

Summary of Radiation Safety Practices at KEK

-For Radiation Workers from other institutes-

High Energy Accelerator Research Organization (KEK)

April, 2020

Preface

This pamphlet provides the minimum requirements to a visitor who is going to participate in radiation work at High Energy Accelerator Research Organization (KEK). It consists primarily of the basic philosophies and policies of radiation safety, the radiation safety control system, standards for radiation safety control, and a list of items that must be obeyed by all participants.

Please understand the radiation safety practices before starting any radiation work at KEK. (For more details, please ask the Radiation Control Office.) If the participant agrees with the requirements, the person is requested to declare it on the attached registration form with one's signature and submit it. If the person has not submitted the registration form, the person is not permitted to perform any radiation work at KEK.

Registration as a Radiation Worker

1. Radiation work is defined as any work in radiation controlled areas at KEK.
2. Whoever intends to participate in radiation work must be registered as a radiation

worker.

3. The following terms are required for registration:

- (1) The applicant must be registered as radiation worker in one's home institute. It is assumed that the person is given basic education and training for radiation safety, and the total amount of radiation exposure is being controlled by home institute.
- (2) The applicant must obtain an approval to be a radiation worker at KEK by the person of one's home institute who is legally responsible.

4. Registration is performed by submitting the prescribed application forms [Form9 and 10]. The form must be prepared using user support system of KEK (KRS) after KEK user registration. The form of contractor should be prepared using contractor registration system operated by radiation control office. The filled-out form will be sent to the radiation control office.

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KEK Dose Limits

5. The standards for exposure control of radiation workers in KEK have been decided as follows. (To be controlled on fiscal-year basis.)

• Effective Dose

Man 20 mSv/year

Woman 6 mSv/year

 2 mSv/3 months

Pregnant Woman (Gestation after Declaration of Pregnancy)

 Internal Exposure; 1 mSv

• Equivalent Dose:

Eyes (crystal lens): 90 mSv/year

Skin, other tissues: 300 mSv/year

Abdomen of woman: 2 mSv (Gestation after Declaration of Pregnancy)

The standards above are more stringent than those adopted by Japanese law:

100 mSv in 5 years and not greater than 50 mSv in one year for radiation worker.

6. The dose levels for daily and weekly control have been decided as follows.

| | | |
|-----------------|--------------------|---------------------|
| Daily control: | Man; 0.5 mSv/day, | Woman; 0.3 mSv/day |
| Weekly control: | Man; 1.0 mSv/week, | Woman; 0.5 mSv/week |

7. Please note that the KEK dose limits in items 5 and 6 above are not necessarily the same as those in the organizations to which participants belong. In case of any problem, please declare it at your registration of radiation worker.

8. Some part of the areas in KEK are classified as radiological working place.

Access of persons and items to those areas is controlled according to four different levels. [Refer to the attached map of Radiation Controlled Areas in KEK.]

Monitoring Area

- Area where dose rate ranges from 0.2 μ Sv/hr to 1.5 μ Sv/hr:

General Radiation Controlled Area

- Area where dose rate ranges from 1.5 μ Sv/hr to 20 μ Sv/hr and area where the concentration of contamination with radioactivity on floor or air does not exceed 1/10 of legal standards:

Restricted Area

- Area where dose rate ranges from 20 μ Sv/hr to 100 mSv/hr, or area where the concentration of contamination with radioactivity on floor or air might exceed 1/10 of legal standards:

Forbidden Area

- Area where dose rate could be exceeding 100 mSv/hr:

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Radiation Controlled Areas

9. There are many radiation controlled areas in KEK. They are grouped into seven sections; to each section one or more regional radiation safety officer (belonging to the Radiation Control Office, refer to the attached "Assignment of Roles for Radiation Safety Controls") and one or more radiation safety liaison officers who belong to the accelerator facilities are allocated. The regional radiation safety officer, in cooperation with the regional radiation safety liaison officer(s), monitors radiation dose and radioactivity levels in their section so as not to exceed predetermined control standards.

Currently, there are more than 200 radiation monitors (or radioactivity monitors) placed at various locations in KEK. Each monitor alarms (sound and flush light) when the average values of a prescribed period (usually 10 seconds) exceeds the KEK dose limits of the corresponding area. Monitors may sometimes alarms with in very short time when accelerators are operated with exceptional parameters. When a monitor in controlled area alarms continuously or frequently, immediately evacuate the area and inform the regional radiation safety officer or the regional radiation safety liaison officer. It is possible that a temporal restricted area is constructed in general radiation areas by a fence or other partition (with sign and description). In case a participant must work in the area for a special reason, the person must obtain advance permission from the regional radiation safety officer.

10. Although a radiation worker may freely enter the monitoring and the general radiation controlled areas, in order to enter the restricted area the person must obtain advance permission from the regional radiation safety officer. Access to the restricted area (such as the beam line room of the accelerator) is strictly controlled by the access control system. When you want to enter such the area, please strictly follow all procedures. It is strictly observed that, in case you notice a precautionary broadcast announcement of operation of the accelerator while you are in the restricted area (such as remaining in accelerator room just before operation, although this is extremely unlikely to happen), you must immediately push the emergency stop button closest to you to cancel starting the accelerator. Otherwise, the beam will be provided in 20 to 30 seconds after the announcement.
11. Radiation worker must wear the personal radiation dosimeters issued by KEK and home institute to enter the radiation control areas, or at any radiological work inside KEK. Two kinds of personal dosimeters are distributed to workers according to the working places. To enter SuperKEKB, ATF, STF, ERL, Linac, PF isotope experimental facility, dosimeters for neutron and photon (X-ray and Gamma) must be wearred. To enter PF, PF-AR, North counter hall and Neutron-meson science facility, dosimeter for photon (X-ray and Gamma) only is applicable.
12. The personal radiation dosimeter, InLight, is issued for radiation workers in KEK. It must be replaced every month. Return the used dosimeter at the end of every month to the office which you belong (the office of Institute of Particle and Nuclear Studies for SuperKEKB) and receive a new one. At the Photon Factory, receiving and returning dosimeters will be done by the concierge at the access control office. **Please return**

your used personal dosimeters as soon as possible.

13. The result of individual dosimeter is informed every three months. When the dose equivalent exceeds 1mSv per month, a warning mark is stamped on the report.
14. KEK is responsible for your radiation exposure at KEK only. Therefore, KEK dosimeter shall not be used outside KEK.

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Handling Radioactive Substances

15. When you want to handle (that is, to use, purchase, carry in, transfer, or generate) radioactive substances including legal radioisotopes (or RIs), non-legal weak radioisotopes (e.g.; checking sources), nuclear fuel materials (three elements, i.e., U, Th and Pu) and materials activated or contaminated with radioisotopes, you must contact to Radiation Control Office for permission in advance. It is strictly forbidden to make or carry into KEK any apparatus which causes the generation of radiation (such as an X-ray generator) without permission. Moreover, it is also strictly forbidden to generate specific radionuclides with the beams from an accelerator without permission from the Nuclear Regulation Authority.
16. All radioactive substances are under the control of the Radiation Control Office. Though the availability is limited in type, amount, and place of use, some of the sealed RIs can be loaned out. Only the authorized person in charge of the experiment can borrow radioisotopes. In addition, the use of non-sealed radioisotopes is limited in the RI laboratories in Shiryo-Sokutei-To (Building for the Measurement of Radioactive Samples) and some facilities. Therefore, if you want to use a radioisotope, please consult the regional radiation safety officer of Section 7 and follow the person's instructions. (Please understand that lending a radioisotope may sometimes not be permitted, or the applicant may first be required to take a special education/ training program to become skilled in handling radioisotopes.)

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Warnings and Emergency

17. When the components of accelerators (such as the targets of irradiated samples) are removed and taken out from a radiation controlled area, permission from the relevant regional radiation safety officer must be required in advance.
18. KEK uses red, yellow, and green warning lamps to draw attention to hazards. The colors of the lamps indicate the following dangers:
 - Red: Apparatus of high voltage electricity is in operation (or high voltage is being applied).
 - Yellow: Radiation generating apparatus is in operation.
 - Green: Apparatus of highly pressured gas is in use.

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General Items

19. If you find a fire or any radiological accident in controlled area, please inform the information center (3399) and the Radiation Control Office (ext.3500) immediately. If you do not know how to make contact with the office, please ask any staff of KEK.
20. KEK Radiation protection policy is based on the principle “the safety is secured while the rules are obeyed”. Hence it is obligatory for every radiation worker to obey the rules and regulations at KEK.
21. For each radiation work, a person in charge of the radiation work must be assigned. For visitors engaging in experiments, a person in charge of the experiment is supposed to be responsible for the radiation work.
22. The person in charge of radiation work must instruct the radiation workers with the content of the work and precautions necessary to secure radiation safety before starting the work. If you have any questions about this, please ask the person in charge of radiation work directly or consult with the Radiation Safety Supervisor of KEK.
23. If you have any questions about radiation safety, please do not hesitate to ask the staff in the Radiation Science Center, administration office of Radiation Science Center(5495). Details can be found on web page (<http://rcwww.kek.jp/user/tebiki/>)

01StudyGuideForRadiationSafety.pdf)

List of Radiation-Safety Officers

| Position | Name | Office | PHS |
|----------------------------------|-----------|--------|------|
| Radiation Safety Supervisor | Y. Namito | 5497 | 4569 |
| Head of Radiation Control Office | T. Sanami | 5490 | 4730 |

| Regional Radiation-Safety Officer | | | | |
|-----------------------------------|-----------------------------|--------------|--------|------|
| Section | Radiation-Controlled Areas | Name | Office | PHS |
| 1 | PS (Digital Accelerator) | K. Iijima | 5488 | 4312 |
| 2 | PS (ERL+North Counter Hall) | H. Matsumura | 6003 | 4456 |
| 3 | PS (Former NML) | K. Iijima | 5488 | 4312 |
| 4A | PF Facility | Y. Kishimoto | 5487 | 4971 |
| 4B | Electron positron Linac | H. Iwase | 6004 | 4388 |
| 5A | SuperKEKB | M. Hagiwara | 5489 | 4744 |
| 5B | DR | T. Oyama | 5486 | 4863 |
| 5C | BT line | M. Hagiwara | 5489 | 4744 |
| 5D | PF-AR | G. Yoshida | 6001 | 4176 |
| 5E | ATF | A. Toyoda | 6000 | 4580 |
| 6 | STF | T. Oyama | 5486 | 4863 |
| 7 | Radio-Chemistry Laboratory | A. Toyoda | 6000 | 4580 |

Radioactive Sources

| | Name | Office | PHS |
|------------------------|------------|--------|------|
| Unsealed radio isotope | A. Toyoda | 6000 | 4580 |
| Sealed radio isotope | G. Yoshida | 6001 | 4176 |
| Checking source. | G. Yoshida | 6001 | 4176 |

Reception of radiation control office 3500, 5496

Radiation Science Center 5495