

SSI FS 2000:8

The Swedish Radiation Protection Institute's Regulations and General Advice on Radiography;

issued on May 26, 2000.

On the basis of §§ 7 and 8 of the Radiation Protection Ordinance the Swedish Radiation Protection Institute has issued the following regulations.¹

§ 1 These regulations apply to radiography. The regulations in the sections 7, 8 and 9, first sub-clause, as well as the sections 14 - 27, are only applicable to open radiography.

For related techniques, to which the Swedish Radiation Protection Institute's regulations (SSI FS 1995:2) on the use of devices in industry containing sealed sources or x-ray tubes are not applicable, the Swedish Radiation Protection Institute decides, in connection to the licensing, which set of regulations shall apply.

§ 2 Definitions

In these regulations terms and concepts are used with the meanings specified here.

Filter: a device that reduces the part of the radiation which does not contribute to the imaging process,

operator: a person who performs radiography, i.e. assembles the equipment and irradiates the object,

primary radiation field: area within which direct ionising radiation is sent out,

radiography: an imaging technical investigation of constructions, goods or materials using ionising radiation.

REGULATIONS

Radiation Protection Organisation

§ 3 The licence holder shall have a radiation protection organisation which is adjusted with respect to the extension and kind of the practice and is described in an organisation scheme. The organisation scheme shall show how the tasks are distributed between the persons with respect to radiation protection matters. The organisation scheme shall be kept up to date.

¹ Cf. Council Directive 96/29/Euratom of May 13, 1996, laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation. OJ L159, 29.6.1996, p. 1. (Celex 396L0029).

Competence

General

§ 4 The licence holder shall ensure that all workers who take part in the practice have the theoretical and practical knowledge needed to be perform the work in a sound way from a radiation protection point of view.

§ 5 The practical activity shall be conducted by a foreman who is familiar with

1. the applicable regulations,
2. the handling of the equipment,
3. the working methods used and
4. measures to be taken to keep the personal doses as low as reasonable achievable.

The foreman shall work for the practice being performed under adequate radiation protection conditions and shall in this respect, by the licence holder, be granted the authority and resources needed.

If the practice is performed at more than one location in the country within the same company, a foreman shall be posted at each location.

§ 6 The licence-holder shall appoint a person, within the company, who is charged with the task of being the contact person with the Swedish Radiation Protection Institute. The contact person shall at least have a such a competence in radiation protection as a foreman. Nothing prevents that the contact person also is a foreman.

The Swedish Radiation Protection Institute shall be notified of the contact person's name.

Open radiography

§ 7 All persons participating in open radiography, by which is meant others than irradiation within a closed area according to the sections 28-31, shall at least have undergone such education for operators or foremen respectively as corresponding to the general advice following these regulations.

The licence-holder shall, through recurrent education and training as well as practical and theoretical individual tests, carried out every five years, ensure that anybody participating in the work has the knowledge required to be able to work in a safe way from a radiation protection point of view. The results of the tests shall be documented.

§ 8 In open irradiation a person or organisation shall be available that at least has such radiation protection competence as described in the Swedish Radiation Protection Institute's general advice (SSI FS 2000:6) on the competence of radiation protection experts². The person or organisation shall serve as the licence-holder's expert on radiation protection issues, and in that position be approved by the Swedish Radiation Protection Institute. It is sufficient if the expert is available as a consultant.

In order to be approved, documents on the competence of the intended expert shall be shown to the Swedish Radiation Protection Institute.

² The general advice describe the content of the Commission's Communication concerning the implementation of Council Directive 96/29/Euratom, regarding qualified experts (OJ C 133, April 30 1998).

Quality Assurance

§ 9 The licence-holder of a practice that includes open irradiation shall ensure that a written quality manual is prepared. The manual shall contain no less than

1. a copy of the licence, conditions if any, and applicable regulations,
2. organisation scheme,
3. description of equipment,
4. description of work methods,
5. routines for personnel education, training and testing of knowledge,
6. routines for periodic performance testing,
7. routines for maintenance work and corrective action in the event of detected deficiencies,
8. routines for the calibration of radiation protection instruments,
9. routines for dose monitoring,
10. description of accidents and incidents which can be anticipated and a description of how these can be avoided,
11. measures to be adopted in case of unplanned events of significance from a radiation protection point of view,
12. routines for keeping journals, reporting and keeping operational statistics and
13. routines for audit to ensure that the quality manual is respected and kept up to date.

For practices with irradiation in closed areas a quality manual shall be prepared which is adjusted to the extent and kind of the practice.

Everyone participating in the activity shall know of, and have access to, the quality manual.

Service³

§ 10 Maintenance and servicing of the equipment that can emit ionising radiation, must only be performed by an individual who has good knowledge of the equipment and the related radiation protection procedures.

General about work and equipment

§ 11 Equipment used must be in satisfactory condition with respect to all functions that are important from a radiation protection point of view. Where reasonably possible, these functions shall be checked every time by the operator before use. Detected faults shall be documented and corrected before the equipment is used.

Faults arising from the design of the equipment shall be reported to the Swedish Radiation Protection Institute.

§ 12 When the equipment is not in use, it shall be locked or kept under lock so that ionising radiation is not accessible to unauthorised persons.

§ 13 Unplanned events of significance from the standpoint of radiation protection shall immediately be reported to the foreman and to the Swedish Radiation Protection Institute.

³ For service of equipment that can emit ionising radiation, a special licence from the Swedish Radiation Protection Institute is required, according to section 20 of the Radiation Protection Act.

Open radiography⁴

General

§ 14 All persons who participate in open radiography shall wear a personal dose meter in accordance with the Swedish Radiation Protection Institute's regulations (SSI FS 1998:4), and, in addition, an instrument that gives an alarm when the dose rate exceeds the set point.

§ 15 Before work starts, all individuals who are not directly involved in the work and who are present in the area where the work is to be performed shall be informed about how to act while the work is going on.

§ 16 The operator shall check the dose rate by measurements at each set up. In areas where people are present on a permanent basis, the dose rate must not exceed 2 microsievert per hour ($\mu\text{Sv/h}$). In areas where an employee is present on a temporary basis, the dose rate must not exceed 20 $\mu\text{Sv/h}$. Such an area shall be marked with signs. Areas with a dose rate exceeding 60 $\mu\text{Sv/h}$ shall be blocked off.

Dose rate measurements shall be made using an instrument of a directly readable type that is calibrated and well adjusted to the present kind of radiation.

§ 17 The operator shall supervise the equipment and the blocked area throughout the entire exposure time. If there occurs any risk that a person would enter the blocked area, the exposure shall be interrupted.

Open radiography with x-ray tubes or other electrically-operated radiation sources

§ 18 During start-up or comparable operating conditions, the primary radiation shall be shielded.

§ 19 A slit diaphragm or equivalent immediately in front of the source and a radiation shielding, limiting the primary radiation field behind the image receptor, shall be used whenever possible.

§ 20 X-ray radiation shall be filtered so that any radiation quality which does not contribute to information concerning the examined object shall be minimised. Beryllium filters alone may be used only if this is considered necessary for the quality of the picture.

§ 21 An x-ray source shall be connected to a warning light which emits a clearly visible light when, and only when, radiation exposure is in progress.

⁴ From the Swedish Radiation Protection Institute's regulations (SSI FS 1998:3) on Categorisation of Workplaces and Workers at Work with Ionising Radiation follow that individuals working with open radiography belong to Category A, as a rule. Additional regulations are connected to Category A:
The Swedish Radiation Protection Institute's Regulations (SSI FS 1998:4) on Dose Limits at Work with Ionising Radiation;
The Swedish Radiation Protection Institute's Regulations (SSI FS 1998:5) on Monitoring and Reporting of Individual Radiation Doses;
The Swedish Radiation Protection Institute's Regulations (SSI FS 1998:6) on Medical Examinations for Work involving Ionising Radiation.

§ 22 If the manoeuvre panel has a setting whereby the equipment can be easily restarted, (e.g. "automatic" or equivalent), it must not be left unsupervised in this mode.

§ 23 After exposure, the operator shall ensure that no ionising radiation is emitted within the primary radiation field, both by switching off the equipment and by checking with a measuring instrument. This shall be done before anybody enters the area.

Open radiography with radioactive sources⁵

§ 24 Before the equipment is used, the function of the mechanical system that affects the position of the radioactive source or its radiation shield shall always be checked. The fact that the check has been carried out and the result of the check shall be confirmed by operator signature in a logbook which belongs to the equipment.

§ 25 A collimator immediately in front of the source and a radiation shielding, limiting the primary radiation field behind the image receptor, shall be used whenever possible.

§ 26 After exposure is terminated, the operator shall check, with the aid of a radiation protection instrument, that the radioactive source has returned to the shielded position. The function of the radiation protection instrument shall be checked immediately before use.

§ 27 In the event of an incident involving the detachment or sticking of the radiation source, the operator shall not attempt to handle the source himself/herself, if this can lead to an increase in the individual dose. Procedures for appropriate action shall be obtained from the foreman.

Blocking and supervision of the work area shall remain until the source is restored to a safe position.

Radiography in closed areas

§ 28 A closed area shall be designed so that the dose rate outside the area does not exceed 2 µSv/h in any accessible point at the distance of 0.1 metre and so that

1. it is not physically possible for a person due to size, the hatch opening or other such device, to be exposed or
2. it is equipped with at least two safety systems which independently of each other prevent exposure if a person should be present in, or enters, the area.

⁵ For transport of radioactive substances, regulations by the Swedish Rescue Services Agency apply, given on the basis of the Law (1982:821) on Transport of Hazardous Goods:

transport by road: ADR,

transport by railroad: RID,

transport by sea: IMDG-CODE and

transport by air: ICAO-TI

In addition, by the same law, a copy of a valid type certificate of the container shall be sent to the Swedish Radiation Protection Institute before it is used for the first time within Sweden.

Council ordinance (EURATOM) no. 1943/93 applies to cross-border transport. The ordinance is shown in the Swedish Radiation Protection Institute's regulations (SSI FS 1996:1) on amendments to the EC ordinance concerning the transport of radioactive substances between member states.

§ 29 An area which is designed so that goods can flow through the area, on a conveyer belt or similar device may, even if it is large enough to allow a person to pass through the area, be considered to be closed if

1. the dose rate outside the area does not exceed 2 µSv/h and
2. an emergency stop is provided at the goods openings and inside the area and
3. in connection with the goods openings, barriers are provided alongside the goods transportation device and
4. it is not possible that the dose to a person exceeds any of the dose limits⁶ imposed by the Swedish Radiation Protection Institute, should a person by mistake accompany the transported goods.

§ 30 A closed area shall be equipped with

1. a warning symbol for ionising radiation⁷,
2. marking with information about the type of radiation source and its data such as tube voltage and current or the nuclide and its activity at a specified date and
3. information about where the manual for the area can be found and the name of the contact person.

§ 31 Outside a closed area, a warning light should be provided which emits a clearly visible light when, and only when, exposure is in progress.

An area which is closed according to the sections 28.2 or 29 shall be equipped with warning lights next to the manoeuvre panel, outside the entrance door as well as inside the area.

Transfer

§ 32 Transfer of equipment is only allowed to somebody who has a licence from the Swedish Radiation Protection Institute for the possession of such equipment.

Scrapped equipment

§ 33 Electrically-operated equipment which is no longer to be used shall be destroyed so that it can no longer emit ionising radiation. An assurance of scrapping shall be sent to the Swedish Radiation Protection Institute.

§ 34 Radioactive sources which are not to be used any longer shall be managed as radioactive waste by an organisation that is approved by the Swedish Radiation Protection Institute to receive radioactive waste. Scrap certificates shall be sent to the Swedish Radiation Protection Institute.

⁶ See the Swedish Radiation Protection Institute's Regulations (SSI FS 1998:4) on Dose Limits at Work with Ionising Radiation.

⁷ The warning symbol for ionising radiation is provided in Svensk Standard SIS 031210 "Bildsymboler för märkning". The symbol is identical to the symbol provided in Council Directive 92/58/EEC of 24 June 1992 on the minimum requirements for the provision of safety and/or health signs at work, OJ L 245, 26.8.29, p. 23, (Celex 392L0058).

Exception

§ 35 If special grounds exist, the Swedish Radiation Protection Institute may grant exceptions from these regulations.

GENERAL ADVICE

1. Education on radiation protection for the personnel

Any worker who participates in open irradiation shall, according to section 7, go through periodic education and tests. These general advice give recommendations for such education.

2. Curriculum for operators

The extent of the education should at new employment be at least 16 hours of which 4 hours should be practical training and 2 hours examination. Regular repetitive education should extend over 8 hours and include one hour of examination. The education should, in consultation with the radiation protection expert, be adjusted with respect to the working situation and the kind of equipment used. The following moments should be covered.

2.1 *Basic physics*

- Different kinds of radiation
- X-rays and how it is produced
- Gamma-radiation sources and their properties

2.2 *Quantities and units*

- The concept of dose
- Dose limits

2.3 *Interaction with matter*

- Absorption
- Scattering

2.4 *Biological effects*

- Acute and late damages
- Relation between dose and effect

2.5 *Measurements and instruments*

- The handling of instruments
- Individual dose monitoring
- Function tests

2.6 *Practical aspects*

- External radiation, primary and secondary radiation fields
- The safe handling of equipment, roped-off areas
- Check of equipment from a radiation protection standpoint
- Examples on accidents
- Routines at transport of radioactive sources (if applicable)

3. Curriculum for foremen

With the education for operators as a base, further education should the first time, contain about 16 hours of which 4 hours is spent on practical training and 2 hours examination. The periodic education should extend over 8 hours. The education should, in addition to the operator's education cover:

3.1 The legal system and radiation protection regulations

3.2 Exercise on calculations

3.3 Emergency situations

3.4 Check of equipment

3.5 Quality assurance and its documentation

3.6 Regulations on transport (if applicable)

These statutes enter into force on October 1, 2000. The regulations replace the corresponding conditions for practices as given earlier.

Provisional regulations

1. A closed area which is approved by the Swedish Radiation Protection Institute may still be used according to earlier given conditions. When it is rebuilt or modified in a way that affects the radiation protection properties, the regulations on closed areas (§§ 28-31) shall apply.
2. Education of workers who are employed when these regulations enter into force may be deferred until the next regular occasion of education.

On behalf of the Board of the Swedish Radiation Protection Institute

LARS-ERIK HOLM

Carl-Göran Stålnacke