Safety Training for Radiation Workers at ICRR, Univ. of Tokyo

2022

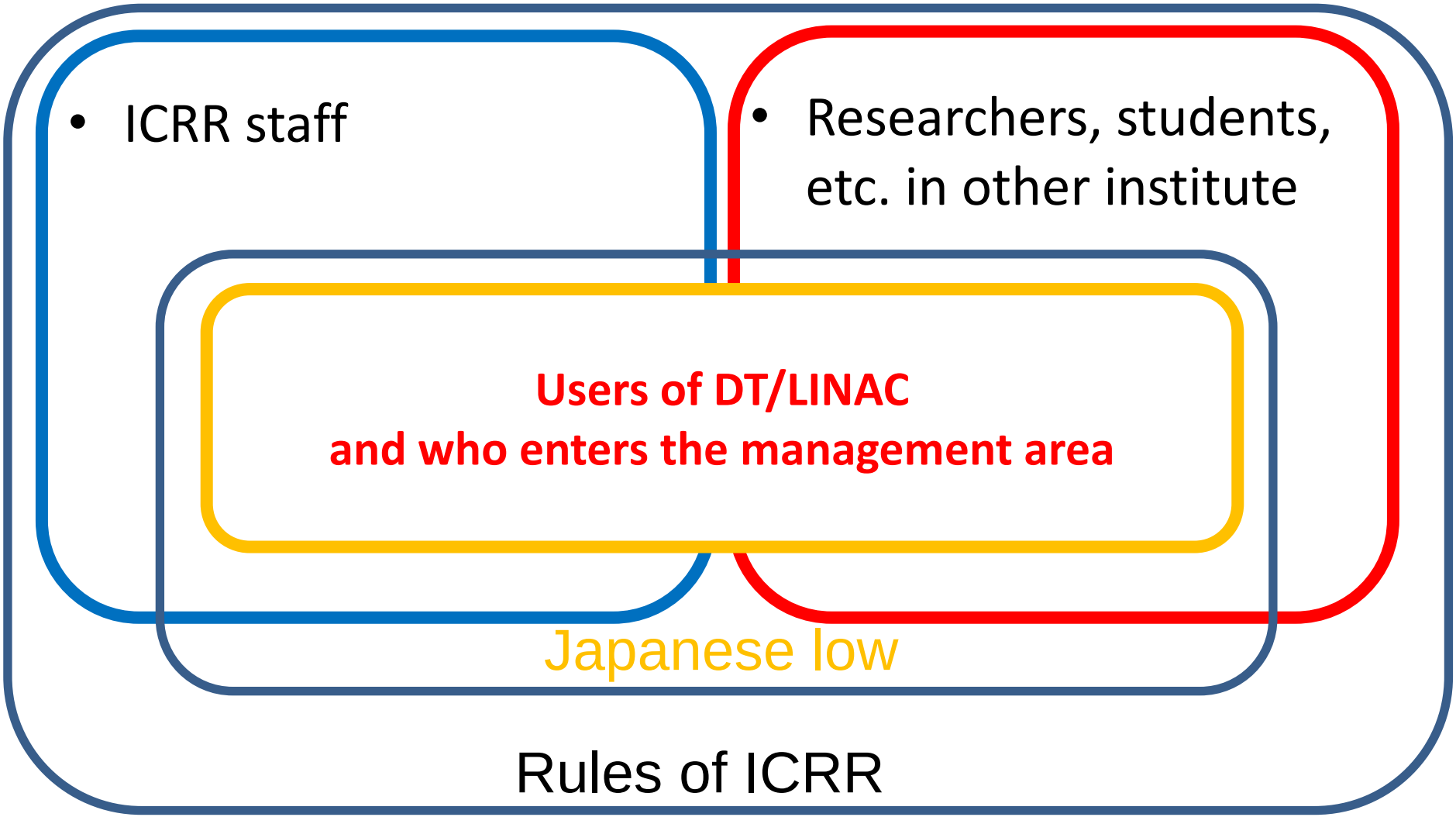
Outline

- What is new in this year
- Law, Rules at ICRR
  - Radiation management at ICRR
  - Rules at ICRR
- Safety handling
  - Important notices on radiation work
  - Radiation effect on human body
  - Emergency
- Radiation work at Kamioka Observatory
- (Regulation on X-ray devices)

Law, Rules at ICRR

(IPMU members also follow ICRR law and rules.)

Users


• ICRR staff
• Researchers, students, etc. in other institute
Users of DT/LINAC
and who enters the management area
Japanese low
Rules of ICRR

Rules related to radiation

Rules of Prevention from Radiation Hazards at ICRR, Univ. to Tokyo

ICRR internal rule, called as "ICRR General Rules"

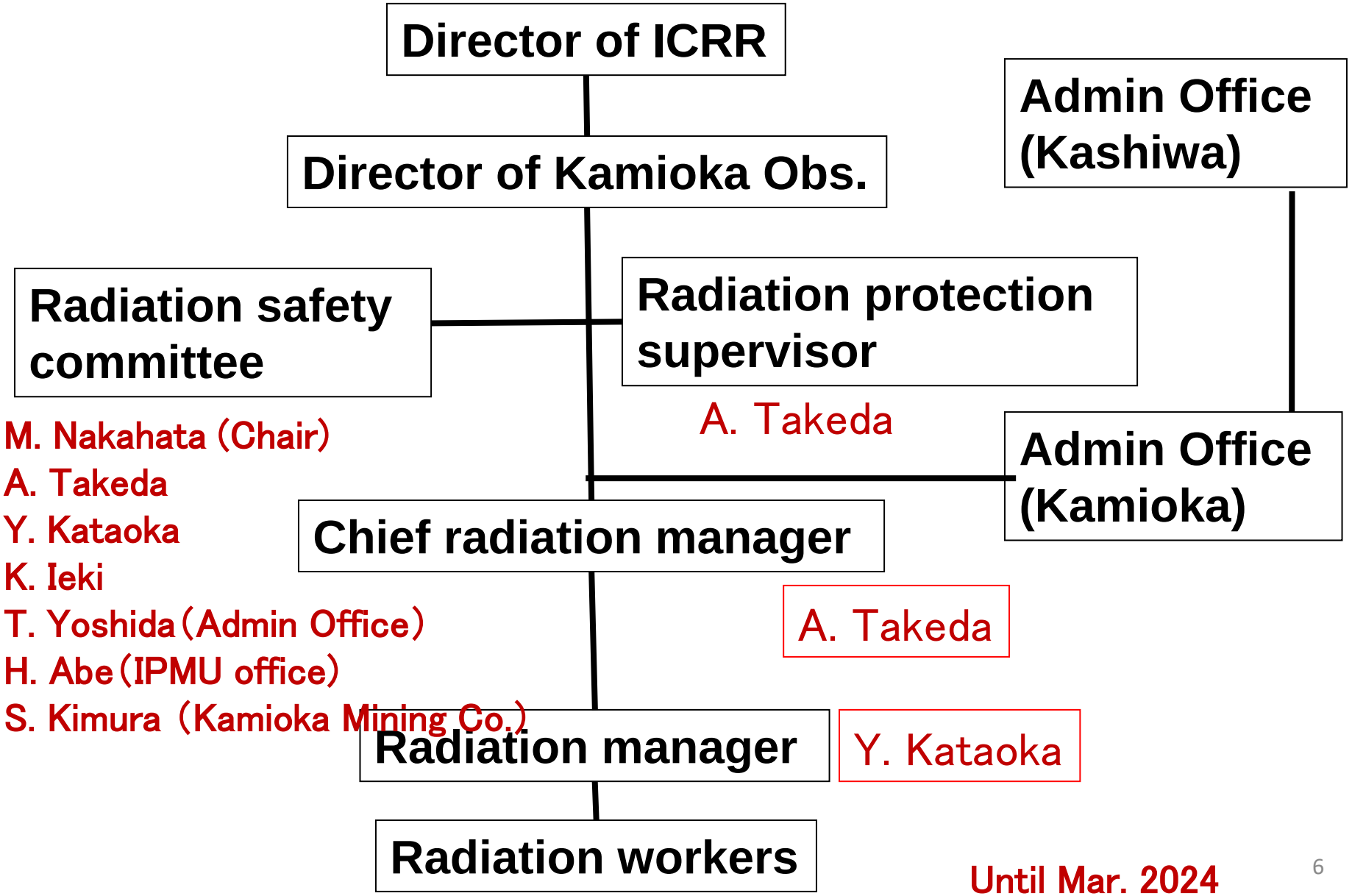
All the people in ICRR, IPMU (staff, students, cooperative researchers, etc.), who are using small weak sealed radiation sources and X-ray device.

Rules of Prevention from Radiation Hazards at LINAC and DT of Kamioka Observatory, ICRR, Univ. to Tokyo

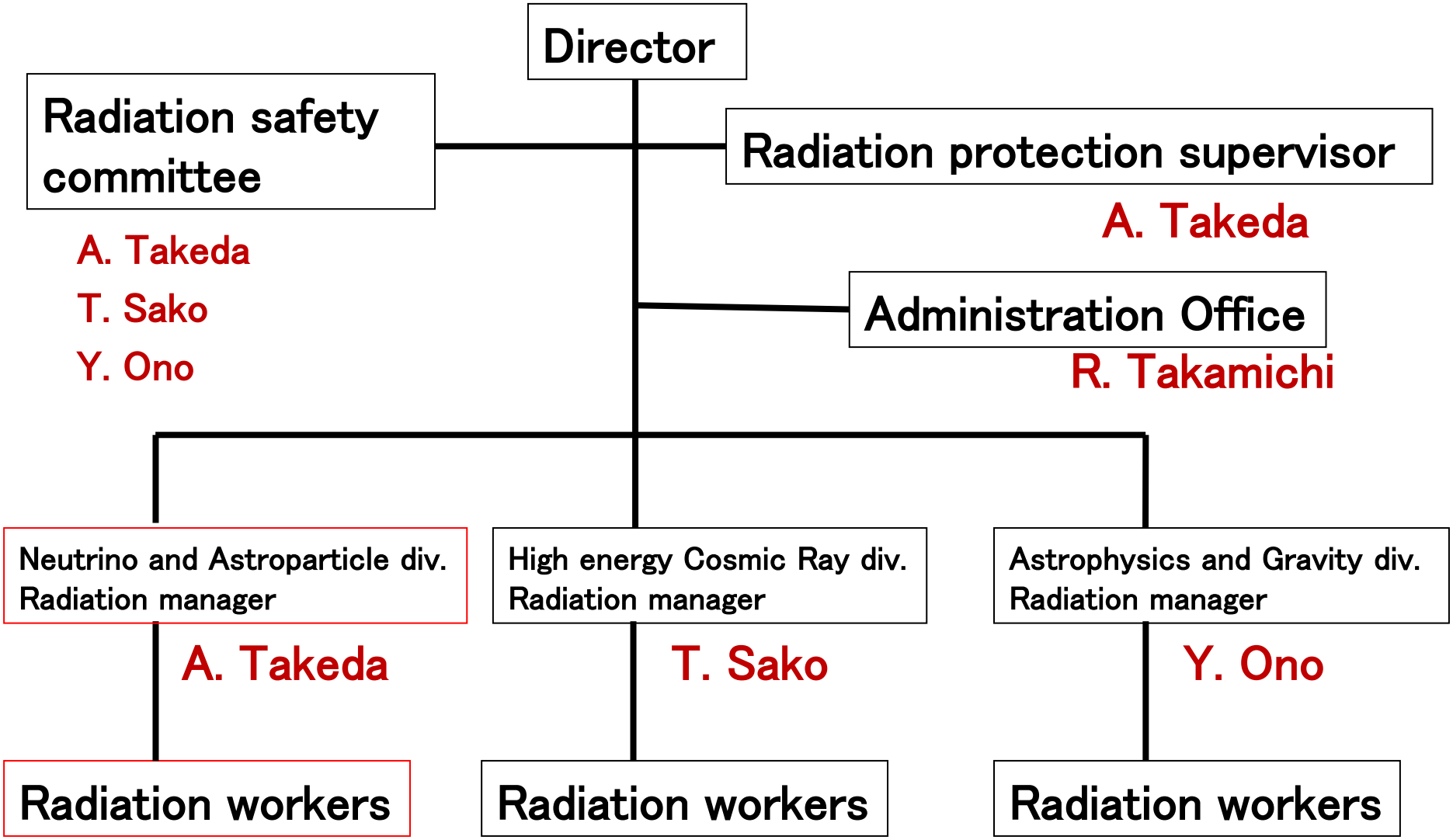
Approved by Nuclear Regulatory Commission, called as "Kamioka Special Rules"

Users of LINAC / DT generator, people entering the radiation management area in Kamioka Obs.

Radiation management in Kamioka



Radiation management in ICRR



2022

Radioactive source at ICRR

ICRR general Rules

In Kashiwa

- Weak sealed radiation sources.

In Kamioka

- Weak sealed radiation sources
- LINAC, DT generator (approved by Nuclear Regulatory Commission)
- X-ray devices at IPMU

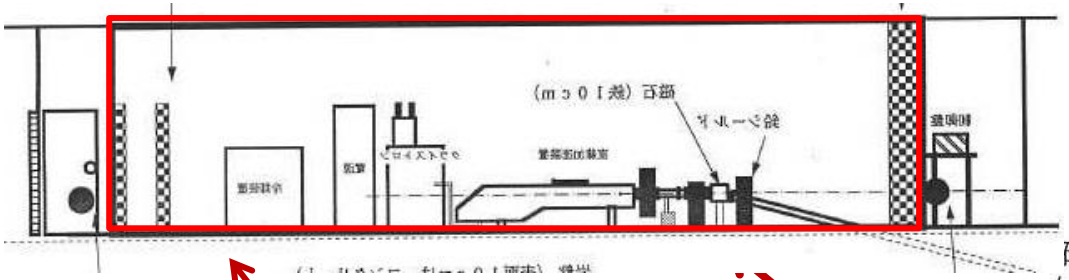
There is no lower limit of the radiation activity in the present rules.

For the time being, regard the radiation sources obtained from the Japan Radioisotope Association as the "sealed radiation source".

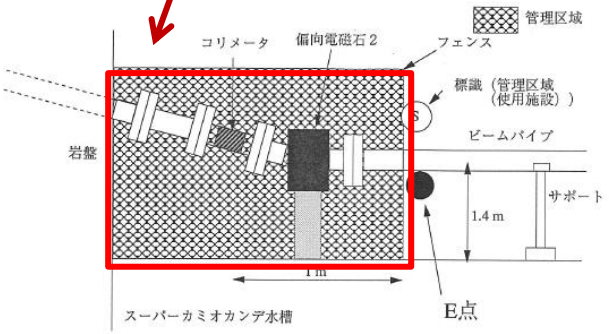
- **One note**:
  - There sometimes are questions about development and usage of small and very week neutron generator, such as “neutrostar”.
  - According to the safety management office in the Univ. of Tokyo, it should be treated as “*an accelerator*”, like our LINAC.
  - This means that it is not easy to handle because the regulation on the neutron device is not a peace of cake.

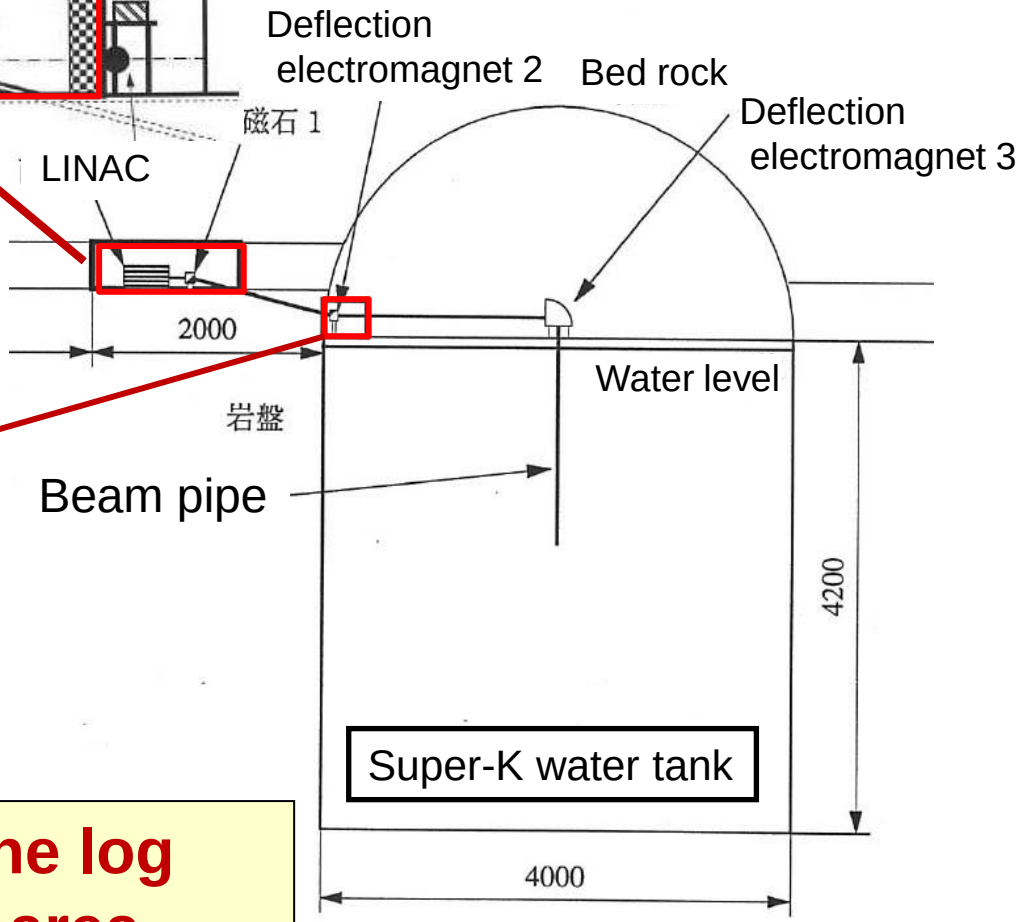
Radiation management area in Kamioka

Kamioka Special Rules



Management area





- **Use dosemeter & sign the log book when entering this area**
- **Safety training is needed**

Lower limit of the radioactive materials

ISHA

The lower limit of the radioactive materials defined in ISHA.
(One has to obey the Law to handle those materials)

Examples:

	(MBq)	(Bq/g)
60Co	0.10	10
57Co	1	100
45Ca	10	10000
51Cr	10	1000
90Sr	0.01	100
137Cs	0.01	10
241Am	0.01	1
226Ra	0.01	10

Full list (in Japanese):
http://law.e-gov.go.jp/htmldata/S47/S47F04101000041.html

Registration of the radiation workers

For ICRR members

- **Required from the Law, Univ. of Tokyo**
  - **All the users of LINAC/DT generator in Kamioka. (staffs, students, cooperative researchers)**
  - **Staff to use radioactive materials in other institutions.**
  - **ICRR staff, students who needs the Certificate of the Radiation Work at ICRR.**
- **Required from ICRR general Rules**
  - **Staff & students to use the weak X-ray device**
  - **Staff & students to use the weak sealed radiation sources**
  - **The cooperative researchers are requested to submit the Certificate of Radiation Works from their institutions.**

Registration of the radiation workers

For ICRR members

- **Registration procedure: obtain approval from Radioisotope Center, Univ. of Tokyo, as radiation worker at Univ. of Tokyo**
  - **Safety training & health check are needed. Exemption is possible.（ http://cosmo.ric.u-tokyo.ac.jp/gyomu/ ）**

- **Health check (every half year) and safety education at ICRR (once per year) are needed.**

Cooperative researchers

For Non-ICRR members

- Take radiation safety training (once per year).
- LINAC & DT generator users should be registered as radiation workers at Univ. of Tokyo.
- The sealed radiation source users should submit the Certificate of Radiation Works from their institutions.

- Ask radiation protection supervisor if you bring a weak sealed radiation sources into mine.
  - The radioactive materials in ISHA cannot be brought.
- Radiation protection supervisor: A. Takeda

Radiation work in other institutions

For ICRR members

- **ICRR has to manage all the exposed dose of the ICRR staff by ISHA.**
  - **Treat ICRR students in the same way**
- **Please report your exposed dose from the radiation work in other institutions.**
- **Any dosemeter could be used.**
  - **Use the glass dosemeter provided from ICRR, if possible.**
  - **TLD, electric dosemeter, and so on are also OK.**
  - **Use neutron dosemeter for the neutron sources.**
  - **Please report your exposed dose every month when the glass dosemeter provided from ICRR is not used.**
    - **Research group → Radiation manager → Radiation protection supervisor**
    - **Ask Radiation protection supervisor, for details.**

For ALL

Safety handling of radiation

Important notices on radiation work

- **Minimize your exposed dose**
- **Use personal dosemeter to enter management area, doing radiation work**
  - **Glass dosemeter**
  - **Electric dosemeter**
  - **Thermo luminescence dosemeter (TLD)**
- **Sign the log notes to use LINAC / DT generator, weak sealed radiation sources.**
- **Sign the log note to enter the management area.**

Glass dosemeter from ICRR

- **The glass dosemeter from ICRR can be start / stop using with one month unit.**

- **Ask administration office to start / stop using the glass dosemeter by 15th in the preceding month.**
  - **In Kashiwa : ICRR Administration office**
  - **Kamioka: Nishikawa-san**

Dose Limit of radiation workers

ISHA

Updated from Apr. 1st 2021. (until than, only 150 mSv/year)

	Effective dose limit	Equivalent dose limit	
Male	100 mSv/5 years 50 mSv/year	Eye	100 mSv/5 years 50 mSv/year
		Skin	500 mSv/year
Female (other than the following)	5 mSv/3 months	(same as male)	
In pregnancy (from the person's offer to childbirth)	1 mSv/till childbirth	Abdominal surface(till childbirth) 2 mSv	
Those who have offered to have no intention of becoming pregnant	100 mSv/5 years 50 mSv/year (same as male)	(same as male)	
Those who have been diagnosed as infertile			

- **Do not exceed even one.**
- If the exposure in the previous year was 5 mSv or less and there is no risk of exceeding 5 mSv in that year, a medical examination with only an interview is sufficient.

Effect on human body

- **Effective dose (Sv)：consider effect on human body**
- **Natural radiation = 1.5mSv/year (average in Japan)**
- **Medical radiation = 2.3mSv/year (average in Japan)**
- **DL for general people=1mSv/yr (except for natural, medical)**
- **Effect of large acute dose**
  - **<200mSv (body): no clinical sign**
  - **3000～5000mSv (body): 50% death**
  - **7000～10000mSv (body): 100% death**
- **1m from 1MBq β source: about 30μSv/h (skin)**
- **1m from 1MBq γ source: about 0.3μSv/h (body)**
  - **Co-60: 0.3μSv/h, Cs-137: 0.1μSv/h**
- (Narita-NY round flight: 0.2mSv)

Usage of the sealed radiation sources

ICRR general Rules

(1) Confirm if the seal is not broken.
(2) Do proper shields
(3) Reduce exposure time as much as possible
(4) When one steps away from the working place during the radiation work, one must put sign, barrier, etc. to prevent possible accident.

Keeping of the sealed radiation sources

ICRR general Rules

(1) Keep the radiation sources in predefined storage box, then the manager manages them.
(2) When radiation worker takes the sources out from th e box, obtain the permission(*) from the manager or protection supervisor.
(3) After the radiation work, return the sources into the box, then report(*) to the manager or protection supe rvisor.

(*): Usually, the writings of the log book (take out & bring back) are regarded as the permission & report. If there is improper treatment of the radiation sources, the worker would be asked to obtain permission individually.

Log book of usage of the sources

Source No. **Nuclide name** **Intensity**

使用記録

登録番号：　神岡－１　　核種名：　Am/Be　　数量：　９７μCi

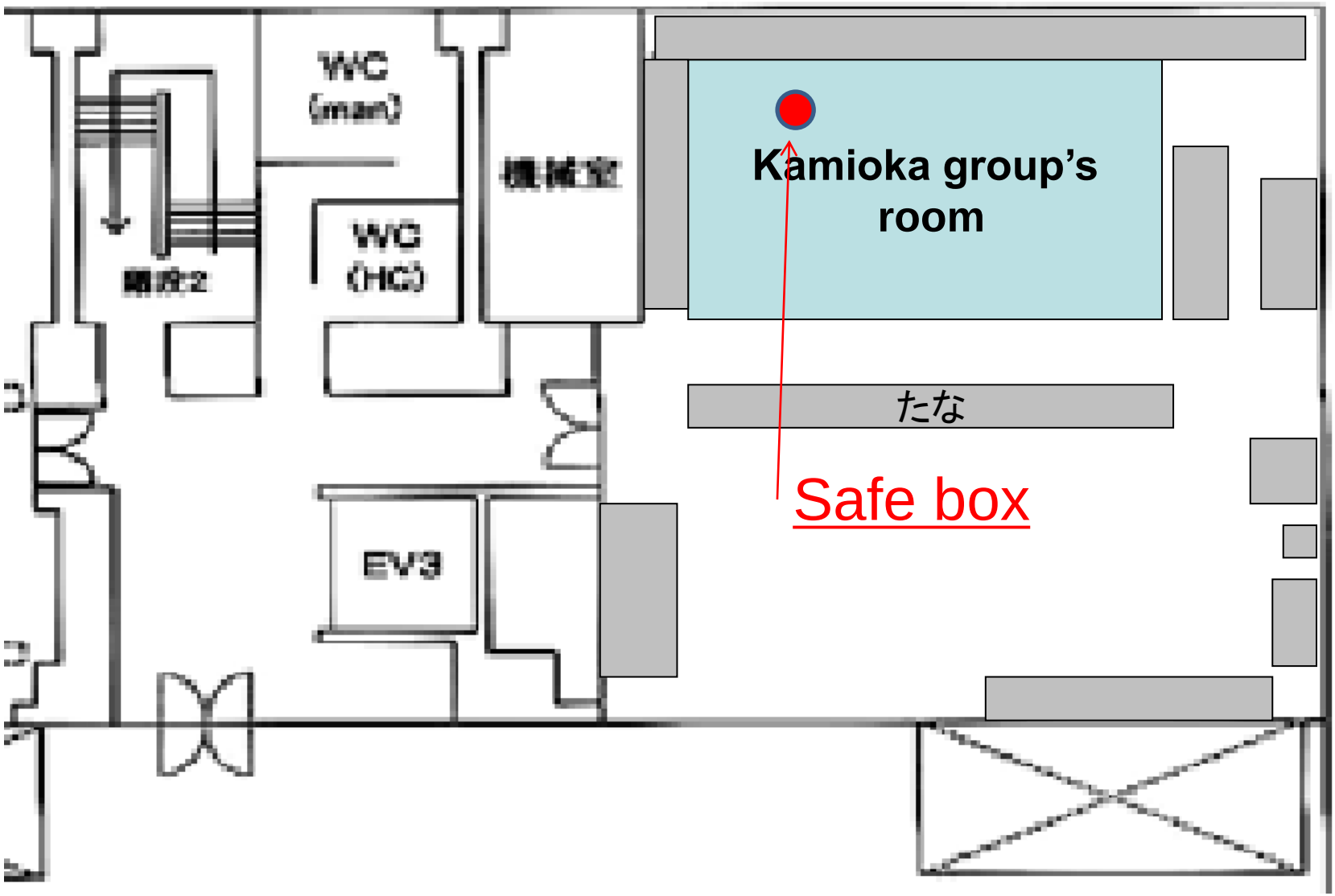
保管場所：　神岡研究棟　　保管責任者：　中畑　雅行

（研究棟から坑内へ（あるいは坑内から研究棟へ）線源を移動した場合は、その旨も記録すること。）

使用者名	使　用　場　所	使用　年月日	返却　年月日
—	2005 年 6 月 29 日現在　研究棟	—	—
Name	**Place to use**	**Take out date**	**Return date**

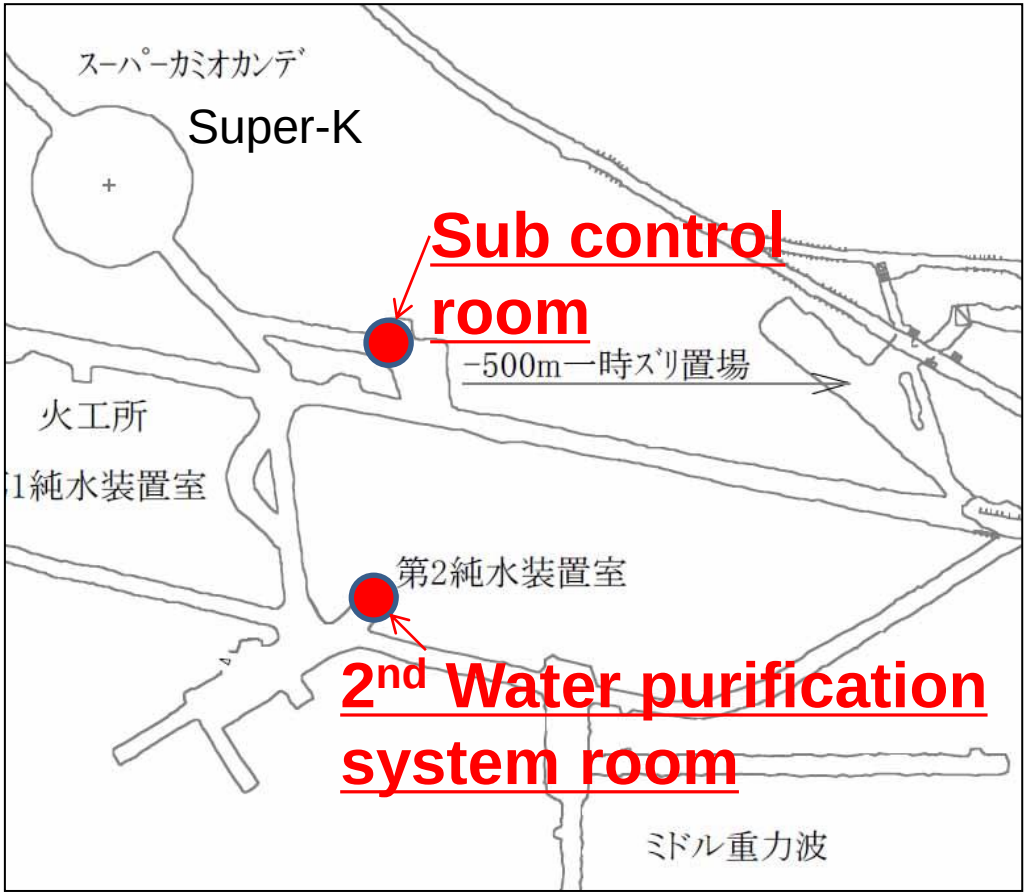
Write down when taking out & returning

The predefined storage (Kashiwa 1F)

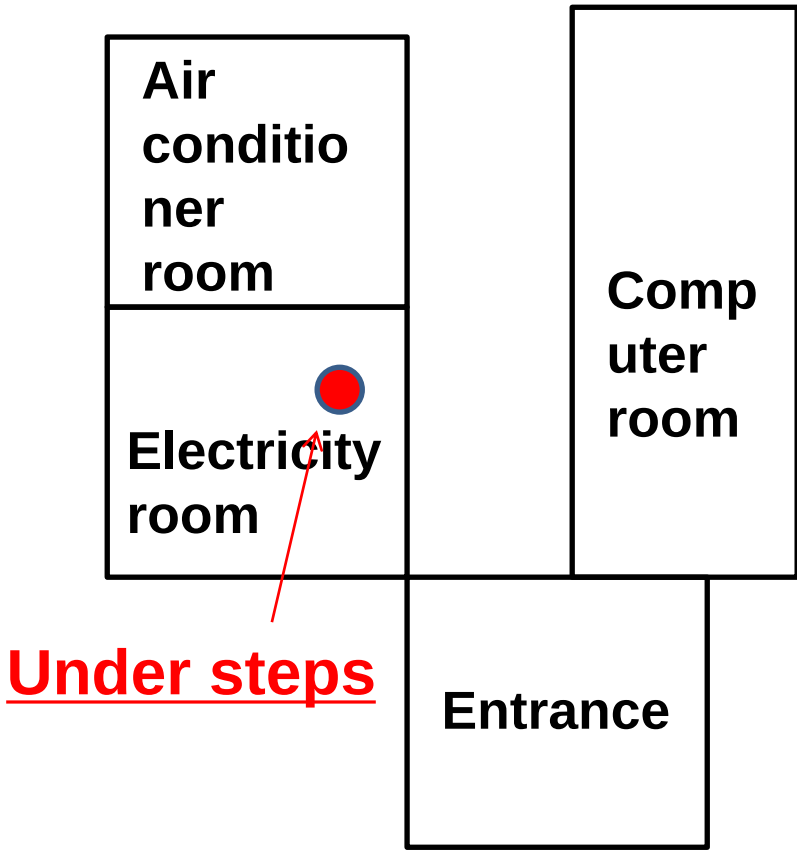


The predefined storage (Kamioka)

In the mine



In computer building



There are safe boxes in each place

Note of radiation source usage

- If one uses the sources under high / low pressure, low temperature, etc., confirm the specification of the source.
- If there is possibility of contamination, one must make contact with the radiation manager, chief radiation manager, & protection supervisor.
- Mark the possible contamination place to prevent other people from entering.

Measures in an emergency (1)

- **Make phone call following the ICRR Safety & Health emergency phone list (April 1, 2021).**
  - **Radiation: A. Takeda (0578-85-9610)**
    E-mail: takeda@km.icrr.u-tokyo.ac.jp

- **Incident related to radiation**
  - **Try to prevent the expanding of the accident**
    - **Damages from fire/earthquake, loss of the source, leak of contaminations, (possible) abnormal exposures, (possible) radiation damages, other unexpected contingencies.**
  - **Make contact with the radiation manager, chief radiation manager, & protection supervisor**
    - **Supervisor → Director → Univ. of Tokyo, MEXT**

Measures in an emergency (2)

- **Do the health examination as soon as possible in the following cases:**
  - **Swallowing / uptake of the sealed sources or contaminations.**
  - **There is a (possible) exposure of more than 5mSv of effective dose or equivalent dose limit.**

- **Disasters, like Earthquake, Fire (Kamioka)**
  - **Make phone call following the Kamioka Observatory Emergency phone list.**
  - **Do inspection of observatory/equipments, if needed.**

For LINAC
and DT users

Radiation work at Kamioka Observatory

Those who use DT and LINAC in Kamioka

Radioactive materials in Kamioka

Approved by Nuclear Regulatory Commission

- **d-T neutron generator (DT generator)**
  - **Sealed tritium source 171GBq**
  - **LINAC 100keV deuterium, 60 micro A**
- **LINAC**
  - **15MeV electron, 200 nano A**

- **These two can be used only when the supervisor is around nearby region.**
  - **The supervisor can nominate a proxy if he is abesent.**
  - **Please tell the schedule of usage *beforehand*.**

Usage of radioactive sources

Kamioka Prevention Rules

- **Accelerating particles, energies, fluxes should be within the permitted limits.**
- **One has to understand and obey the rules before using the devices**
- **Sign the log notes to use the device (Name, Time, Contents of the work)**
- **DT generator must be used under water in the SK tank.**
- **The maximum number of generated pulses by DT generator is 100,000 pulses per week.** (From June 2011)

Keeping, disposing, moving

ICRR general Rules

- DT generator must be kept in the LINAC room or horizontal magnet No.2 area. The doors should be locked.
- DT generator will not be disposed.
- When DT generator will be moved outside Kamioka Observatory, it is packed as a radioactive package, then obey the rules of transport.

LINAC usage log note

Managed under Law

LOG OF LINAC

超微弱電子発生装置使用記録

operating time

Date and Time	Purpose	Operation mode	User 使用者	Operating time 使用時間
2017.7.5 16:00 19:00	データ取得	8MeV mode	Ikeda Kai	2h

DT generator usage log note

Managed under Law

LOG OF DT GENERATOR USAGE

中性子発生装置（含むトリチウム密封線源）使用記録

放射線発生装置の種類： 中性子発生装置

放射性同位元素の種類及び数量： トリチウム、~~7.4~~ 17.1 ギガベクレル

DATE PURPOSE Place to use # of pulses Operation time user

Date	Purpose	Place to use	# of pulse	Operation time (*)	User
例 M/D/Y 1999.4.5	例：Data taking データ取得	例 In SK tank タンク水中で取得	例： １００	例： ４００秒	例： 中畑 雅行
2-26-19	~~X+12, Y-12~~ DT CALib	X+12, Y-12 IN TANK	4000	16000	Jeff + DT crew
2-27-19	DT CALib	Y+12	3200	12800	Jeff + DT crew
2-28-19	DT CALib	X-12	2000	8000	Jeff + DT crew

（＊）パルス数×４秒にて計算

Operating time
= # of pulse X 4sec

DT generator keeping log note

Managed under Law

LOG OF H3 CUSTODY

トリチウム密封線源（中性子発生装置装備）保管記録

放射性同位元素の種類及び数量： トリチウム、~~7.4~~ 171 ギガベクレル

保管に従事する者の氏名： 岸本 康宏

返却年月日 時刻 Return Time	返却者 Return person	保管方法 How	保管場所 Place	持ち出し年月日 時刻 Take out time	持ち出した者 Take out person
例(eg)： 1999.4.5 13：20	例(eg)： 中畑 雅行 (B.Svoboda)	例(eg)： LINAC 室内に置き施錠 (Put in LINAC room and lock)	例(eg) LINAC 室 (LINAC room)	例(eg)： 1999.5.6 9:00	例(eg)： 中畑 雅行 (B.Svoboda)
2-28-19 12:00AM	Jeff + KAI	LINAC CAGE Locked	LINAC CAGE	2-25-19 9:00 AM	Jeff + KAI + Team

M/D/Y

返却した時はここまで記録する。

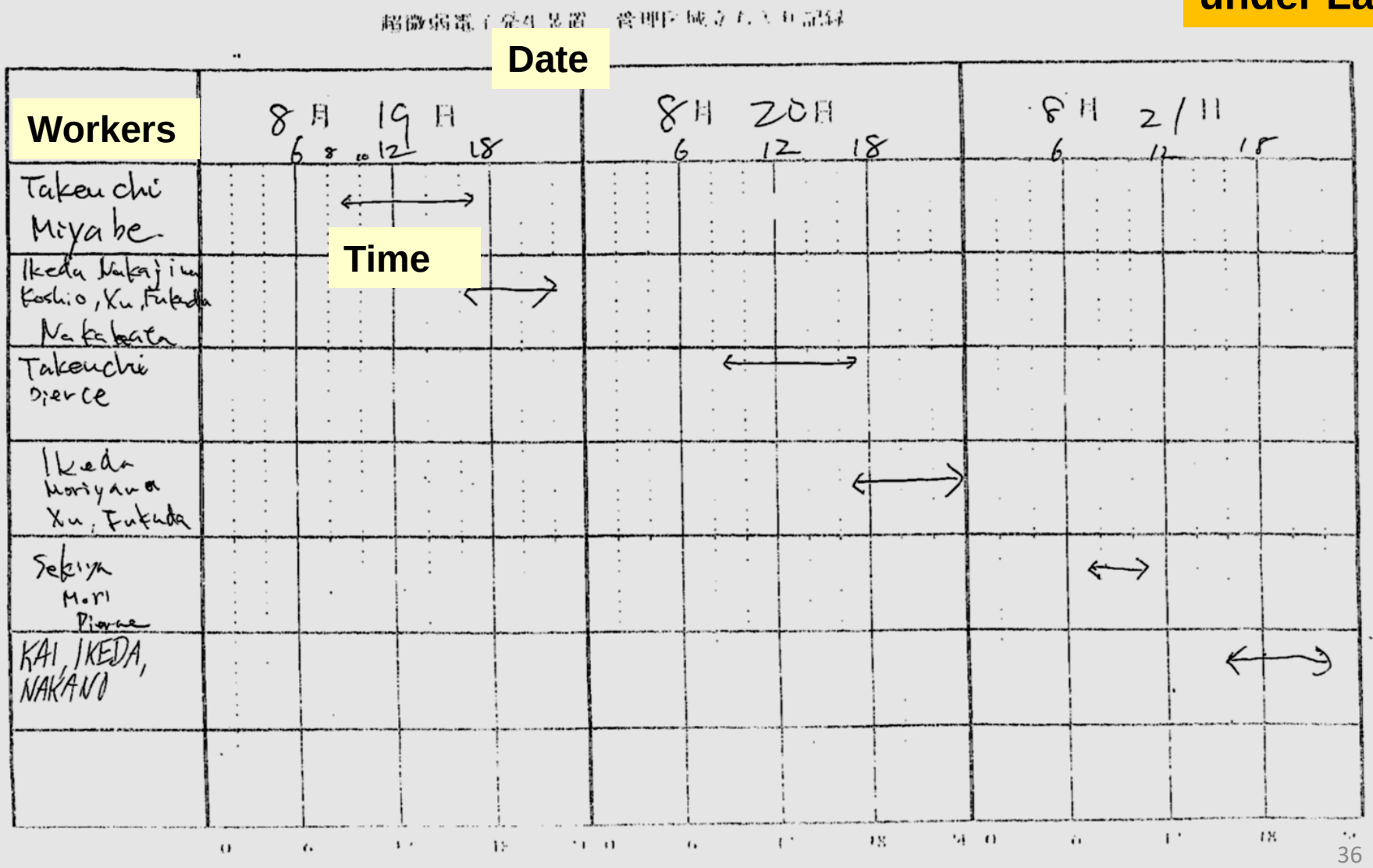
Write down <-- at returing DT

持ち出す時はここ以降を記録。

Write down --> at taking out

Entrance log of Management area (1)

Managed under Law



Entrance log of Management area (2)

Managed under Law

神岡宇宙素粒子研究施設　超微弱強度電子線発生装置

H29　　管理区域立ち入り記録（一時立ち入り者）　**For Visitor**

日付、時刻	氏名	所属（会社等）	作業内容
Date & Time	**Name**	**Affiliation**	**Purpose**
.6	東哲工	ICRR	点検
H29.8.3	長谷川 誠	神戸大	LINAC
〃	中馬原博	ICRR	LINAC
H29.10.24	大澤（KEK）	KEK	見学