

Code of Practice for Radiation Safety at SPring-8

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Chapter 1. General Provisions

(Purpose)

Article 1. This Code, which is set by the Institute of Physical and Chemical Research (hereafter referred to "RIKEN") and Japan Synchrotron Radiation Research Institute (hereafter referred to "JASRI") under Paragraph 1 of Article 21 of the *Law for Protection against Ionising Radiation and for the Safety of Radiation Sources* (1957 Law No. 167; hereafter referred to "*Radiation Safety Law*"), is designed to define rules on the operating radiation generators (particle accelerators) and handling of sealed radioisotopes (hereafter referred to "sealed source") at SPring-8 to protect working people from harmful effects of ionizing radiations and to ensure public safety.

(Definitions of Terms)

Article 2. Terms to be used in this code have the meanings as defined below. Definitions of the terms other than those listed below shall be provided by law.

- (1) "radiation facility" means facilities where safety-control of radiation is needed.
- (2) "radio-activated material" means materials used in accelerator tunnels of SPring-8, to which significant induction of radioactivity is recognized.
- (3) "radiation work" means the work operating or maintaining particle accelerators and beamlines, using and transporting radioactive materials, and other relating activities executed in radiation controlled area.
- (4) "radiation workers" means those who are engaged in radiation works in the controlled area of SPring-8

(Relations with Other Bylaws)

Article 3. In addition to provisions herein, other safety-related bylaws including those listed below shall apply to the works of preventing harmful effects of ionizing radiations (hereafter referred to "RCW"; Radiation Control Works).

- (1) Bylaws on Safety and Hygiene Control
- (2) Bylaws of the Radiation Safety Committee of SPring-8
- (3) Bylaws on the Organization JASRI
- (4) Bylaws on the Integrated Implementation of Radiation Safety of the Operational Organization at SPring-8 and the New Subaru

(Obligations)

Article 4.

- 4.1. Radiation workers shall observe related laws and this code and also shall follow instructions given by the Director General (hereafter referred to “DG”) of JASRI under said laws or bylaws.
- 4.2. The DG of JASRI shall pay due respect to opinions given by the Radiation Safety Supervisor of SPring-8 (hereafter referred to “RSS”) under relevant laws and/or this code.
- 4.3. The DG of JASRI shall pay due respect to reports and opinions given under this code by the Radiation Safety Committee of SPring-8 (hereafter referred to “RSC”) defined in Article 9.

Chapter 2. Organization and Responsibilities

Section 1. Organization

(Organization)

Article 5.

- 5.1. The organization involved in the radiation safety of the particle accelerators, the beamlines and the sealed sources at SPring-8 shall consist of those listed below and the members of the RSC.
 - (1) The DGs of RIKEN and JASRI
 - (2) The RSS
 - (3) The Safety Officer of JASRI (referred to “SO”)
 - (4) The Director of the General Affairs Division of JASRI (hereafter referred to “DGA”)
 - (5) The Director of the Facility Management Division of JASRI (hereafter referred to “DFM”)
 - (6) The Directors of JASRI
 - (7) The Radiation Safety Manager defined in Article 14 JASRI (hereafter referred to “RSM”)
- 5.2. The organization involved in the operating the particle accelerators and the beamlines, and in the handling of the sealed sources at SPring-8 shall consist of those listed below.
 - (1) The Radiation Facility Supervisor (hereafter referred to “RFS”) defined in Article 16
 - (2) The Radiation Facility Manager (hereafter referred to “RFM”) defined in Article 17
 - (3) The Radiation Workers of SPring-8 (hereafter referred to “RW”)
- 5.3. The organization defined in this Article shall be shown in Figure 1.

Section 2. Responsibilities

(Director Generals of the Two Juridical Persons)

Article 6.

- 6.1. The DGs of RIKEN and JASRI shall jointly carry out activities for RCW at SPring-8 in an integrated and consistent manner.

- 6.2. As the representative of the two juridical persons, the DG of JASRI shall administrate activities for RCW at SPring-8.
- 6.3. The DG of JASRI shall have the RSS attend the legal course specified by the *Radiation Safety Law*.

(Radiation Safety Supervisor)

Article 7.

- 7.1. SPring-8 shall have one RSS.
- 7.2. The DG of JASRI shall appoint, subject to the approval of the DG of RIKEN, one person among JASRI's staff members, who hold a Class I Radiation Safety Supervisor's License, as the RSS of SPring-8.
- 7.3. The RSS shall observe the reliability of the system of radiation safety control, supervise the RCW and carry out activities listed below by order of the DG of JASRI.
 - (1) Participate in the formulation, revision and repeal of basic policies on RCW.
 - (2) Participate in the formulation of important plans for RCW.
 - (3) Examine applications, registrations and reports under relevant laws.
 - (4) Attend on-the-spot inspections conducted by government offices concerned.
 - (5) Participate in the investigation into causes of problems and accidents relating to radiation facilities.
 - (6) Audit the status of the management of the particle accelerators, beamlines and the sealed source and the situation of the radiation facility.
 - (7) Audit relevant books and documents.
 - (8) Give advice, recommendations, guidance and instructions to those concerned in terms of RCW.
 - (9) Require the convening of a session of the RSC.
 - (10) Carry out any other activities necessary for RCW.
- 7.4. The RSS shall give instructions or orders under relevant law or this code to those who are engaged radiation work and those who enter the Radiation Controlled Area (hereafter referred to "controlled area") according to the necessity.
- 7.5. The RSS shall give opinions or recommendations on radiation safety and security concerning Spring-8 to the DG of JASRI according to the necessity.

(Acting Radiation Safety Supervisor)

Article 8.

- 8.1. SPring-8 shall have one or more Acting Radiation Safety Supervisors.
- 8.2. The DG of JASRI shall appoint, subject to the approval of the DG of RIKEN, Acting Radiation Safety Supervisor (s) of SPring-8 from staff members of JASRI who hold Class I Radiation Safety Supervisor's License.

- 8.3. The Acting Radiation Safety Supervisor (s) shall assist the RSS in carrying out his/her responsibilities and fulfil such responsibilities on behalf of the RSS when he or she is unable to do so due to travel, illness or accidental circumstances.

(Radiation Safety Committee)

Article 9.

- 9.1. Spring-8 shall have the Radiation Safety Committee (hereafter referred to "RSC").
- 9.2. The RSC shall, at the requirement of the DG of JASRI, investigate into, deliberate and report on the matters listed below concerning RCW. The RSC may give opinions to the DG of JASRI required.
- (1) Basic policies on RCW
 - (2) Matters related to safety evaluation concerning the radiation facility
 - (3) Matters related to measures to be taken at emergency, accidents or other circumstances to which any of the DGs of RIKEN and JASRI considers measures are needed to be taken, as well as investigation into their causes
 - (4) Matters related to applications, registrations and reports under relevant laws
 - (5) Matters related to revise this code
 - (6) Other necessary matters
- 9.3. The RSC shall consist of the following members.
- (1) The RSS
 - (2) The SO
 - (3) The DGA
 - (4) Those appointed by the DG of RIKEN
 - (5) Those appointed by the DG of JASRI

(Safety Officer)

Article 10. The SO shall, by order of the DG of JASRI and under the supervision of the RSS, administrate RCW and carry out the activities listed below.

- (1) Clerical work involved in applications, registrations and reports under relevant laws.
- (2) Access control of controlled areas.
- (3) Technical matters concerning the safety of the radiation work.
- (4) Confirmation of the plans of operating of the particle accelerators, the beamlines and the sealed source.
- (5) Overseeing the RSM.
- (6) Confirmation of the results of regular checkups of the radiation facility.
- (7) Evaluation of the results of measurement of radiation dose and the status of radioactive contamination and controlling radiation exposure.
- (8) Drawing up and implementing education and training programs of radiation safety.
- (9) Providing guidance and instructions of radiation safety to people concerned.

- (10) Taking measures at emergency, accident or other circumstances.
- (11) Check, close and store relevant books.
- (12) Clerical work involved in change of these bylaws.
- (13) Secretary of the RSC.
- (14) Other activities necessary for RCW.

(Director of the General Affairs Division)

Article 11. The DGA shall, by order of the DG of JASRI, carry out activities listed below concerning RCW.

- (1) Implement medical examinations for those who enter the controlled area and keep records of their health conditions.
- (2) Security and disaster damage prevention in the radiation facility.
- (3) Other activities necessary for RCW.

(Director of the Facility Management Division)

Article 12. The DFM shall, by order of the DG of JASRI, carry out activities listed below concerning RCW.

- (1) Maintenance of buildings and structures related to the radiation facility.
- (2) Maintenance of exhaust and discharge systems related to the radiation facility.
- (3) Other activities necessary for RCW.

(Directors)

Article 13. Directors shall, by order of the DG of JASRI, work to prevent those who, subject that they belong to the sections under their control, are engaged in radiation work and enter controlled areas from suffering harmful effects from radiation.

(Radiation Safety Manager)

Article 14.

14.1. SPring-8 shall have one RSM.

14.2. The RSM shall be appointed by the DG of JASRI upon nomination by the SO and approval by the RSS.

14.3. The RSM shall, under the supervision of the SO, carry out radiation safety control activities listed below.

- (1) Individual Monitoring: measurement and estimation of individual doses.
- (2) Area Monitoring: measurement and estimation of levels of radiation and radioactivity in air as well as on the surface of articles.
- (3) Access Control to controlled areas.
- (4) Maintenance of devices and facilities for RCW.
- (5) Bookkeeping for RCW.

- (6) Inspection of the operating logbooks of the particle accelerators and the beamlines.
- (7) Confirmation of acquiring (through purchase or handover), using, storing, transporting, transferring or disposing sealed sources.
- (8) Give instructions to the Radiation Facility Manager, those using the particle accelerator(s), the beamline(s) or sealed source(s), and those entering controlled areas.
- (9) Carry out any other matters ordered by the SO.

(Acting Radiation Safety Manager)

Article 15.

- 15.1. SPring-8 may have one or more Acting RSM.
- 15.2. The DG of JASRI may appoint, subject to the approval of the RSS, Acting RSM(s) upon the nomination of the SO.
- 15.3. The Acting RSM shall assist the RSM in carrying out his/her responsibilities and fulfil such responsibilities on behalf of the RSM when he or she is unable to do so due to travel, illness, or other circumstances.

(Radiation Facility Supervisor)

Article 16.

- 16.1. SPring-8 shall have RFSs, each of those is in charge of a particle accelerator or a group of particle accelerators, a beamline or a group of beamlines, or sealed sources (hereafter collectively referred to "RD": Radiation Device).
- 16.2. The DG of JASRI shall appoint the RFS from the Directors.
- 16.3. The RFS shall, by the order of the DG of JASRI, take measures necessary for preventing harmful effects of ionizing radiation with respect to the facilities under its control, and draw up manuals and procedures for utilizing the facilities under its control.
- 16.4. The RFS shall draw up manuals and procedures for installing and modifying the accelerator(s), the beamline(s), sealed source(s), or related devices under its control.
- 16.5. The RFS shall prepare a plan of usage, stating the purpose, method and place of use, etc. and submit it to the SO in advance.

(Radiation Facility Manager)

Article 17.

- 17.1. SPring-8 shall have one or more Accelerator Manager (hereafter referred to "AM") in charge of the particle accelerator or a group of accelerators, one or more Beamline Manager (hereafter referred to "BM") in charge of the beamline or a group of beamlines, and one RI Manager (hereafter referred to "RIM") in charge of the sealed source (hereafter collectively referred to "FM": Facility Manager).
- 17.2. The RFMs shall be nominated from radiation workers by the RFS in charge of the relevant

RDs and shall then be appointed by the DG of JASRI.

- 17.3. The RFMs shall, under the supervision of the RFS administrate activities in connection with the operation, utilisation and maintenance of the RDs.
- 17.4. The RFMs shall use or let others use the RDs strictly under conditions specified by the RFS.
- 17.5. The RFMs shall not modify or let others modify the RDs without permission of the DG of JASRI.
- 17.6. The AMs shall draw up and implement manuals and procedures for checkups and maintenance of the RDs safety control equipment.
- 17.7. The RIM shall keep records of the checks and use of the device and on the acquisition (through purchase or handover), use, storage, transport, transfer and disposal of the sealed source and report such matters to the RFS.
- 17.8. The RFMs shall, under the supervision of the RFS, give appropriate instructions on the operating and handling of the RDs to users of such RDs and work to ensure safety of such users.
- 17.9. Device Operator, DO, may be appointed to carry out part of the operation, maintenance and other activities on behalf of the AM or the BM. DOs shall be appointed by the AM or the BM.

(Acting Facility Manager)

Article 18.

- 18.1. The DG of JASRI may appoint one or more Acting Accelerator Manager, Acting Beamline Manager, and Acting RI Manager to work on behalf of the AM, the BM and the RIM respectively. (hereafter collectively referred to the Acting Radiation Facility Manager).
- 18.2. Acting Radiation Facility Managers shall be nominated from radiation workers by the RFS relevant devices and shall then be appointed by the DG of JASRI .
- 18.3. The Acting Radiation Facility Manager shall assist the RFM in carrying out his/her responsibilities and fulfil such responsibilities on behalf of the RFM when he or she is unable to do so due to travel, illness and other circumstances.

(Radiation Works and Access Control of Radiation Controlled Areas)

Article 19.

- 19.1. Only those who are registered as RW can engage radiation works at Spring-8.
- 19.2. Application for the approval must be made by submitting written application through the Director concerned and be approved by the SO.
- 19.3. Those who are not a RW and desire to enter any controlled areas must obtain approval of the SO in advance.

Chapter 3. Radiation Controlled Area

(Designation of the Radiation Controlled Area and Cancellation of the Designation)

Article 20.

- 20.1. The DG of JASRI shall, on the basis of advice from the RSS, designate the following areas as controlled areas: the area where external radiation dose exceeds or could exceed the dose limit specified by law, the area where the concentration of radioactive materials in the air exceeds or could exceed the concentration specified by law, or the area where the surface density of matters contaminated with the radioactive materials exceeds or could exceed the density specified by law.
- 20.2. When cancelling the designation of the controlled area, the DG of JASRI shall have the SO carry out necessary investigations into the status of contamination and safety of the relevant area and shall, on the basis of the advice of the RSS with respect to the results of said investigations, take necessary steps.
- 20.3. The DG of JASRI may designate parts of controlled areas among the candidates approved by regulatory authority as the Suspended-Control Areas (hereafter referred to "SCA") while accelerators are shut down for more than seven days.
- 20.4. When designating the SCA, the DG of JASRI shall have the SO carry out necessary investigations into the safety of the relevant area and shall, on the basis of the advice of the RSS with respect to the results of said investigations, take necessary steps.

(Classification of the Radiation Controlled Areas)

Article 21. The SO shall classify controlled areas into the following designated categories and manage them in accordance with the following provisions.

- (1) Class I Controlled Area: The controlled area where the concentration of radio-activated materials in the air exceeds or could exceed the concentration specified by law or the controlled area where the surface density of matters contaminated by the radio-activated materials exceeds or could exceed the density specified by law
- (2) Class II Controlled Area: The controlled area other than Class I controlled areas
- (3) SCA: The controlled area designated with a specified period by the DG of JASRI among the Class II Controlled areas, where only access control is necessary.

(Indication of Radiation Controlled Area)

Article 22.

- 22.1. The SO shall put up signs specified by the law on the borders controlled areas, at the entrances of accelerator tunnels and other relevant places.
- 22.2. The SO shall put up a notice board showing dos and don'ts in a conspicuous position near the entrance of each controlled area.

22.3 The SO shall put up signs of the SCA and the relevant notice in a conspicuous position near the entrance of each SCA.

(Restriction of Access to the Radiation Controlled Area)

Article 23.

23.1. The SO shall restrict entry into controlled areas to RWs. However, the SO may admit those who are not RWs (hereafter referred to "non-RW") entering controlled areas temporarily upon conditions..

23.2. When the SO permits a non-RW entering controlled area (hereafter referred to "Temporary Entrant", TE), the SO shall have a RW accompany the TE to take care of his/her safety.

23.3. The SO may permit, despite of the first paragraph of this article, a non-RW entering SCA s.

(Rules Concerning the Radiation Controlled Area)

Article 24.

24.1. Those who enter controlled areas shall observe the rules listed below.

- (1) Enter and exit through the specified entrance and, either in a record book or by means of the access control device, record the time and date of entrance and exit, name of the entrant, the areas he or she will enter and a description of the work he or she will carry out.
- (2) When using a door other than the specified entrance, obtain permission from the RSM. On finishing using the door, submit to the RSM without delay a record containing the time and date of entrance and exit, name of the entrant, the door used, the areas he or she entered and a description of the work he or she carried out.
- (3) Wear a personal dosimeter on a specified part of the body.
- (4) RWs shall follow instructions from the RSS, the SO, or the RSM who are in charge of the RCW, as well as instructions from the RFS, the RFM, the DO or the DFM who are in charge of security of RDs or the radiation facility.
- (5) TEs shall also follow instructions from the RW who is in charge of their radiation safety, in addition to the instructions mentioned in (4).

24.2. In addition to the rules listed in the preceding paragraph, those who enter a controlled area of Class 1 shall follow (1) through (5) below. For those who enter a controlled area of Class 2, the additional requirement is (1) below.

- (1) Do not eat, drink, smoke or apply cosmetics.
- (2) Wear the specified footwear, the specified uniform, gloves and other protective gear as may be necessary. Do not leave wearing said clothing in controlled areas.
- (3) When leaving the controlled area, check with the provided contamination monitor, such as radiation survey meters, the status of contamination by radioactive materials on the surface of the body parts such as hands and feet and clothing surfaces such as the uniform, footwear and protective gear.

- (4) When carrying an article out of the controlled area, check with the provided contamination monitor the status of the contamination by radioactive materials on the surface of the said article.
- (5) If any of the followings observed, inform the SO immediately and follow his/her instructions.
 - a) Significant radioactive contamination is found with the body or belongs.
 - b) Significant radioactive contamination is found on the goods in the facility.
 - c) Accidental ingestion or inhalation of radioactive materials.
 - d) Decontamination of body skin was not successfully executed.
 - e) Possible intake of radioactive material through wound(s) of the body.

Chapter 4. Maintenance of Radiation Facility

(Maintenance of the Radiation Facility)

Article 25. The SO shall maintain the structure and installation of the radiation facility in the way that meets the technical standards set by law.

(Checkups of Radiation Facility)

Article 26.

26.1. The RSM shall carry out checks on the items specified in the attached table, following the rules listed below.

- (1) Carry out regular checks twice a year.
- (2) Besides the checkups specified in the previous provision, patrol the facility for checks as needed.

26.2. The RSM shall report to the SO the results of the checkups mentioned in the preceding paragraph whenever such checks are conducted.

(Procedures to Follow the Checkups of Radiation Facility)

Article 27.

27.1. If any trouble or potential trouble is detected in the checkups mentioned in the preceding article, the SO shall, depending on the situation, restrict or prohibit the use of the relevant radiation facility or its equipment, require those who are in charge of the relevant RD or the radiation facility or equipment to make repairs, and take other appropriate steps.

27.2. When a requirement for repairs mentioned in the preceding paragraph is made, the RFS and the RFM in charge of the RD, radiation facility or equipment shall carry out repairs on the relevant RD, radiation facility or equipment without delay.

27.3. The SO shall make records of the checkups mentioned in the preceding article and the actions taken followed the steps mentioned in Paragraph 1 of this article, have the record confirmed by the RSS, and submit them to the DG of JASRI through the RSS, and keep the original.

27.4. The record mentioned in the preceding paragraph shall be stored for 5 years.

Chapter 5. Usages

(Use of Radiation Devices)

Article 28.

- 28.1. Those who are not RWs shall not use RDs.
- 28.2. RWs who use RDs shall use them under the supervision of the relevant RFM.
- 28.3. When using RDs, the RFS shall follow instructions of the SO with respect to the plan of use specified in Paragraph 5 of Article 17.
- 28.4. When asked to give the instructions mentioned in the preceding paragraph, the SO shall check the contents of the plan of use.
- 28.5. When changing the contents of the plan of use, the RSF shall give prior notice to and have the change checked by the SO.
- 28.6. In the commissioning use of RDs, the RFM shall make sure that radiation levels in the vicinity of the RDs are not exceeding the controlling criteria.
- 28.7. When operating particle accelerator(s) or beamline(s), those who use the RDs and the AM or the BM shall carry out the checkups specified in Figure 2-1.
- 28.8. When using the sealed source, those who use the sealed source and the RIM shall carry out the checkups specified in Figure 2-2.
- 28.9. The SO and the RSM shall monitor the status of use of RDs and, if they deem it necessary, shall instruct RWs, the RFM and the RFS to limit or suspend use of the RDs.
- 28.10. The RFM shall keep a record on the use of the RDs and submit it to the SO through the RFS.

(Acquisition, Storage, Transfer and Disposal of Sealed Sources)

Article 29.

- 29.1. Those other than RWs shall not acquire (through purchase or handover), store, transfer or dispose of a sealed source.
- 29.2. Those who acquire (through purchase or handover) and transfer a sealed source shall gain prior consent of the SO through the RIM.
- 29.3. Those who store sealed sources shall store it under the supervision of the RIM in a storage facility specified by the SO.
- 29.4. When disposing of sealed sources, the RIM shall hand it over to a waste disposal contractor subject to the approval of the SO.
- 29.5. The SO and RSM shall supervise the acquisition (through purchase or handover), storage,

transfer and disposal of a sealed source and, if they deem it necessary, give appropriate safety instructions.

29.6. The RIM shall keep a record on the acquisition (through purchase or handover), storage, transfer and disposal of the sealed source and submit it to the SO through the RFS.

(Transport of Sealed Sources)

Article 30.

30.1. Only those whom the SO approved can transport radioactive materials.

30.2. When transporting a sealed source, the RIM shall obtain permission or consent in advance from the SO and follow his/her instructions.

30.3. When giving the consent mentioned in the preceding paragraph, the SO and the RSM shall order the implementation of the following steps and make sure that these steps have been taken.

- (1) Prohibit the loading of a sealed source with the “dangerous materials” specified by the *Fire Service Law*, prevent it from tipping over or falling, prevent radiation exposure, prevent it from being misplaced, and take other safety measures.
- (2) When transporting the sealed source inside the facility site (excluding the controlled area), take steps to ensure that the dose rate on the surface of the container does not exceed 2 mSv an hour and the dose rate at 1 meter away the surface does not exceed 100µSv an hour.
- (3) When transporting the sealed source outside the facility site, take steps to meet Article 18-2 of the *Radiation Safety Law*.

30.4. The RIM shall keep a record of transportation of sealed sources and submit it to the SO.

Chapter 6. Measurement

(Area Monitoring)

Article 31.

31.1. Under the provisions below, the RSM shall measure using proper measuring instruments the radiation dose, the status of radio-active contamination and the concentration of radioactive materials in air with regards to places where the RSS indicated. However, if it is extremely difficult to measure these values with instruments directly, these values may be estimated indirectly.

- (1) Measurement of radiation dose shall be carried out with H(10) rate or H(10). However, as for places where H(0.07) rate is expected to exceed by 10 times the H(10) rate, carry out measurement with H(0.07) rate. As for places where H(0.07) is expected to exceed 10 times of H(10), carry out measurement with H(0.07).
- (2) Measure radiation dose shall be carried out at the representative points of workspace in the

controlled area, on the boundary of controlled area and on the borders of SPring-8.

- (3) Measure the status of contamination by radio-activated materials in Class I controlled areas, at the exhaust port of the exhaust system, at the drain hole of the drainage system, and on the borders of the controlled area at locations most appropriate to learn the status of contamination.
- (4) Measure the concentration of radioactive materials in air in Class I controlled areas at locations and at frequencies given by the SO.
- (5) Carry out the measurement mentioned in (1) through (4) once prior to start working and, after the work is started, at least once a month while the work is underway.
 - a) Measure the status of contamination with radioactive materials at the exhaust port of the exhaust system once prior to start working and carry out measurement on a continuous basis while exhausting air. Measure the drain hole of the drainage system once prior to start working and carry out measurement every time water is drained.
 - b) In places in which RDs are used where they are fixed, measure radiation dose at least once every 6 months as long as the procedures for handling the RDs and the position of radiation shields remain unchanged.

31.2. The RSM shall keep a record whenever the measurement or estimation mentioned in the preceding paragraph is carried out and submit the record to the SO.

31.3. The SO shall have the record mentioned in the preceding paragraph checked by the RSS and store it for 5 years.

(Procedures to Follow the Results of Area Monitoring)

Article 32.

32.1. The RSM shall report the results of measurement mentioned in the preceding article to the RFM and post them at conspicuous places in the relevant controlled area.

32.2. When, as a result of the measurement mentioned in the preceding article, the SO and the RSM find any problem, they shall give the RFS and the RFM instructions necessary for RCW and take steps below.

- (1) When a problem with radiation dose is found, take steps to reduce exposure to radiation by, for example, restricting entry.
- (2) When a problem in the status of contamination by radio-activated materials is found, take steps to prevent the contamination from spreading and remove it.

(Individual Dose Monitoring)

Article 33.

33.1. In accordance with the provisions below, the RSM shall have those who enter controlled areas wear an appropriate personal dosimeter to measure individual dose resulting from their exposure to radiation from external sources. However, if it is extremely difficult to measure these values with the personal dosimeter, they may be estimated in directly.

- (1) Measure H(10) and H(0.07) on the chest (or on the abdomen for women when the provision applies that says, "Women who reported in writing that they have been diagnosed as sterile or have no intention to becoming pregnant shall be excluded. However, this provision shall not apply when there are good, rational reasons.")
 - (2) Measure in a manner specified by the SO if it is deemed necessary to evaluate uneven exposure to radiation.
- 32.2. Based on the results of measurement in the preceding paragraph, the SO shall summarise and record individual doses due to exposure to external sources for every 3 months starting from April 1, July 1, October 1, and January 1, and for every year starting from April 1. As for pregnant women who have informed the SO of their pregnancy, the SO shall summarise and record their individual doses due to exposure to external sources for each month starting from the 1st day of every month until childbirth. However, as for measurement of individual dose of the TE, the SO shall summarise the results of measurement carried out at the time of the completion of their temporary entry.
- 32.3. In accordance with the provisions below, the RSM shall measure the intake of radio-activated materials of those who entered Class I controlled areas or those who inhaled or swallowed or could have inhaled or swallowed radio-activated materials accidentally, by measuring radiation emitted from the body or by other means, and estimate the individual dose resulting from their internal exposure and record the results every time said measurement and estimation are carried out. However, if it is extremely difficult to measure these values with the instruments, they may be estimated indirectly.
- (1) Carry out measurement and estimation concerning those who entered Class I controlled areas at least once every 3 months (or, for pregnant women who informed the SO of their pregnancy, at least every month until childbirth).
 - (2) Carry out measurement and calculation promptly concerning those who accidentally took in radio-activated materials.
- 32.4. Based on the result of measurement in Paragraphs 2 and 3, the SO shall calculate, evaluate and record effective dose and equivalent dose for every 3 months starting from April 1, July 1, October 1 and January 1, and for every year starting from April 1. As for pregnant women who informed the SO of their pregnancy, the SO shall calculate, evaluate and record their effective dose and equivalent dose for each month starting from the 1st day of every month until childbirth.
- 32.5. The RSM shall measure with proper instruments and record the status of contamination by radioactive materials for those who entered Class I controlled areas and have been contaminated the body beyond the legal limit of the surface density by radioactive materials such that it could not be easily removed. However, if it is extremely difficult to measure the status of contamination with instruments directly, it may be estimated indirectly.

(Omission of Measurement)

Article 34. With respect to the measurement for the TE mentioned in Paragraphs 1 and 3 of Article 33, the SO may omit said measurement if he or she is certain that the combined effective dose due to external and internal exposures that the TE suffered does not exceed 100 μ Sv.

(Procedures to Follow the Results of Individual Dose Monitoring)

Article 35.

- 35.1. The RSM shall check the results of measurement of individual dose due to exposure to radiation from external sources everyday for those whose effective dose could exceed 1 mSv a day.
- 35.2. As a result of the evaluation of effective dose under Paragraph 4 of Article 33, if the effective dose for 1 year starting from April 1 exceeds 20 mSv, the accumulated effective dose (the total of the effective dose calculated each year starting from April 1 under Paragraph 4 of Article 33) over the period of 5 years (each period whose length was divided by 5 years starting from April 1, 2001) including the above-mentioned 1 year shall be recorded when doses are summed up each fiscal year.
- 35.3. The SO shall issue copies of the records mentioned in Paragraphs 2 through 5 of Article 33 and Paragraph 2 of Article 35 to those concerning whom relevant measurement was carried out and, if necessary, report on the records to Directors. However, this provision shall not apply if the person on whom measurement was carried out was a TE and the radiation dose he or she was exposed to was no more than 100 μ Sv.
- 35.4. The SO shall have the records in Paragraphs 2 through 5 of Article 33 and Paragraph 2 of Article 35 checked by the RSS and shall store them.
- 35.5. The records mentioned in the preceding paragraph shall be stored indefinitely.
- 35.6. If, as a result of evaluation mentioned in Paragraph 4 of Article 33, it was found that someone had been exposed to radiation that exceeds the legal limits of the effective dose or the equivalent dose, the SO shall immediately report it to the DG of JASRI.
- 35.7. Upon receiving a report mentioned in the preceding paragraph, the DG of JASRI shall immediately report it to the Ministry of Education, Culture, Sports, Science and Technology (hereafter referred to as "MEXT"). Also, the DGs of RIKEN and JASRI shall, within 10 days, report to the MEXT on how the event happened and what measures were taken to address the situation.

(Maintenance of Measuring Instruments)

Article 36. The RSM shall maintain the instruments used for the measurement specified in Articles 31 and 33 to ensure at all times their normal functioning.

Chapter 7. Radiation Safety Training

(Implementation of Education and Training)

Article 37.

37.1. At the timings specified below, the SO shall provide radiation safety training necessary for the prevention of harmful effects of ionising radiation to those who enter controlled areas and those who are engaged in radiation work at outside controlled areas.

- (1) For RWs, prior to engaging in radiation work for the first time at Spring-8.
- (2) For those who engaged in radiation work at outside controlled areas, prior to start the work for the first time.
- (3) For RWs, at intervals of no longer than 1 year, after entering a controlled area and start radiation work for the first time.
- (4) For TEs, prior to entering controlled areas.
- (5) For non-RWs who work only in the SCA, prior to enter the SCA for the first time after designation.

37.2. The SO may require those who enter controlled areas or those engaged in radiation work to receive additional safety training when he or she deems it necessary.

37.3. The RFM shall provide education to those who use or maintain RDs on matters necessary for the fulfilment of their responsibilities.

(Subjects and Hours of Education and Training)

Article 38.

38.1. Subjects and hours of radiation safety training specified in Paragraphs 1-(1) and 1-(2) of the preceding article shall be shown in the table below.

SUBJECTS	HOURS	
	Paragraphs 1-(1)	Paragraphs 1-(2)
Effects of ionising radiation on human health	> 0.5 hr	> 0.5 hr
Safe handling of radiation sources	> 4 hr	> 1.5hr
The Radiation Safety Law	>1 hr	> 0.5 hr
Code of Practice for Radiation Safety at SPring-8	> 0.5 hr	> 0.5 hr

38.2. The subjects of education and training specified in Paragraph1- (3) of the preceding article shall be as specified in the preceding paragraph.

(Omission of Education and Training)

Article 39. Notwithstanding the provisions in Article 37, the SO may exempt those believed to have sufficient knowledge and skills concerning all or part of the subjects or items listed in the

preceding article from the education and training about such subjects or items.

Chapter 8. Healthcare

(Implementation of Health Checkups)

Article 40.

40.1. The DGA shall have health checkups on RWs carried out by a medical doctor at the timings below.

- (1) Before the SO approves radiation workers for the first time
- (2) After the SO has approved radiation workers, at intervals of at least a year

40.2. The health checkups mentioned in the preceding paragraph shall consist of an interview and a physical checkups or examination.

- (1) The following questions shall be asked during the interview.
 - a) Whether he or she has a history of exposure to radiation or not.
 - b) For those who have a history of being exposed to radiation, where they worked, what kind of activities they were doing, how long they were doing these activities, their radiation dose of the previous fiscal year and the current fiscal year, if they have been suffering from any deleterious effects of radiation exposure, and other conditions concerning exposure to radiation
- (2) Physical checkups or examination shall be carried out on the following body parts and items. However, the body parts or items mentioned in a) through c) (in the health checkups concerning Paragraph 1-(1), the body parts and items mentioned in a) and b) shall be excluded) shall be examined only when the doctor deems it necessary.
 - a) Haemoglobin or haematocrit value, red blood cell count, white blood cell count and the percentage of white blood cells in peripheral blood
 - b) Skin
 - c) Eye lens

40.3. The SO shall require the DGA to have the doctor examine a radiation worker or anyone else without delay if he or she:

- a) accidentally inhaled or swallowed radioactive materials;
- b) had his/her skin contaminated with radioactive materials beyond the legal limit of the surface density and the contamination cannot easily be eliminated;
- c) had or could have had the surface of his/her wound contaminated by radioactive materials;
- e) suffers or could suffer from deleterious health effects of ionising radiation.

40.4. In case those who take the health checkups mentioned in Paragraphs 1 and 3, the SO shall show the medical doctor the amount of radiation dose that the persons have been received since their last medical examinations.

(Steps to Take in Response to Results of Health Checkups)

Article 41.

- 41.1. If, as a result of the health checkups mentioned in the preceding article, it is found that anyone suffers or could have suffered from harmful effects of ionising radiation, the doctor shall immediately report it to the DGA and notify the person who received the medical checkups.
- 41.2. When he or she received a report mentioned in the preceding paragraph, the DGA shall notify Directors, the RSS and the SO of the fact, and report it to the DG of JASRI.
- 41.3. When he or she received a report mentioned in the preceding paragraph, and if the person who suffered or could have suffered from harmful effects of ionising radiation is a radiation worker, the DG of JASRI shall consult with the RSS, the SO and medical doctor and the SO to take steps, depending on the extent of radiation exposure or the degree of possibility of radiation exposure, such as reducing the hours of the radiation worker's entry into the radiation controlled area, prohibiting him/her from entering the radiation controlled area, transferring him/her to a position where there is less risk of radiation exposure. The DG of JASRI shall also have the DGA implement necessary health training programs.
- 41.4. When he or she received the report mentioned in Paragraph 2, and if the person who suffered or could have suffered from harmful effects of ionising radiation is someone other than radiation workers, the DG of JASRI shall consult with the RSS, the medical doctor and the SO to have the DGA take necessary steps such as the implementation of health care programs without delay.
- 41.5. When he or she implemented the steps mentioned in Paragraph 3 or Paragraph 4, the DGA shall promptly report it to the DG of JASRI.
- 41.6. When he or she received the report mentioned in Paragraph 2, the DG of JASRI shall immediately inform MEXT of the fact that there is a person who suffered or could have suffered from harmful effects of ionising radiation. Also, on the basis of the report in Paragraph 5, the DGs of RIKEN and JASRI shall, within 10 days, inform MEXT of the situation of the radiation hazards and the steps taken to address it.

(Records of Results of Medical Examination)

Article 42.

- 42.1. With respect to results of the health checkups in Paragraphs 1 and 3 of Article 40, the DGA shall record them every time such health checkups are implemented.
- 42.2. The DGA shall issue a copy of the record mentioned in the preceding paragraph to the person about whom the record is kept whenever he or she makes the record. The DGA shall also notify the RSS and the SO of the record.
- 42.3. The DGA shall store the record mentioned in Paragraph 1.
- 42.4. The record mentioned in the preceding paragraph shall be stored indefinitely

Chapter 9. Keeping and Storing of Books

(Keeping and Storing of Records)

Article 43.

43.1. The SO shall provide the books concerning the matters listed below and have necessary items kept in them.

- (1) Matters concerning the use of the particle accelerators and beamlines
- (2) Matters concerning the use, storage, disposal and transport of the sealed source
- (3) Matters concerning the checkups of the radiation facility
- (4) Matters concerning radiation safety training
- (5) Other matters deemed necessary with respect to RCW

43.2. The SO shall close the books specified in the preceding paragraph each year starting from April 1 and, subject to RSS's audit, store them for 5 years.

Chapter 10. Emergency

(Preventive Measures)

Article 44. To cope with the occurrence of any of the events listed below (hereafter referred to as "Emergency"), the SO shall take preventive steps deemed necessary, including the establishment of reporting and communication system and the preparation, maintenance and checks of instruments and equipment necessary for such reporting and communication.

- a) Situations in which radiation hazards occur or could occur due to earthquake, fire and other disasters
- b) Situations in which radiation hazards occur or could occur due to any other reasons

(Reporting at Emergency)

Article 45. Anyone discovering a situation mentioned in the preceding article shall immediately report it to appropriate person(s) in accordance with the Urgent Contact Network at SPring-8 (hereafter referred to as the "Reporting System") shown in Figure 2.

(Steps to Take at Emergency)

Article 46.

46.1. When receiving a report concerning emergency, those using a particle accelerator, a beamline or a sealed source shall immediately cease the electron beam, stop irradiating synchrotron radiation or stop using the sealed source.

46.2. When receiving a report concerning emergency, the DG of JASRI shall immediately take emergency steps listed below, depending on the situation.

- (1) If fire breaks out in an area that houses the particle accelerators, the beamlines or the sealed

sources, or if fire is expected to spread to such an area, try to extinguish fire or stop the spread of fire.

- (2) If it deemed to be necessary for the safety, warn those around the particle accelerators, the beamlines or the sealed sources to evacuate.
- (3) If there is anyone who has suffered or could have suffered from harmful effects of radiation, rescue and evacuate him/her immediately.
- (4) Take other necessary steps to prevent harmful effects of radiation, including personnel deployment.

46.3. The DG of JASRI shall take appropriate steps to minimize the individual dose of those engaged in the activities mentioned in the preceding paragraph. The maximum allowable dose applied to the people engaged in said activities shall be as specified by law.

46.4. The DG of JASRI shall promptly order The DGA to have a doctor examine or treat those who has suffered or could have suffered from harmful effects of radiation.

46.5. The SO shall measure or estimate without delay the effective dose or the equivalent dose inflicted on those who could have been exposed to radiation dose greater than the maximum allowable effective dose or the maximum allowable equivalent dose due to the event mentioned in Article 44 or those examined or treated under the provision of the preceding paragraph.

(Responsibility of the DG at Emergency)

Article 47. The DG of JASRI shall, on receiving a report mentioned in Paragraph 6 of the preceding article, hear opinions from the RSS and the RSC and order staff members concerned to take the best possible measures, depending on the situation.

(Checkups in the Event of Earthquake, Fire and Other Disasters)

Article 48. If the SO is informed of the occurrence of earthquake, fire and other disasters through the Reporting System, he or she will promptly carry out checkups on items specified in Table 1 and report the results of the checkups to the RSS.

(Reporting)

Article 49.

49.1. When he or she received a report on the event of (a) in Article 45, the DG of JASRI shall report it to MEXT without delay.

49.2. When he or she received a report on someone who was exposed to or could have been exposed to radiation that exceeds the legal limit of the effective dose or the equivalent dose, or when he or she received a report on the event of (b) in Article 45, the DG of JASRI shall immediately report it to MEXT. Also, the DGs of RIKEN and JASRI shall report, within 10 days, on the situation and the steps taken to address it to MEXT.

49.3. When he or she made the report mentioned in the preceding paragraph, the DG of JASRI shall report it without delay to the heads of government offices concerned other than MEXT.

(Records of Dangerous Events)

Article 50.

50.1. The SO shall keep records of any events mentioned in Article 44 and store the records.

50.2. The records mentioned in the preceding paragraph shall be kept for 5 years.

Chapter 11. Reports on the Status of Radiation Safety

(Reporting on the Status of Radiation Control)

Article 51.

51.1. The SO shall report to the DG of JASRI on the status of radiation safety and other relevant matters.

51.2. The DGs of RIKEN and JASRI shall report the status of radiation safety to MEXT by June 30 of the next fiscal year.

51.3. Matters relevant to the status of radiation safety specified in Paragraphs 1 and 2 shall be as follows.

- (1) Status of inspection of facilities
- (2) Storage status of sealed sources
- (3) Number of RWs
- (4) Distribution individual doses

TABLE 1. Items of Regular Checkups

CATEGORY	ITEM
Position of the Facility	(1) Whether the site boundary is changed. (2) Whether there exists any possibility for being flooded or subject to landslide
Principal Structure of the Facility	(1) Whether the walls, floors, pillars and ceilings of the facility with fireproof or non-flammable materials.
Radiation Shield	(1) Performance 1) Whether structures of the facility is consistent with the description of the application document. 2) Whether radiation shield has cracked or damaged to the degree that may affect the performance. (2) Dose Levels 1) Whether dose levels at the work space in the controlled area do not exceed the legal limit. 2) Whether dose levels at the site boundary do not exceed the legal limit.
Controlled Area	(1) Demarcation 1) Whether the structure of the controlled areas are consistent with the description of the application document. 2) Whether the controlled areas are demarcated so that no one can enter without proper procedures. (2) Dose Levels 1) Whether dose levels at the boundary of controlled area do not exceed the legal limit.
Signboard and Notice	(1) Signboard 1) Whether legal signboards are post up where specified by the law. 2) Whether the positions of the legal signboards are consistent with the description of the application document. 3) Whether legal signboards are faded or damaged. (2) Notice 1) Whether notice boards near the entrance of controlled area are conspicuous.

CATEGORY	ITEM
Radiation Facility	<p>(1) Status Indication</p> <ol style="list-style-type: none"> 1) Whether the positions of the operational status indicator are consistent with the description of the application document. 2) Whether the indicators work appropriate. <p>(2) Safety Interlock</p> <ol style="list-style-type: none"> 1) Whether the structure and performance of the safety interlock are consistent with the description of the application document. 2) Whether the safety interlock works appropriate. <p>(3) Lock Out</p> <ol style="list-style-type: none"> 1) Whether doors other than the specified entrance are locked so that no one can enter there.
Storage Facility	<p>(1) Storage Room</p> <ol style="list-style-type: none"> 1) Whether the fireproof structures are intact. 2) Whether the storage room is locked rigidly. <p>(2) Storage Container</p> <ol style="list-style-type: none"> 1) Whether the fireproof structures are intact. 2) Whether legal signboard is put on the surface of the container and whether the kinds and the activities of the radioisotopes are displayed there. <p>(3) Lock Out</p> <ol style="list-style-type: none"> 1) Whether doors other than the specified entrance are locked so that no one can enter there.
Waste Disposal Facility	<p>(1) Exhaust System</p> <ol style="list-style-type: none"> 1) Whether the performance of exhaust fans are consistent with the description of application document and whether they work appropriate. 2) Whether the air filters are consistent with the description of application document. 3) Whether exhaust ducts are damaged. 4) Whether exhaust system has legal signboard at proper places. <p>(2) Drainage System</p> <ol style="list-style-type: none"> 1) Whether drainage tanks are consistent with the description of application document and whether they are damaged. 2) Whether drainage pipes have leakage. 3) Whether drainage system has legal signboard at proper places.

TABLE 2. Items of Operational Checkups

SITUATION	ITEM
Operating Particle Accelerators	<p>(1) DOs or the AM shall check up accelerator tunnels so that no one is staying inside.</p> <p>(2) The RSM shall check-up the following items occasionally;</p> <ol style="list-style-type: none">1) Whether safety interlock (including radiation monitors) work properly.2) Whether the operational status indicators work properly.3) Whether doors other than specified entrance are locked.4) The exhaust system and the drainage system work properly.
Using sealed Sources	<p>(1) Those using the sealed sources shall put up a signboard indicating “IRRADIATING” at the conspicuous position.</p> <p>(2) The RIM shall check-up the sources whether they have leakage or damaged.</p>

Glossary

AM	Accelerator Manager of SPring-8
BM	Beamline Manager of SPring-8
Controlled Area	Radiation Controlled Area of SPring-8
DFM	Director of the Facility Management Division of JASRI
DG	Director General
DGA	Director of the General Affairs Division of JASRI
DO	Device Operator
Emergency	a) Situations in which radiation hazards occur or could occur due to earthquake, fire and other disasters, b) Situations in which radiation hazards occur or could occur due to any other reasons
Fire Service Law	Fire Service Law (1948 Law No.186)
JAERI	Japan Atomic Energy Research Institute
JASRI	Japan Synchrotron Radiation Research Institute
non-RW	non Radiation Worker of SPring-8
Radiation Facility	facilities where safety-control of radiation is needed
Radiation Safety Law	Law for Protection against Ionising Radiation and for the Safety of Radiation Sources (1957 Law No. 167)
Radiation Work	the work operating or maintaining particle accelerators and beamlines, using and transporting radioactive materials, and other relating activities executed in radiation controlled area.
Radio-Activated Material	materials used in accelerator tunnels of SPring-8, to which significant radioactivity is induced
RCW	Radiation Control Works: the activities of preventing harmful effects of ionising radiations
RD	Radiation Device: a particle accelerator or a group of particle accelerators, a beamline or a group of beamlines, or sealed source
Reporting System	Urgent Contact Network at SPring-8
RFM	Radiation Facility Manager of SPring-8
RFS	Radiation Facility Supervisor of SPring-8
RIKEN	Institute of Physical and Chemical Research
RIM	RI Manager of SPring-8
RSC	Radiation Safety Committee of SPring-8
RSM	Radiation Safety Manager of JASRI
RSS	Radiation Safety Supervisor of SPring-8
RW	Radiation Worker of SPring-8: those who are engaged in radiation works in the controlled area of SPring-8
SCA	Suspended-Control Area
Sealed Source	sealed radioisotopes

SO

Safety Officer of JASRI

TE

Temporary Entrant