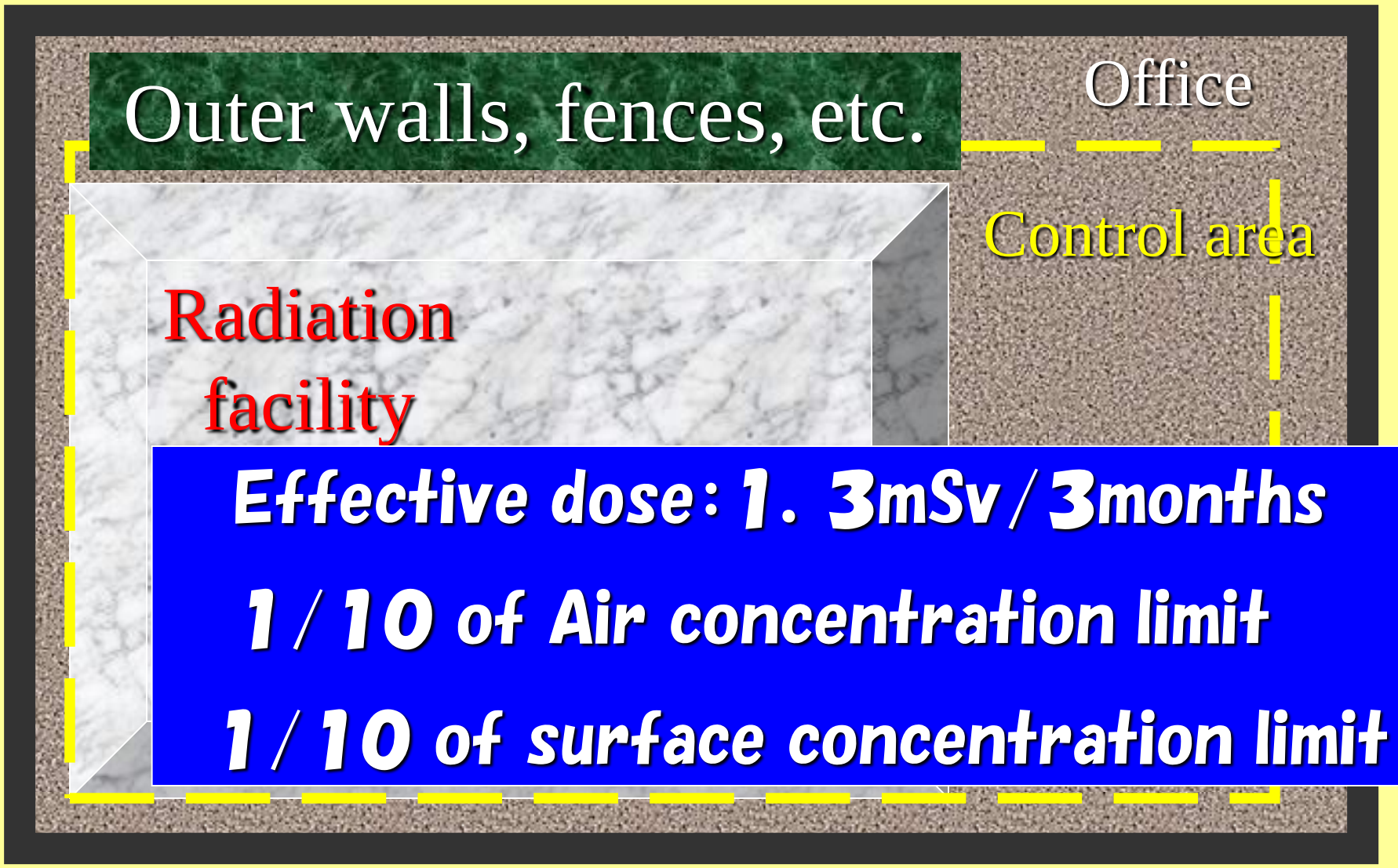
Office

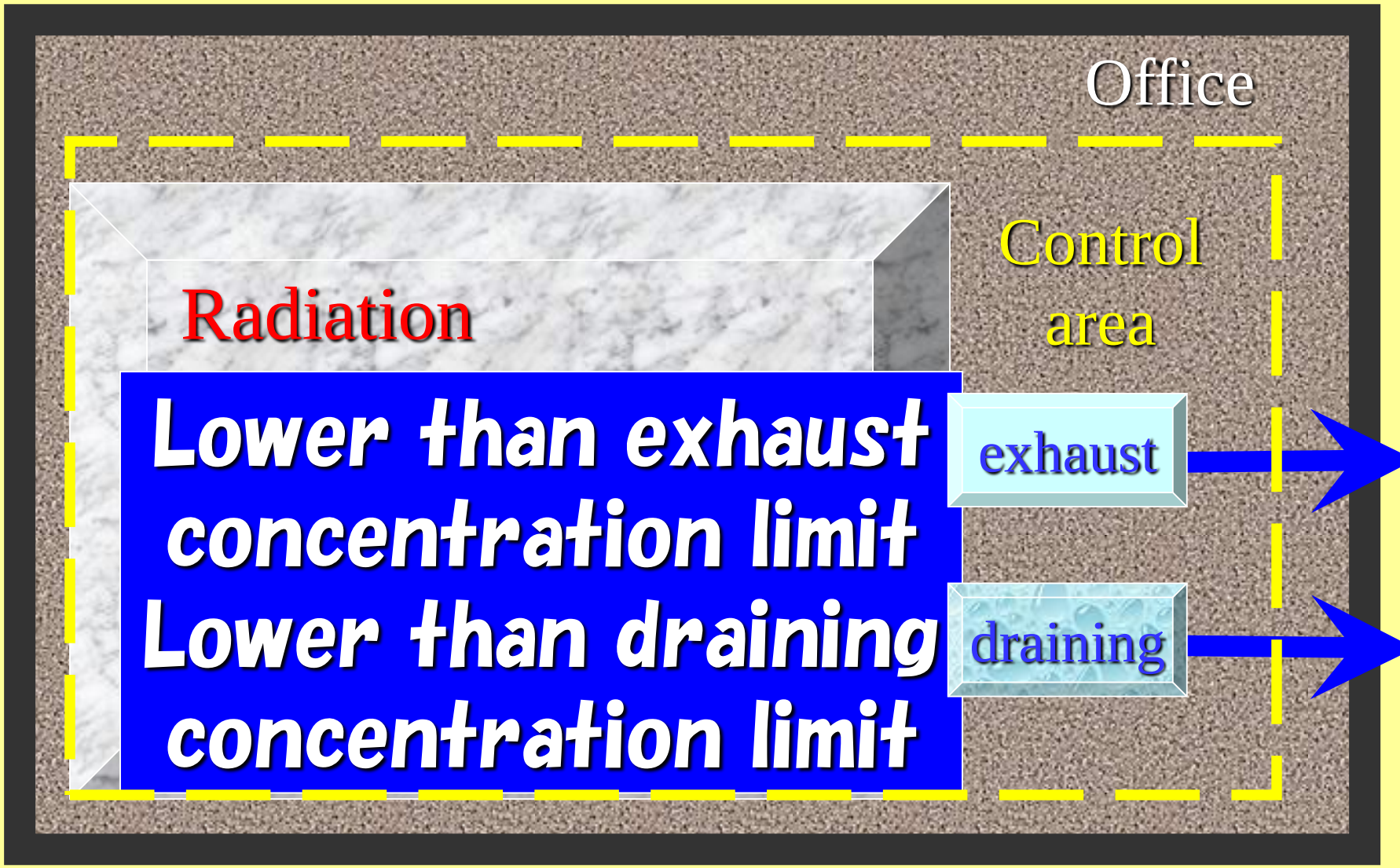
50mSv/yr

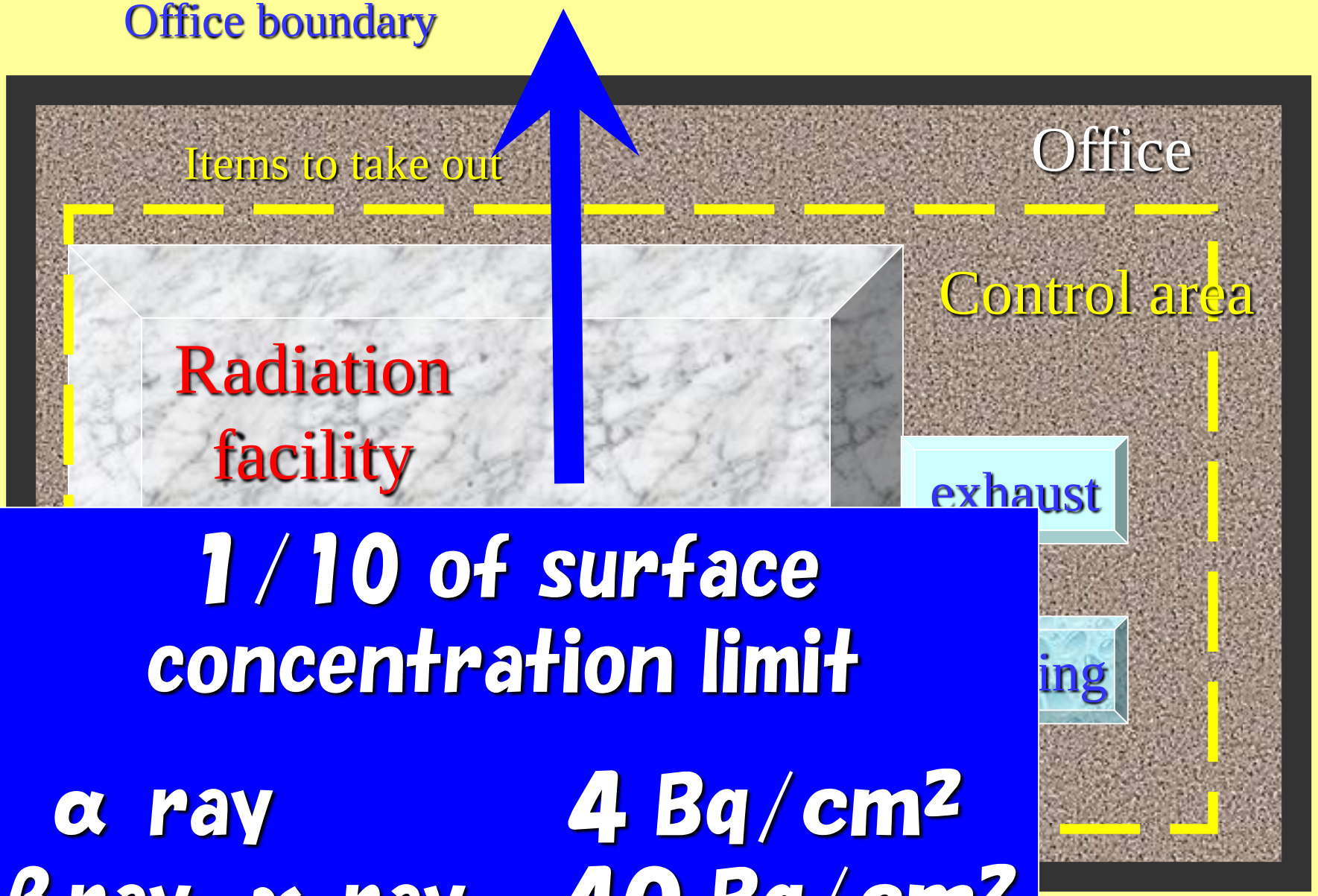
Radiation facility

Workspace

hood

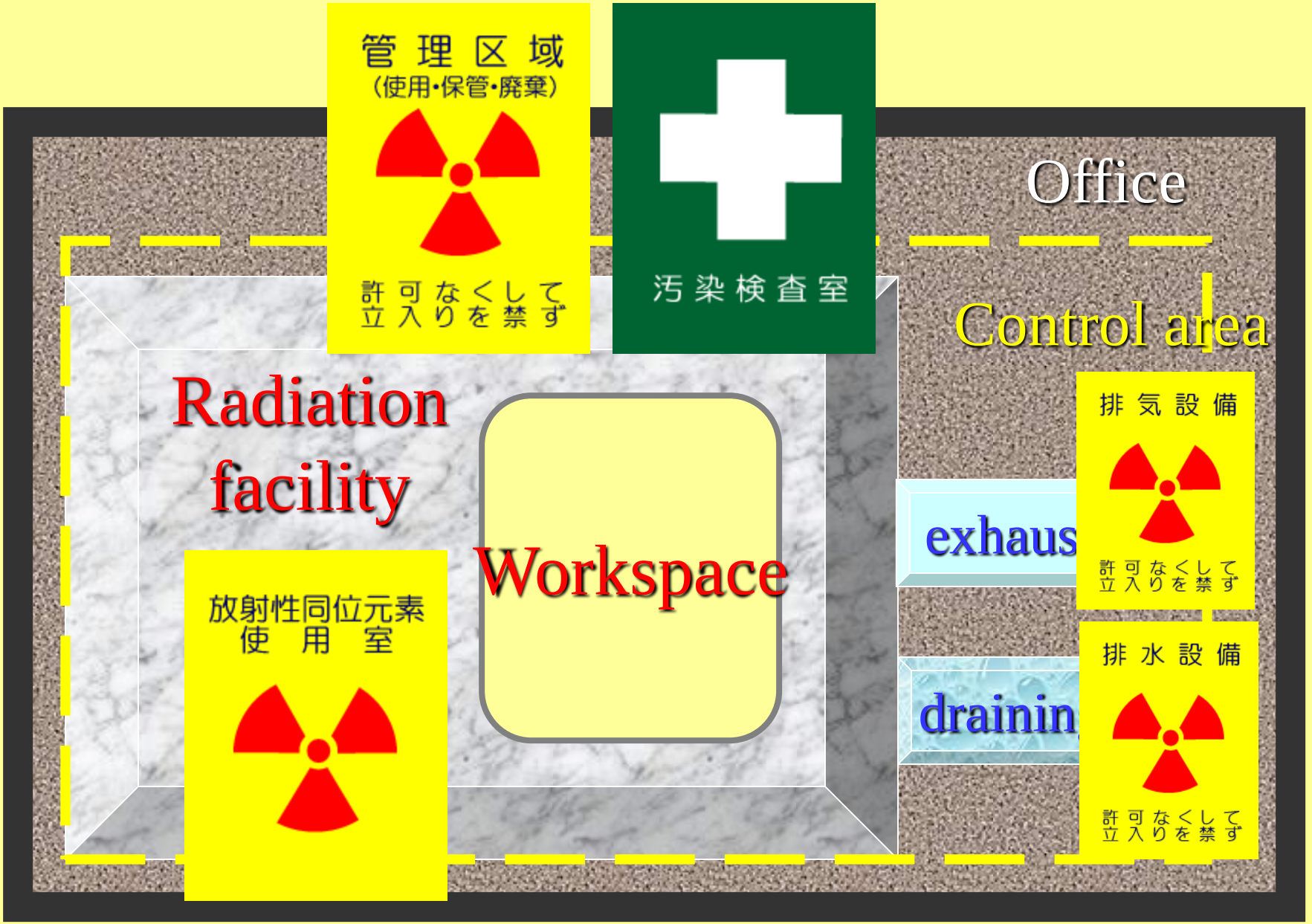

Office boundary
Outer walls, fences, etc.
Office
Control area
Radiation facility
Effective dose：1．3mSv／3months
1／10 of Air concentration limit
1／10 of surface concentration limit


Office boundary
Office
Control area
Radiation
Lower than exhaust concentration limit
Lower than draining concentration limit
exhaust
draining



1/10 of surface concentration limit

α ray	4 Bq/cm²
β ray, γ ray	40 Bq/cm²


管理区域
(使用・保管・廃棄)
許可なくして
立入りを禁ず
汚染検査室
Office
Control area
Radiation
facility
Workspace
放射性同位元素
使用室
排気設備
許可なくして
立入りを禁ず
exhaus
排水設備
許可なくして
立入りを禁ず
drainin

Automatic display device

- Doors that people normally enter and exit must be equipped with a device that automatically displays the presence or absence of use.

(In the case of a room where one or a set uses a sealed radioisotope or radiation generator of 400 GBq or more.)

Interlock

- Doors that people normally enter and exit will be equipped with interlocks to prevent people from entering unnecessarily.

(In the case of a room where one or a set uses a sealed radioisotope or radiation generator of 100 TBq or more.)

- However, this is not necessary if a wall is installed in the room so that the dose is below the dose limit.

If the doorway is open, the radiation source is not come out.

Radiation facility inspection

- **Before using:**
  Get a facility inspection

  Cannot be used unless passed

- **After starting use:**
  get regular inspections and confirmations
- **When changing the permission contents::**
  Need new permission

Radiation facilities are required to
always comply with legal standards

使用数量等（密封されていない放射性同位元素）

A- 1 - 1

番号	核　種	年間使用数量	3ヶ月間使用数量	1日最大使用数量	使用の目的	使用の場所	備　考
1	^{109}Cd	8.000 MBq	8.000 MBq	2.000 MBq	目的1	場所2	
2	^{110m}Ag	8.000 MBq	8.000 MBq	2.000 MBq	目的1	場所2	
3	^{125}I	4.000 GBq	1.000 MBq	40.000 MBq	目的2	場所2	

The quantity that can be used is determined for each nuclide, period, purpose, and location.

(For radiation generators, energy, time, direction, etc.)

9	^{17}C	4.000 GBq	1.000 GBq	20.000 MBq	目的3	場所4	
10	^{14}C	4.000 GBq	1.000 GBq	.000 MBq	目的3	場所5	
11	^{14}C	800.000 MBq	200.000 MBq	4.000 MBq	目的3	場所6	

Permits vary depending on the radiation facility.
Confirm the permission contents of the facility to be used in advance.

18	^{22}Na	300.000 MBq	100.000 MBq	20.000 MBq	目的1	場所2	
19	^{241}Am	20.000 kBq	5.000 kBq	100.000 Bq	目的1	場所1	
20	^{32}P	24.000 GBq	6.000 GBq	120.000 MBq	目的3	場所2	

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Radiation handlers

- A person who enters a controlled area by engaging in the handling and management of radioactive isotopes or radiation generators.

- Radiation handlers need to be educated training, have a medical examination, and have exposure measurements.

- (Persons engaged in handling)

It is a sealed radioisotope, and the device is well shielded, and the device surface may be a controlled area. In that case, he is not a radiation worker because he does not enter the controlled area. No health check and exposure measurements are required.

Education training

(1)Before entering the controlled area for the first time
(New education)

(2)After entering the controlled area, every period not exceeding one year
(re-education)

- The number of hours for each item is set.
- If you have sufficient knowledge and skills, you can omit some of them.

Education training items and hours

(1)Effect of radiation on the human body
over 30minutes

(2)Safe handling of radioisotopes or radiation generators
over 4hours

(3)Decree on prevention of radiation damage caused by radioisotopes and radiation generators
over 1hours

(4)On-campus rules
over30minutes

Health checkup

(1) Before entering the controlled area for the first time

(2) After entering the controlled area, every period not exceeding one year (Actually every period that does not exceed 6 months)

(3) If any of the following applies, without delay

- イ Inhalation or oral intake by mistake
- ロ Skin is contaminated beyond the surface density limit
- ハ The wound surface of the skin is contaminated
- ニ Exposure to radiation exceeding the effective dose limit or equivalent dose limit

Hearth check

(1)Interview

イ Presence or absence of radiation exposure history Includes electron and X-rays with energies less than 1 MeV

ロ About those who have a history of exposure
Work location, content, duration, dose, presence or absence of radiation damage, and other conditions of radiation exposure

(2)Examination or examination

イ Blood pigment amount or hematocrit value in peripheral blood, red blood cell count, white blood cell count and white blood cell percentage

ロ Skin

ハ Eye

ニ Other parts or items specified by the Minister of Education, Culture, Sports, Science and Technology

Measurement of personal exposure dose

The measurement results of personal exposure dose are permanently stored.

(1)Measurement of external exposure

Man (chest) Woman (belly):

Continuous measurement while entering the controlled area

※If you do not have a radiation measuring instrument, you will be prohibited from entering the controlled area.

(2)Measurement of internal exposure

Whole body counter, calculation

Measures for those who have or may have suffered radiation damage

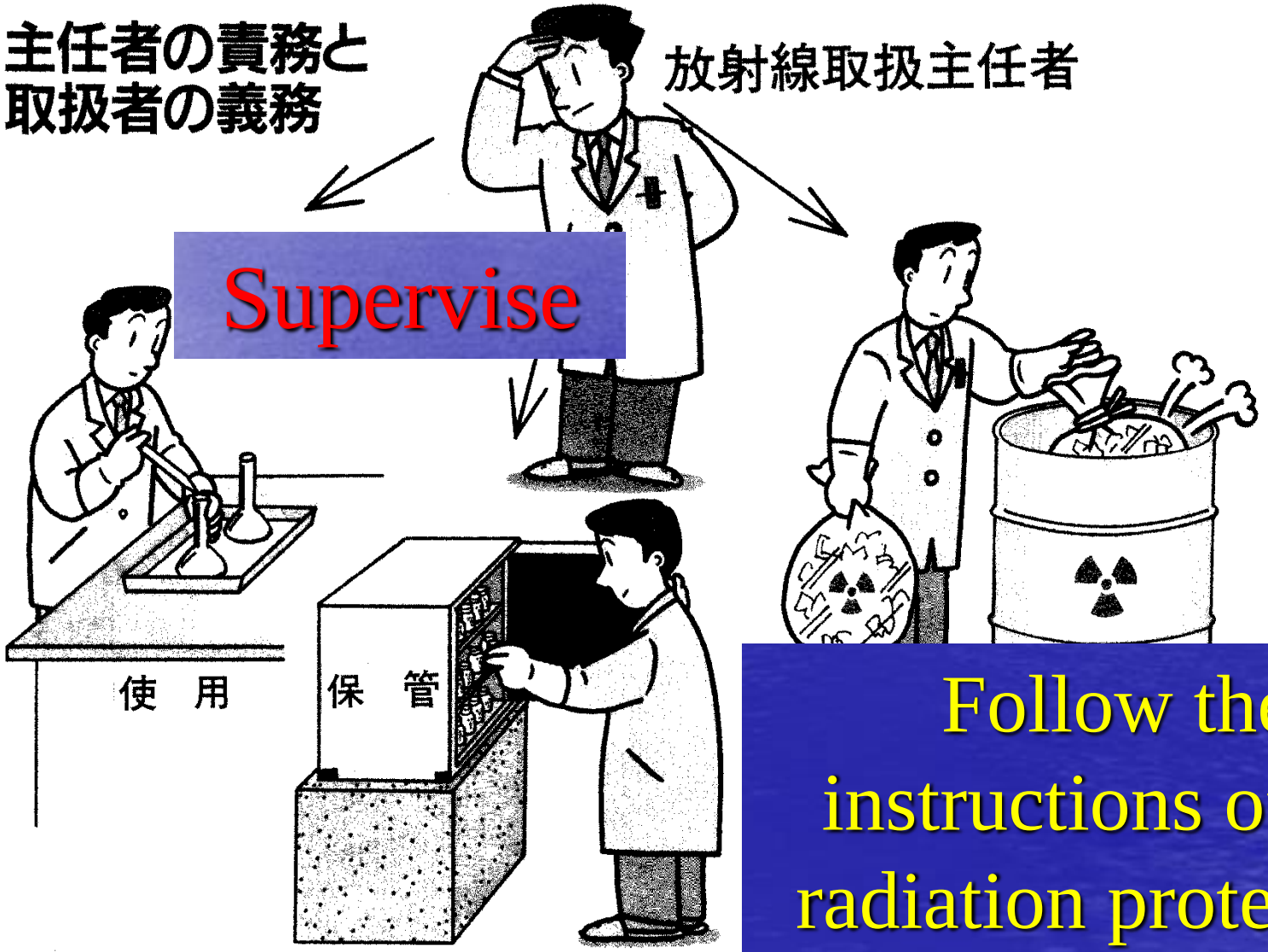
(1)Radiation handlers

- **Reduced access time** to controlled areas
- **No entry** into the controlled area
- **Relocation to work** with less risk of exposure
- Provide necessary health guidance

(2)Persons other than radiation workers

- Take appropriate measures such as diagnosis by a doctor and necessary health guidance without delay.

To prevent radiation damage



Follow the instructions of the radiation protection supervisor

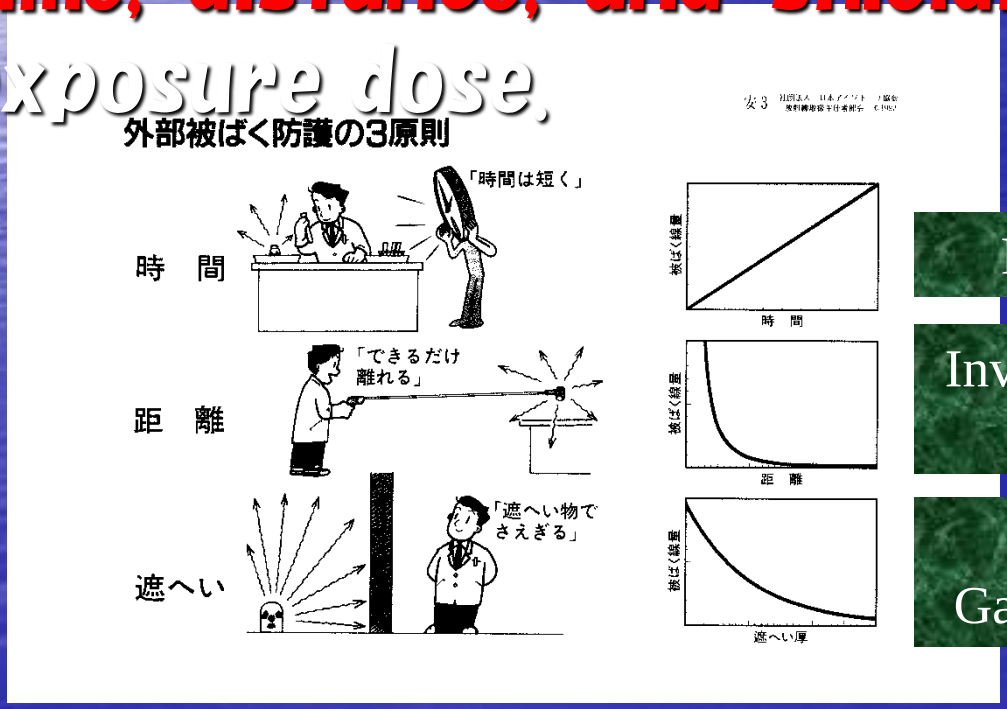
Handling standards

(1) Criteria for use
(2) Criteria for refilling
(3) Storage standards
(4) Standards for transportation
(5) Criteria for disposal
(6) Criteria for disposal outside the office

Criteria for use

(1)Use of radioisotopes or radiation generators shall be carried out in the designated facilities.

(2)Effectively utilize **the three elements of time, distance, and shielding** to control the exposure dose.



Proportional to time

Inversely proportional to the square of the distance

Beta rays are acrylic plates
Gamma rays are shielded by lead

Criteria for use

(3)Keep the concentration in the air in the work room and the surface density of objects that people touch below the limit.

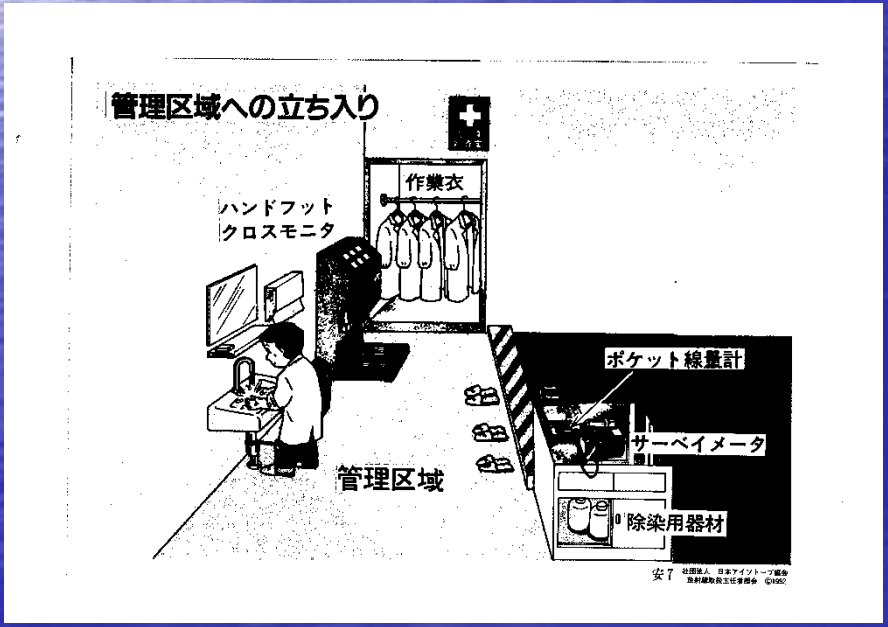
(4)Wear work clothes and protective equipment in the work room. When leaving, inspect for contamination.

(5)Prohibit eating, drinking and smoking in the work room.

Criteria for use

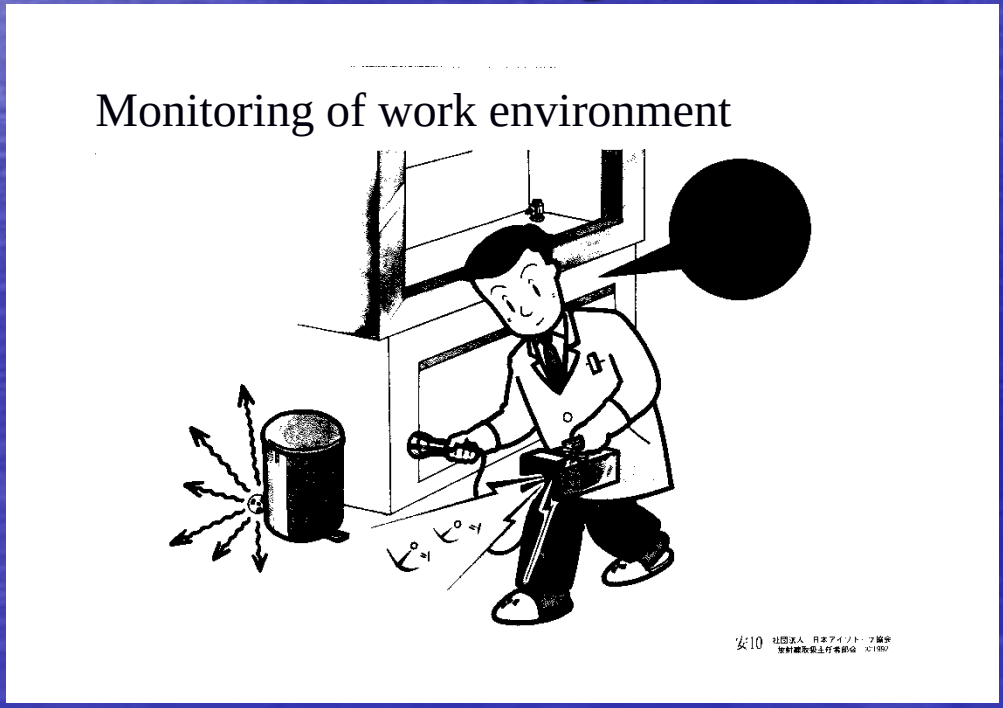
(6)Do not unnecessarily remove radioactive isotopes from the work room or controlled area.

(7)When a person other than a radiation handlers enters, follow the instructions of the radiation handlers.



Criteria for use

(8) When the sealed radioisotope is moved and used, **immediately after use, check for any abnormalities such as loss or leakage** with a radiation measuring instrument. If any abnormality is found, take necessary measures to prevent radiation damage.



Storage standards

(1)Store in storage room or storage

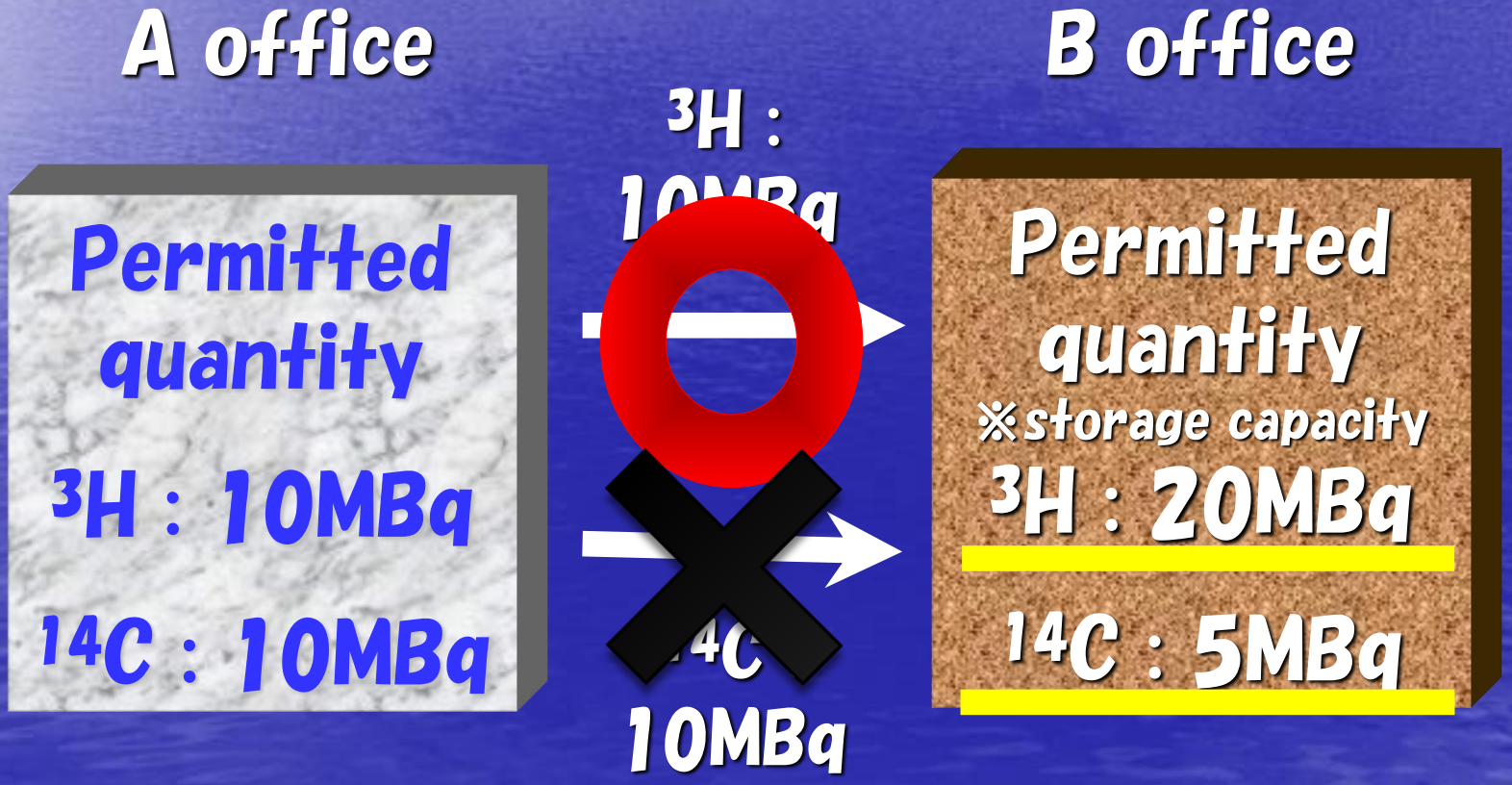
(2) Do not exceed the storage capacity

(3)Place in a storage container and use a saucer / absorbent so that the surface density limit is not exceeded.

(4)Take measures to prevent people from entering unnecessarily (key / fingerprint verification, etc.)

Conditions of transfer

Approval of the supervisor is required for transfer



Standards for transportation

A. Transportation within the office (inside the facility)

(1) Enclose in a container and transport

(2) 10 cm or more on each side, no cracks or dam

(3) S

densit

B. Tra

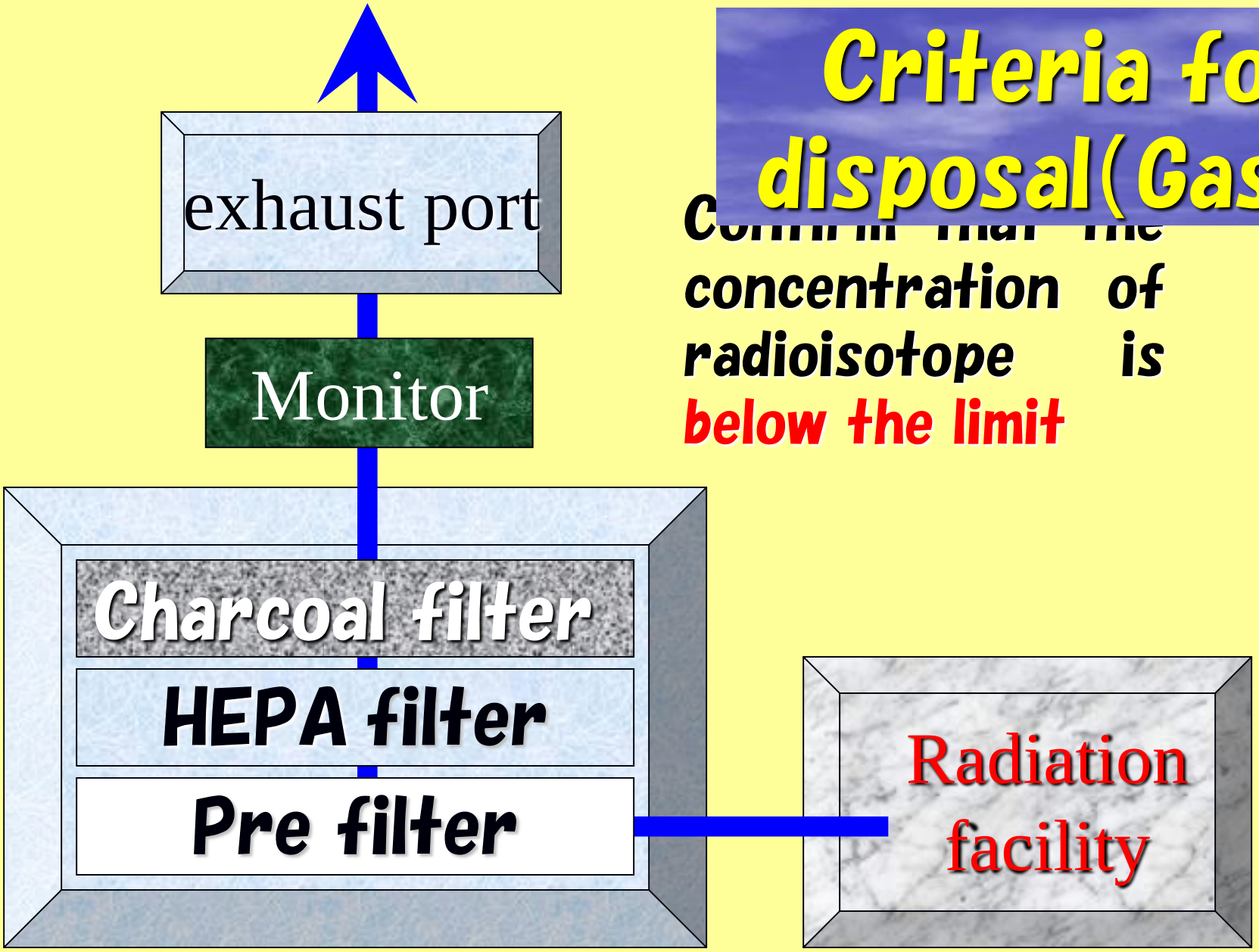
(betw

(1) L-type, A-type, B-type shipments

(2) Container test (watering / dropping / penetration / compression)

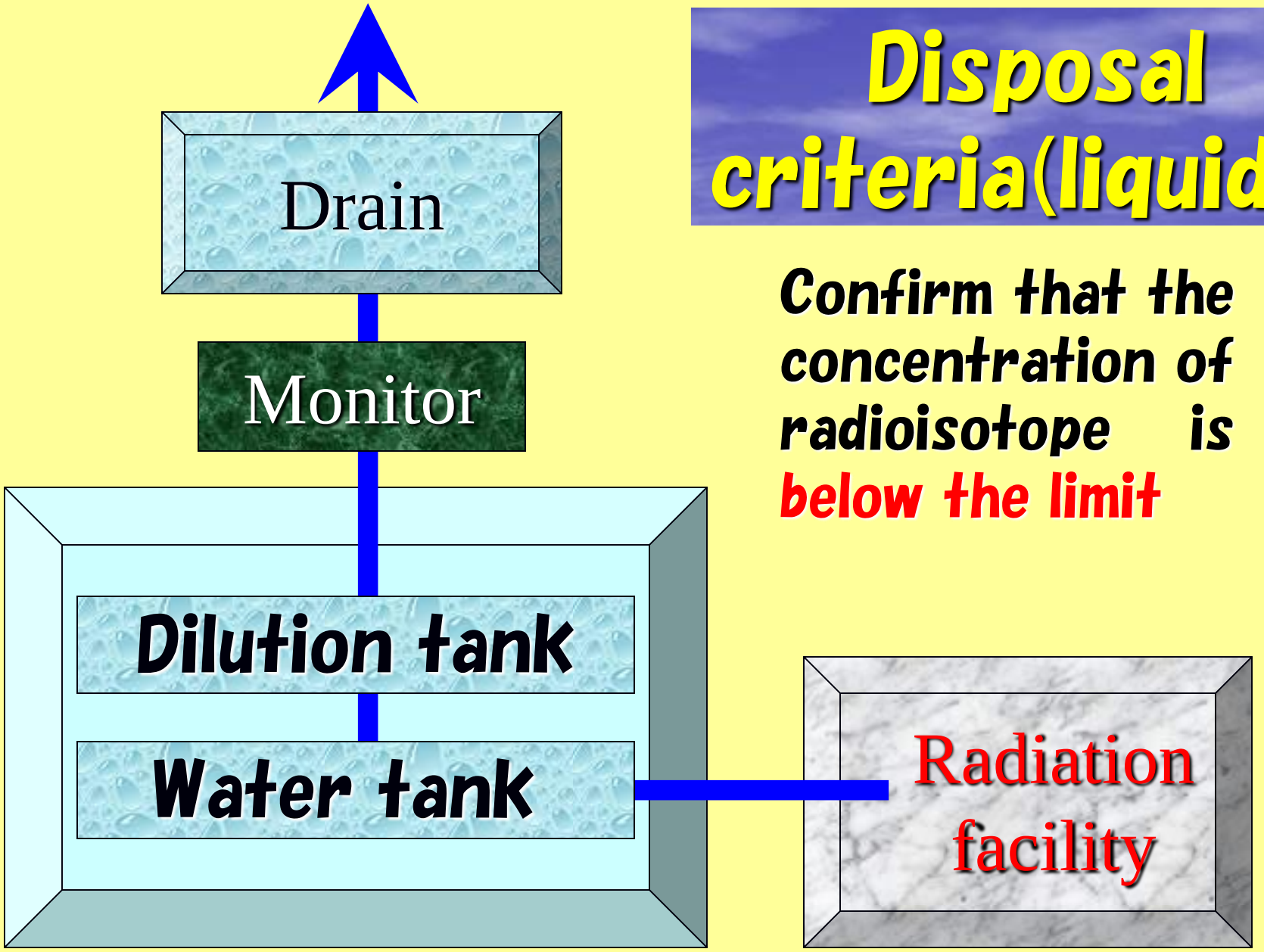
Since there are detailed regulations for each, follow the instructions of the Radiation protection supervisor when actually transporting.

Criteria for disposal(Gas)



Confirm that the concentration of radioisotope is below the limit

Disposal criteria(liquid)



Confirm that the concentration of radioisotope is *below the limit*

Disposal criteria (s

(3)Solid radioisotope

イ Incinerate in an incinerator.

ロ Enclose in a container and store in a storage /disposal facility.

- Handed over to Japan Radioisotope Association

  Follow the disposal classification (Combustibles, flame-retardant, non-combustibles, animals, inorganic liquids, organic liquids)

Write up

(1)Use(type, quantity, date of use, purpose, method, location, name)

(2)Storage(type, quantity, storage period, method, location, name)

(3)Transportation(transportation date, method, name)

(4)Disposal(type, quantity, disposal date, method, location, name)

(5)Inspection (date of implementation, item, name)

(6)Education and training (date of implementation, item, name)

※ Closed every year, stored for 5 years after closing

Measurement (handling plac

A. Dosimetry of the place (stored for 5 yea

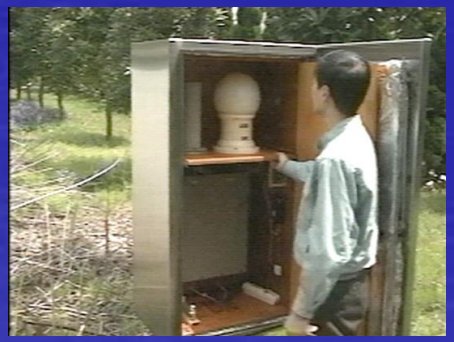
Confirm that it does not exceed 1mSv / week,
1.3mSv / 3months, 250μSv / 3months

Measuring method: Radiation measuring instrument

Measurement location

(Radiation amount): Use / storage / disposal facility, controlled area boundary, place of residence in business establishment, business boundary

(RI contamination): Work room, disposal work room, contamination inspection room



Measurement(handl

B . Measurement of individual exposure dose (permanent storage)

(1)Measurement of external exposure

Male (chest) Female (belly): 1cm、70μmdose equivalent
Radiation measuring instrument: glass badge, pocket dosimeter, etc.

Continuous measurement during the controlled area entry period

(2)Measurement of internal exposure

When inhaled or orally ingested by mistake.
Places where ingestion may occur Once every 3 months

Radiation injury prevention regulations

(1)Duties / organization
(2)Maintenance, management and inspection of radiation facilities
(3)Use of radioactive isotopes
(4)Measurement / recording / radiation amount, etc.存
(5)Education and training / health examination
(6)Bookkeeping
(7)Measures in case of danger

Details will be explained in the lecture that follows.

It must be prepared and notified to the NRA before the start of use of radioisotopes.
Any changes must be notified to the NRA within 30 days from the date of the change.

Radiation injury prevention regulations

- It must be prepared and notified to the NRA before starting the use of radioisotopes.
- Any changes must be notified to the NRA within 30 days from the date of the change.
- It must provide for duties and organizations relating to persons engaged in the handling of radioisotopes or radiation generators.

On-site inspection

- On-site inspections are conducted by the NRA to ensure that the Radiation Hazard Prevention Law is complied with and that radiation control is being carried out smoothly.

- You will be asked to improve the problem.

Reports

The permit notification user must immediately report the situation and response to the NRA within 10 days in the following cases.

1)When the radioisotope is stolen or the whereabouts are unknown.

2)When the concentration limit or dose limit is exceeded when the radioactive isotope is purified by exhaust or drainage equipment and discarded.

3)When a radioisotope leaks out of the controlled area.

4)When a radiation worker is exposed to radiation that may exceed the effective dose limit or equivalent dose limit

Accident

- In the event of a radioisotope theft, unknown location, or other accident, the permit notification user must notify the police officer or coast guard officer without delay.

Corresponding at the time of danger

- If there is a risk of radiation damage due to an earthquake, fire or other disaster, immediately notify the police officer or coast guard officer.
- In the event of a danger, the user must notify the NRA without delay of the date and time, location, cause, situation of radiation injury, and the content of first aid measures.
- The above situation and measures against it must be reported to the NRA within 10 days.

(1)The used amount of radioactive material exceeded the permitted amount.

(2)When I tried to dispose of the equipment, it was equipped with radioactive material.

(3)There is no record of handling radioactive materials.

Stop all medical treatment using radiation

(1)The used amount of radioactive material exceeded the permitted amount.

The used amount of radioactive material is licensed for each nuclide and period. Do not use more than this quantity.

Check in advance whether the nuclide / amount you want to use is within the permitted range.

(2)When I tried to dispose of the equipment, it was equipped with radioactive material.

Do not carry equipment setted up radioactive materials without permission.

Check in advance whether the nuclide / amount you want to purchase is within the permitted range.

(3)There is no record of handling radioactive materials.

A record must be recorded each time radioactive material is used, stored or disposed of it.

Record the date of use, storage, and disposal, nuclide, quantity, name of the handler, etc.

Use of radioactive materials

It can only be handled by licensed radiation facilities.

Taking out radioactive materials

Only possible with the permission of the Radiation protection supervisor.

(Destination is limited to radiation facilities)